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The Law for the Emerging Active Role of Electricity Consumers

A thesis

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Abstract

This thesis investigates the role of law in shaping the liberalised electricity system for a more active role of consumers. The research studies three countries, New Zealand, Colombia and the Netherlands, to analyse how different electricity systems and legal frameworks are responding to the new technologies that enable active consumers. In order to provide a better understanding of the current law, this thesis classifies the multiple regulatory responses in terms of conventional regulation, decentred regulation and market-driven approach. In addition, the research applies legal theories regarding law and innovation such as the existence of regulatory disconnection, risks of disruptive technologies and the role of law in stimulating technological change.

Law and regulation have the role of creating a level playing field for active consumers to participate and compete in the market together with traditional actors. In this sense, the role of consumers, distribution companies, markets and retailers should be reconsidered and therefore, the need to update the regulation and avoid regulatory disconnection. The main features that such legislation should include are different regulatory treatments depending on the size of the project and fair remuneration for the supply of energy and services provided by prosumers. The distribution tariffs or their methodologies should not deter the participation of prosumers , also it is necessary the existence of simplified licensing and procedures for small prosumers. It is also vital to undertake pilot projects and legal experimentation to help underpin future regulation.

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Table of Acronyms

AC	Alternating Current
ACCES	Additional Consumer Choice of Electricity Services
AMI	Advanced Metering Infrastructure
ACM	Authority for Consumers and Markets – The Netherlands
AMR	Automated Meter Reading
BAU	Business as Usual
BEL	Blueskin Energy Ltd
BRCT	Blueskin Resilient Communities Trust
CAPEX	Capital Expenditures
CBD	Central Business Association
CGA	Consumer Guarantees Act 1993
CHP	Combined Heat and Power
CREG	Energy and Gas Regulatory Commission – Colombia
CTA	Connection and Transport Agreement
DC	Direct Current
DER	Distributed Energy Resources
DG	Distributed Generation
DIY	Do-it-Yourself
DLR	Dynamic Line Rating
DMS	Distributed Management System
DO	Distribution Operator
DR	Demand Response
DS	Distributed Storage
DSM	Demand Side Management
DSO	Distribution System Operator
EA	Electricity Authority in New Zealand
EECA	Energy Efficiency and Conservation Authority in New Zealand
EIA	Electricity Industry Act 2010
EIPC	Electricity Industry Participation Code
EMS	Energy Management System

ENTSO-E	European Network of Transmission System Operators for Electricity
EPM	Public Utilities of Medellin
EPRI	Electric Power Research Institute
ETNZ	Energy Trusts Of New Zealand
EU	European Union
FACTS	Flexible AC Transmission System
FAER	Financial Help Fund to Provide Energy to the Rural Interconnected Areas
FAZNI	Financial Help Fund to Provide Energy to the Non-Connected Areas – Colombia
FC	Fuel Cell
FERC	Federal Energy Regulatory Commission In U.S
FIP	Feed In Premium
FIT	Feed-In Tariff
GHG	Greenhouse Gas
GIS	Geographic Information System
GWh	Gigawatt-Hour
GPS	Government Policy Statement
HDVC	High Voltage Direct Current
HTS	High-Temperature Superconductors
HVDC	High Voltage DC
ICP	Installation Control Point
ICT	Information and Communication Technologies
IEA	International Energy Agency
IEC	International Electrotechnical Commission
INDC	Intended Nationally Determined Contributions
IPAG	Innovation and Participation Advisory Group
IPSE	Planning and Promotion Institute for Energy Solutions to Non-Interconnected Zones – Colombia
ISO	International Organization for Standardization
ITO	Independent Transmission Operator
kW	Kilowatts

KWp	Kilo Watt Peak
MBIE	Ministry of Business, Innovation and Employment of New Zealand
MTs	Microturbines
MME	Ministry of Mines And Energy – Colombia
MW	Megawatts
NERC	North American Electric Reliability Corporation
NOBEL	Neighbourhood Oriented Brokerage Electricity and Monitoring System
NPS	National Policy Statements Renewable Electricity Generation – New Zealand
NRA	National Regulatory Authority – The Netherlands
OEF	Firm Energy Obligation
OFGEM	Office of Gas And Electricity Markets. Regulatory Authority in United Kingdom.
OMS	Outage Management System
OPEX	Operational Expenditures
P2P	Peer-to-Peer
PCA	Postal Code Arrangement
PERS	Rural Plans for Providing Sustainable Energy – Colombia
PPA	Power Purchase Agreements
PTC	Photovoltaic Technical Committee
PUC	Public Utility Commissions
PURPA	Public Utility Regulatory Policies Ac
PV	Photovoltaic
RE	Renewable Energy
RIIO	Revenue = Incentives + Innovation + Outputs
RMA	Resource Management Act – New Zealand
RNM	Reference Network Model
S	Section
SDL	Local Distribution System
STR	Regional Transmission System
SIC	Superintendence of Industry and Commerce – Colombia

SIN	Grid-Connected System
TOTEX	Total Expenditures
UPME	Mining and Energy Planning Unit – Colombia
VAT	Value-Added Tax
WITS	Wholesale Information and Trading System
WMS	Workforce Management System
XM	Expert in Markets
ZNI	Off-Grid Areas n Colombia

Table of Contents

INTRODUCTION **1**

CHAPTER 1: THE POWER SYSTEM: PRESENT AND FUTURE **11**

1.1. HOW THE TRADITIONAL-CENTRALISED SYSTEM WORKS 12
1.1.1 Traditional-centralised and liberalised electricity industry *16*
1.2 WHAT COULD THE FUTURE LOOK LIKE? 21
1.2.1 Distributed generation *22*
1.2.2 Demand side management (DSM) or Demand Response (DR) *29*
1.2.3 Smart Grids *31*
1.2.4 Advanced Metering Infrastructure and Smart Meters *33*
1.2.5 Micro-grids *36*
1.2.6 Emerging perspectives of the power system *37*
1.3 KEY POINTS 38

CHAPTER 2: COEXISTENCE OF THE TRADITIONAL-CENTRALISED POWER SYSTEM REGULATION AND EMERGING TECHNOLOGIES REGULATION – OVERVIEW **40**

2.1 EUROPEAN UNION 41
2.1.1 Regulation of activities in the European Directives *45*
2.2 THE NETHERLANDS 51
2.2.1 Regulation of activities *52*
2.3 NEW ZEALAND 58
2.3.1 Regulation of Activities *61*
2 .4 COLOMBIA 70
2.4.1 Regulation of Activities *72*
2.5 KEY POINTS 82

CHAPTER 3: LAW AND SOCIETY: HOW THE ACTIVE ROLE OF CONSUMERS FITS INTO THE BIGGER PICTURE **84**

3.1 ACTIVE CONSUMERS AND THE MULTIPLE SOCIO-POLITICAL CONSTRUCTIONS 85
3.1.1 The Prosumer Society *85*
3.1.2 Sharing economy *91*
3.1.3 Localism and bioregionalism *93*
3.2 CONTEXT AND VALUES FOR THE ACTIVE ROLE OF CONSUMERS 95
3.2.1 Climate change *95*
3.2.2 Community involvement in the electricity industry *100*
3.2.3 Energy security *101*
3.2.4 Energy efficiency *103*
3.2.5 Energy justice *105*
3.2.6 Energy transition *107*
3.2.7 Energy democracy *111*

3.3 AN ACTIVE CONSUMER AND THE MULTIPLE REGULATORY PERSPECTIVES AT STAKE 112
3.3.1 The role of regulation *113*
3.3.2 Reason to regulate *115*
3.3.3 Regulatory instruments *118*
3.3.4 Who regulates? *122*
3.3.5 Technological innovation and regulation *125*
3.3.5.1 Regulatory gaps and regulatory disconnection 127
3.3.5.2 Potential risk of technologies 129
3.3.5.3 Regulation advancing technological change 131
3.3.6 Smart regulation *133*
3.4 KEY POINTS 134

CHAPTER 4: ACCESS TO THE NETWORK: THE REGULATION OF THE DISTRIBUTION ACTIVITY **136**

4.1 TRADITIONAL AND EMERGING ISSUES OF THE TRANSPORTATION SYSTEM: TRANSMISSION AND DISTRIBUTION 137
4.1.1 Emerging issues for the transportation system *139*
4.1.2 Emerging functions of the distribution operator *141*
4.2 CURRENT FUNCTIONS OF THE DISTRIBUTOR IN COLOMBIA, THE NETHERLANDS AND NEW ZEALAND 146
4.2.1 Colombia *146*
4.2.2 The Netherlands and the European Union *147*
4.2.3 New Zealand *151*
4.2.4 The role of the distribution network and regulatory disconnection *155*
4.3 CONNECTION OF DISTRIBUTED GENERATION 157
4.3.1 Colombia *157*
4.3.2 The Netherlands and the European Union *160*
4.3.3 New Zealand *164*
4.3.4 Regulation of connection of distributed generation and regulatory disconnection *168*
4.4 PRICE OF DISTRIBUTION ACTIVITIES 172
4.4.1 Colombia *174*
4.4.1.1 Contribution of the DG to the overall cost of distribution 175
4.4.2 The Netherlands and the European Union *175*
4.4.2.1 Contribution of the DG to the overall cost of distribution 176
4.4.3 New Zealand *177*
4.4.3.1 Contribution of the DG to the overall cost of distribution 181
4.4.4 Challenges of price control for distribution and regulatory disconnection *185*
4.5 KEY POINTS 186

CHAPTER 5: ACTIVE CONSUMERS: ACCESS TO RELEVANT MARKETS AND CONSUMER RIGHTS **189**

5.1 ENERGY SURPLUS AND ACCESS TO RELEVANT MARKETS 190
5.1.1 Wholesale market access *191*
5.1.2 Retail market *193*

5.1.3 New markets *199*
5.2 REMUNERATION OF PROSUMERS FOR THEIR ENERGY SURPLUS 203
5.2.1 Net-metering *203*
5.2.1.1 The Netherlands' net-metering 208
5.2.1.2 Colombian net-metering 209
5.2.2 Feed-in Tariff (FIT) *211*
5.2.3 Net billing *212*
5.2.4 Auctions and tenders *213*
5.2.5 Fixed price *213*
5.3 PARTICIPATION OF DEMAND RESPONSE IN THE MARKET AND A REMUNERATION SCHEME 214
5.3.1 Wholesale market *215*
5.3.2 The role of the aggregator *219*
5.3.3 The Retail market *220*
5.3.4 Remuneration *221*
5.4 CONSUMER RIGHTS AND SMALL PROSUMERS 223
5.4.1 Who is a consumer? *225*
5.4.2 Traditional electricity consumer rights *227*
5.4.3 The Right to self-generate electricity and decide on its use *231*
5.4.4 Universal access *232*
5.4.5 The right to change supplier *234*
5.4.6 Access to relevant information and participation in decision making . *235*
5.4.7 Making technologies available for vulnerable consumers *237*
5.4.7 The access to specific and simplified procedures *240*
5.5 KEY POINTS. 242

CHAPTER 6: THE LEGAL ASPECTS OF COMMUNITY ENERGY PROJECTS **244**

6.1 TERMINOLOGY AND SCENARIOS 246
6.2 THE PROS AND CONS OF COMMUNITY ENERGY PROJECTS 249
6.3 LEGAL ASPECTS OF COMMUNITY ENERGY 250
6.3.1 European Union Legislation *253*
6.4.1.1 Citizen energy communities 254
6.4.1.2 Renewable energy community 256
6.3.2 Netherlands *259*
6.3.2.1 Postal Code Area Arrangement (PCA) 259
6.3.2.2 Experimentation Decree 261
6.3.2.3 Distribution unbundling rules 263
6.3.3 Colombia *265*
6.3.3.1 Self-generators located in off-grid areas 266
6.3.3.2 Unbundling rules 268
6.3.4 New Zealand *269*
6.3.4.1 The Energy trusts 270
6.3.4.2 National Policy Statements on Renewable Electricity Generation (NPS) and the Blueskin Energy Project 273
6.3.4.3 Unbundling rules 277
6.4 KEY POINTS 279

CHAPTER 7. WHAT IS THE ROLE OF LAW IN SHAPING THE ELECTRICITY SYSTEM FOR A MORE ACTIVE ROLE FOR CONSUMERS? 281

7.1 THE IMPORTANCE OF RETHINKING THE ROLE OF TRADITIONAL ACTORS ..282
7.1.1 Rethinking the role of the traditional retailer/supplier *282*
7.1.2 Rethinking the role of the distributor *287*
7.1.3 Rethinking the role of the market *291*
7.2 RETHINKING THE ROLE OF THE CONSUMER/PROSUMER 293
7.3 THE ROLE OF LAW IN DEALING WITH INNOVATION IN THE ELECTRICITY SECTOR 297
7.4 THE ROLE OF LAW AND REGULATION IN INTEGRATING PROSUMERS INTO THE ELECTRICITY INDUSTRY 305

8. CONCLUSIONS 308

9. BIBLIOGRAPHY 315

9.1 CASES 315
9.2 LEGISLATION 315
9.3 BOOKS 317
9.4 CHAPTER IN BOOKS 319
9.5 JOURNAL ARTICLES 323
9.6 PARLIAMENTARY AND GOVERNMENT MATERIALS 333
9.7 REPORTS 336
9.8 INTERNET RESOURCES 338
9.9 OTHER RESOURCES 342

INTRODUCTION

Background

According to ancient Greek mythology, the Titan Prometheus, feeling sorry for the unfair state and darkness in which humankind lived, stole the fire from Zeus, the supreme ruler of the Gods. He gave it as a gift to humanity, bringing progress and enlightenment. For this generous act, Zeus punished Prometheus and chained him to a rock, where every day an eagle came to eat his liver, which would grow again by the next day, endlessly tormenting the Titan. After many years, luckily for him and humankind, Hercules, the hero, half-god, half-human, came to his aid, killed the eagle and freed Prometheus from the chains.[1]

This legend introduces the topic and objective of this thesis. Scientists, entrepreneurs, engineers, innovators (Prometheus) have created new technologies (the fire) that today allows consumers (humanity) to no longer be dependent on large energy companies (Zeus) to supply them with electricity. These new technologies enable them to generate, in situ, their energy, manage their energy needs and interact actively with the electricity system in a sustainable manner (enlightenment). However, these emerging technologies and business models face multiple obstacles, including financial, technical, institutional, cultural and legal challenges (eagle and chains). The 21st Century Prometheus deserves to be free from chains and be reunited with humankind because everyone should have access to fire, both humanity and the Gods. The question that remains is, who will be Hercules? Who will take on the responsibility of removing the chains that limit innovation and restrict consumers in managing their own energy needs?

The electricity sector is on the verge of significant change because of technological innovation, together with distrust in conventional energy companies and increasing awareness of climate change. Such a shift implies a more active role for consumers who can generate and manage their energy supply and trade or store their energy surplus.

[1] Robin Hard "The Rise of Zeus and Revolts against his Rule" in *The Routledge Handbook of Greek Mythology* (Routledge, New York, 2008) at 92.

The expression used to describe this situation is ‘energy prosumer’. This term refers to the combination of production and consumption in one entity, the prosumer. New technologies and business models, such as distributed generation, peer-to-peer trading, smart grids, demand-side management and energy storage, offer a brilliant opportunity for making energy prosumers a reality. This emerging model could lead to enormous benefits including enhancing energy security, mitigation and adaption to climate change, improved sustainability and efficiency, energy democracy, a more economical and efficient energy supply service and a growth in customer benefits.

Nevertheless, the rise of energy prosumers brings new challenges to legal systems. Current legal systems underpin the traditional electricity supply, which was established based on a clear distinction between consumers and producers. The emerging and overlapping roles of energy prosumers creates uncertainty, legal gaps and questions for the current legal system, resulting in outdated regulation and regulatory disconnections. Such disconnection is the gap between the emerging technologies that bring a new set of values and possibilities and the applicable regulations which cannot adapt fast enough to the changing circumstances. As a result, we do not know what new legislation and regulation are needed or what the role of law should be. Thus, the question of how to adapt the present legal system or whether there is a need to create a new one is now open for debate.

Research Question

Hence, the research question underpinning this thesis is, what is the role of law in shaping the liberalised electricity system, allowing for an emerging and more active participation by the consumer?

Answering the Question

To answer this question, this research identifies three countries with liberalised electricity industries to help understand some of the current legal approaches to prosumers. The three selected countries are New Zealand, Colombia and the Netherlands. Such diverse and geographically distant countries were chosen to analyse how electricity systems and legal frameworks experiencing different energy policy

challenges are responding to the new technologies that enable a more active role for consumers.

On the one hand, New Zealand is a developed country with a small population distributed throughout the territory whose primary centralised energy generation resource is hydropower with immense renewable energy potential. On the other hand, Colombia is a developing country with a much larger population concentrated in the big cities, and a small proportion of citizens living in off-grid areas. As with New Zealand, hydropower is the main energy resource, and the country also has significant renewable energy potential. The third country is the Netherlands. It is in a unique position, as a member of the European Union, it must follow European energy and electricity policies and regulations but has a level of discretion in the implementation of these. Its electricity mix relies mainly on fossil fuels, principally gas and liquid fossil fuels but its use of renewable generation has been increasing in recent years. This diversity in the energy mix and its characteristics is important when analysing the different approaches used by liberalised countries when dealing with prosumers.

The thesis's premise is that the current legal framework is tailor-made for the centralised-traditional electricity system in which the role of the consumer is passive. All consumer are required to do is to pay the electricity retailer for the energy that they consume. In opposition to a more active role of consumers, in which they self-generate power, manage their consumption and participate in the system's costs and benefits.

The thesis examines the contrast between the traditional-centralised legal framework and the emerging demands and opportunities created by new technologies and the changing nature of energy supply. This comparison aims to explore whether the legal and regulatory framework of the three jurisdictions can incorporate these new needs and to what extent they can adapt to the changing perspectives. It does this by identifying existing legal barriers that present challenges to the participation of active consumers in the market. The role of law also needs to consider the emerging energy and social values such as climate change concerns, the democratisation of energy and energy justice while ensuring energy security and energy efficiency.

Literature Review

It is important to note that there has to date, been very little academic writing on this topic. As a result, while highlighting the contribution of this research, means it was difficult to find relevant legal literature. There are articles dealing with the legal obstacles in integrating prosumers or distributed generation to the electricity system. However, these articles identify barriers in countries like the United States where the electricity system and institutions work differently compared to the chosen countries.[2] This research takes some of the ideas that are exposed in those articles and analyses whether those issues applyed to the chosen countries. Perez-Arriaga[3] identifies some general regulatory obstacles for the implementation of distributed generation in the European Union, but only focuses on the distribution activity and there is no further analysis of obstacles in either generation, transmission, markets or challenges for consumers. Although his article works as a support for the ideas and concepts introduced in Chapter 4, I go into more detail applying such concept in jurisdictions beyond the European Union. Roberts[4] does an interesting study of the legal framework needed to reinforce prosumer rights and ensure their participation in the European electricity market. Although his ideas are an important contribution to this research they have been expanded in this thesis, as it identifies the legal measures that a country can take to promote those technologies and analyses which current regulatory provisions may obstruct the promotion and implementation of technologies that enable prosumers to actively participate in the industry.

In respect of legal research in the chosen countries, in New Zealand, there were a series of reports[5] about Smart Grid development, which also included distributed resources

[2] Heather Payne "A tale of two solar installations: how electricity regulations impact distributed generation**"** (2016) 38 Harward Law Review 135. Sharon B Jacobs "The Energy prosumer" (2017) 43 Ecology Law Quarterly 519. Jon Wellinghoff and Steven Weissman "The right to self-generate as a grid-connected customer. Joel Eisen "Who regulates the smart grid? FERC's authority over demand response compensation in wholesale electricity markets" (2013) 4 San Diego Journal of Climate & Energy Law 69

[3] Ignacio Perez-Arriaga *From Distribution Networks to Smart Distribution Systems: Rethinking the Regulation of European Electricity DSOs* (European University Institute, Florence, 2013)

[4] Josh Roberts *Prosumer Rights: Options for an EU Legal Framework Post 2020* (ClientEarth, London, 2016)

[5] Prosumer collectives: A review, Smart Grid Edge Technologies; Case Studies of Early Adopters; Smart homes: What New Zealanders think, and want; and Relative Progress of Smart Grid development in NZ. To look closer at the analysis and conclusions of such reports: Rebecca Ford, Juliet Whitaker and Janet Stephenson *Prosumer collectives: A review a report for the Smart Grid Forum* (University of Otago — Centre for Sustainability, Dunedin, 2016). Rebecca Ford *Smart Grid Edge Technologies Case Studies of Early Adopters* (Centre for Sustainability University of Otago, Dunedin, 2016). Rebecca Ford and Rana Peniamina *Smart Homes What New Zealanders Think, and Want* (Centre for Sustainability University of Otago, Dunedin, 2016).

and prosumers. These reports identified some of the difficulties for the parties involved in the process and drew attention to the importance of considering a more flexible electricity system and the role of pricing in encouraging these kind of initiatives. However, the reports do not question the current legal and regulatory obstacles to achieve the smart grids development in New Zealand, nor the role of law in shaping or promoting smart grids and distributed generation in the industry.

In the Netherlands, there is legal literature which analyses the legal framework that applies to prosumers and identifies legal obstacles. The work of Diestelmeier and Kuiken[6] and Butenko[7] is useful in this instance. The latter article is especially relevant for my research because it analyses the legal aspects regarding energy prosumption issues, and applies the concept of regulatory disconnection. I build on the use of regulatory disconnection and its application to new technologies that enables energy prosumers and replicate it on the Colombian and New Zealand case throughout this thesis. In Colombia, although Hernandez[8] identifies some of the regulation applicable to distributed generation, he does not identify all the legal frameworks and legal barriers that challenge implementation in the Colombian electricity sector.

Therefore, the contribution of my research to the existing literature on the topic is to create an understanding of the main features or legal characteristics of good law in this field, and how liberalised counties can legally adapt their electricity system with more active consumers. The thesis will point out legal and regulatory obstacles and recommend legal approaches that reflect current social values such as energy justice, energy transition and energy democracy. Also, the research will answer a question that has not been answered before in the relevant literature regarding the role of law in shaping the electricity sector in liberalised countries for a more active role of consumers in the energy sector.

The relevance of the topic

[6] Lea Diestelmeier and Dirk Kuiken "Legal framework for prosumers in the Netherlands" (2018) 12 European Energy Law Report XII at 40,

[7] Anna Butenko "Sharing energy: dealing with regulatory disconnect in Dutch energy law " (2016) 7 SSRN 701 at 709.

[8] Johann Hernandez, Francisco Santamaria and Cesar Trujillo "Impacts of Regulation in the Development of Distributed Generation" (2015) 28 The Electricity Journal 83.

This research is necessary to advance the knowledge of the current legal framework concerning the emerging active role of electricity consumers, especially in countries where the electricity sector is liberalised. There will be an emphasis on the regulation applicable to renewable distributed generation, demand response and smart grid regulation.

The investigation aims to encompass current academic research in the study of regulation and legal scholarship interested in looking for answers to the philosophical question relating to the role of law in shaping an important economic activity (electricity), to new technologies and business ideas. Such analysis embraces efficiency, and social and justice energy values in the current context of climate change and smart regulation.

Furthermore, the study aims to provide a resource for lawyers and practitioners interested in energy law who want to develop a clear understanding of the current legal framework of some liberalised countries in respect of prosumer issues. This thesis is an update and an analysis of the legal aspects that are needed to ensure a more active role for consumers. It also identifies gaps in regulations and current legislation which may be problematic for such initiatives.

Additionally, this research is intended to make it easier for individuals, communities, business entrepreneurs or others engaged in local generation, and businesses (solar companies, aggregators, IT companies or community energy) with a clearer understanding of how the electricity market and electricity regulation in the three chosen countries are dealing with prosumer initiatives. In this sense, the research is necessary for clarifying topics such as connection rules, access to markets, relationships with retail and distribution companies, as well as the rights and duties placed on prosumers and emerging actors which are required to provide prosumers with legal certainty.

A more robust understanding will help individuals and groups interested in engaging in energy projects to encourage or to lobby governments to make the fundamental advances or agreements in integrating more local perspectives into the electricity

system. Among the communities that will benefit from these new initiatives are isolated populations, such as native and low-income people in Colombia and Maori in New Zealand. The prosumer initiatives can help in the economic development of vulnerable communities while sharing the energy benefits more directly and fairly. The intention is to assist policy and decision-makers who want to embrace new technologies that allow a more active role for consumers in the electricity system. The thesis will develop strategies and legal approaches to integrate new technologies more efficiently and effectively.

Although this study recognise the relevance of the right to access data, which has become of enormous importance in the presence of smart and IT technologies, facing cybersecurity or data appropriation, the analysis of this issue is beyond the scope of this research, and will be better covered in specific research on data protection in its own right. The thesis does not engage with the legal analysis of energy storage by prosumers, but instead, focusses on distributed generation and demand response with some consideration of smart grids.

Methodology

The thesis undertakes studies of regulation in the particular area of electricity regulation which needs to incorporate new technologies and ideas that allow a more active role for the consumer and in creating a more dynamic electricity system. The research involves conventional legal research using primary and secondary legal materials and conventional methods of analysis. The approach taken is conventional policy analysis and theory of regulation. In order to provide a better understanding of the current law, the study organises the existing legal framework, legal obstacles and gaps according to a regulatory classification. This classification comes from Regulatory Studies doctrine, which analyses conventional regulation, decentred regulation and market-driven approach.

The thesis will also apply different concepts of the legal theory of law and innovation. For example, when assessing the different legal responses to new paradigms brought by disruptive technologies to the electricity industry, we will apply concepts such as regulatory disconnection, to identify whether there is a discrepancy between the current

regulatory environment and the developing innovations. Other issues that will be identified within the thesis are the challenges or risks that the emerging technologies can bring into the electricity system that need to be anticipated and addressed adequately. In this context, the role of law in dealing with technological innovation refers to minimising or addressing potential risks.

Finally, another concept that will be recognised within the thesis, which is also related to the theoretical constructions of law and innovation, is the role of law in stimulating technological change. In applying such a concept, we will look at regulatory provision that serves to stimulate the uptake of innovation and new technologies enabling a more active role for consumers.

Thesis Structure

This thesis has seven chapters. The first chapter begins with a technical explanation of how the traditional and centralised system works in order to understand some of the challenges that a more active role for consumers creates. This explanation is followed by an introduction to the implications of liberalisation in the electricity industry. It continues with a discussion contrasting the characteristics of the traditional-centralised system with the characteristics of the emerging technologies and functionalities that empower consumers. The chapter will then introduce the disruptive technologies and concepts that make technological change possible, and their implications for the system. These concepts are demand response, distributed generation, smart grids, advanced-metering infrastructure and micro-grids.

The second chapter undertakes an initial legal analysis of the coexistence of traditional-centralised aspects encountered with decentralising approaches in the three chosen jurisdictions. Each of the different sectors involved in the traditional supply of power (generation, transmission, distribution, wholesale and retail market and consumers) will be analysed. Such analysis is followed by recognising whether the current legal and regulatory framework incorporates a decentralised concept (distributed generation, smart meters and demand response) and in which manner.

The third chapter will develop knowledge and understanding of the many socio-political constructions that have foreseen consumers becoming more active and their political and market relevance. In this sense, we will explore the origin and significance of 'prosumers', the sharing economy and the concepts of localism and bioregionalism. This chapter will also explore the values underpinning the emerging system, which addresses climate change, community involvement, energy security, energy efficiency, energy transition, energy democracy and energy justice. The chapter will conclude by exploring the multiple regulatory perspectives that constitute the theoretical framework of the thesis. In this sense, we will ask about the role that regulation plays, the form that it takes and who can regulate, followed by an analysis of the relationship between regulation and technological innovation and the concept of smart regulation. Building on the description and preliminary legal analysis of the traditional regulatory system and the challenges that emerging concepts bring, especially a more active role for consumers, the thesis presents some of the legal challenges. The main legal challenges are access to the networks, access to the markets, consumer legal protection and the legal aspects of community energy.

Chapter 4 will discuss access by prosumers to the distribution network. As a consequence of the increasing injection of energy by prosumers to the network, distributors have to change the way they manage and operate the distribution network. This chapter will explore both the functions of the distributor and the procedures for connection of distributed generation and whether the components of price-control over the distribution activity recognise or promote investment in new technologies for the more efficient management of the network.

In Chapter 5, two issues will be discussed. One of these issues relates to access to markets for prosumers for a fair and transparent remuneration. Consideration will be given to selling energy surplus and participation in demand response programmes. In doing this, we will refer to the participation of prosumers in the wholesale, retail and emerging markets and remuneration through net-metering, feed-in tariff and net billing, among others. The second issue is whether small prosumers should be entitled to consumer protection rights. Such rights include the ability to self-generate, universal access, the right to change supplier, access to relevant information, the right to specific and simplified procedures and access to the technology for vulnerable consumers.

Chapter 6 will address distinctive issues relating to community energy projects. A more active role for the consumer can also result in him or her deciding to belong to a community to satisfy energy need as a collective. Such an energy community may face different legal challenges regarding its size, market participation and even legal setting. The section includes an analysis of how the literature describes and understands community energy and explores legal examples or practices of the concept. The section will conclude with an analysis of the legal challenges that community energy projects face and how this emerging legal entity has been introduced in the selected jurisdictions and its legal treatment.

Having explored some of the most important legal challenges that prosumers are facing in liberalised countries and having analysed the multiple approaches that the three chosen jurisdictions have implemented, Chapter 7 can finally provide an answer to the question that motivates this thesis. The question that will finally be answered is, "What is the role of law in shaping the electricity system for more active participation of the consumer?" The answer involves rethinking the role of the traditional actors in the system and the opportunities for emerging actors, such as prosumers, interacting with others and being integrated effectively within the system. The answer to this question requires an understanding of the role of law in dealing with innovation in the electricity sector.

Throughout, this thesis will refer to the terms consumer and prosumer. Consumers who become prosumers can be either residential, commercial, community or medium or large customers. In this thesis, the principal focus is on residential and community prosumers, though some consideration will be given to large prosumers. This difference is essential because it highlights the different regulatory and market treatment of prosumers according to their size. Therefore, when referring to small prosumers, it refers to households and small commercial consumers while larger prosumers refer to industrial customers.

Chapter 1: The Power System: Present and Future

Since humans first made fire, they have found different ways to not only warm places and cook food but also to bring light to the sometimes dark world. For thousands of years and throughout different civilisations, artificial lighting was possible thanks mainly to the combustion of fuels. Gas, coal, kerosene lamps and even whale oil were used to bring light into homes once the sun set. However, by the end of the nineteenth century, the invention of the light bulb and the alternating current changed the way we interact within society.

In 1879, Thomas Edison invented the light bulb and an electricity system based on 'direct current', which means energy is generated and consumed within only a few miles from the power plant.[1] In the early days of electricity generation, distributed generation was the norm, and the first power plants supplied electricity to customers in nearby locations, albeit the supply voltage was limited. Later, through technological evolution, grids allowed electricity to be transported over longer distances in high voltages.[2] In 1896, Westinghouse Electric, helped by Nikola Tesla, introduced the technology of the 'alternating current', allowing an expansion of the reach of power plants to cover significant distances.[3] The shift from direct to alternating current made it possible to construct larger, centralised electricity systems which we called in this thesis the 'traditional-centralised electricity system'. The world, as we know it today, is here thanks to the traditional-centralised electricity system: artificial lighting in every urban house, appliances that work every time we switch them on, industries that work 24/7, beautiful Christmas lights that decorate houses and streets, bridges and avenues lit by thousands of lights.

However, a changing world and industry are dictating new perspectives. Thanks to new inventions and technologies, a new way of producing and consuming electricity is possible. Information and communication technologies (ICT), solar panels, energy

[1] David Tuttle, Gurcan Gulen and Robert Hebener *The history and evolution of the US electricity industry* (The University of Texas Energy Institute, Texas, 2016) at 3.
[2] Guido Pepermans and Dries Haeseldonck "Distributed generation: definition, benefits and issues" (2005) 787 Energy Policy 787 at 788.
[3] Tom McNichol *AC/DC, The savage tale of the first standards war* (Wiley & Sons, Washington, 2006) at 48.

storage, wind turbines, smart meters and electric vehicles, among other technologies, allow multiple functions that were once unthinkable. Consumers are now able to produce energy on site, exchange energy surplus with the network and other consumers or store energy. It is vital then to integrate these new realities into the electricity system.

The purpose of this chapter is to compare the process behind the traditional centralised electricity system with a more complex system that decentralises some functions, opens new market opportunities and enables consumers to become more active. In doing so, this chapter is organised in the following way: the first section will explore and describe how the traditional centralised system works by characterising the main activities of which it is composed. This is followed by discussion about liberalisation in the electricity industry which introduced more specific characteristics into the power system. Once the traditional system has been explained, the second part of this chapter will focus on the characteristics of the emerging technologies and functionalities that empower consumers. Thereby, this chapter will explore the emerging functionalities and technologies and the benefits and challenges to the power system as a whole.

1.1. How the Traditional-Centralised System Works

The traditional system is a centralised and uni-directional structure that takes the power generated on one side by a large generator to another location further away, where it is consumed. The generation and consumption points are connected by an interconnected system that is composed of a national grid and multiple distribution lines. The output generated is transported by the high voltage transmission grid. It is then converted to lower voltages and distributed to end users through multiple distribution networks, where the voltage is adjusted as necessary for residential and business use. The interconnected system consists of generation plants and equipment, interconnection networks, regional and interregional transmission networks, distribution networks and users' electrical charges. Such components determine the different activities that are performed in order to supply power to households, industries and businesses throughout the country. Thus, a centralised electricity system consists of four main sections or activities that interact in a top-down approach: generation, transmission, distribution

and customers. In the following paragraphs, the main characteristics of each activity will be explained further.

Generation. Electricity comes from different resources, including hydro, geothermal, fossil fuels, wind and solar. Generators are generally large and usually located close to primary energy sources. The output of these generators often cover relatively large distances in only one direction of flow to where the electricity is consumed.There are two key reasons why electricity generation is often located a long way from loads which increases the need for electricity transmission and distribution networks. The first is that it is often more economical to transport energy in the form of electricity than to carry the natural resource. Historically, it was cheaper to construct large plants close to the energy source rather than build large plants close to consumers and transport the energy resource. Whilst this applies to generation using geothermal, hydro, wind and solar, in the case of coal, although it is possible to transport it, it is cheaper to locate the plant close to the mouth of a coal mine. The second reason is that the system was designed using technologies that were more cost-effective when used in a large-scale way and other technologies were not yet invented or not available at that time. Solar panels or wind turbines are examples of this.[4]

The demand for electricity can vary depending on the time of day, the day or season. Accordingly, the conventional design and planning of power plants and the network have been structured to meet the 'peak-load' or highest demand. Traditionally, the demand for electricity is divided into three categories: base-load, intermediate and peak-load. [5]

(i) The base-load is the minimum amount of electricity that needs to be supplied at all times, regardless of changes in consumption behaviour. Base-load plants run most of the time at stable levels of output where capital costs are high but operational cost are low, even though they have expensive start up times. The resources used are mainly coal, nuclear and hydro. Being a

[4] Darryl Biggar and Mohammad Reza Hesamzadeh *The Economics of Electricity Markets* (John Wiley & Sons Ltd, Sussex, 2014) at 33.

[5] International Energy Agency *Status of Power System Transformation: System Integration and Local Grids 2017* (International Energy Agency, Paris, 2017) at 33.

base-load resource does not require much flexibility and tends to run without interruption for long times.[6] For instance, in New Zealand and Colombia, the base-load plants are hydro plants and in the Netherlands they are coal.

(ii) The intermediate load varies depending on consumption within different sectors including households, business and industry. Intermediate load plants are designed to adjust their output to accommodate changes in demand throughout the day and to start and stop frequently. Some of these plants are combined-cycle gas turbine, hard-coal plants and some hydro plants.[7]

(iii) Peak-load deals with the highest demand of the day, which means a small number of hours with a system peak for heating or cooling, driven for changes of season. These plants have very short start up times and the cost structure requires a reduced fixed cost and high operating costs. The traditional electricity system has been designed to meet the highest level of demand, which means that the system requires investment in capacity and, during non-peak times is underutilised.

Even though large-size plants have ensure access to energy to large parts of the population, it is worth mentioning that these plants have created impacts in the environment and society where the project is located, depending on the selected generation resource. Depending on the size of the project, these impacts can be considerable. For instance, in the case of fossil fuel use, it affects the environment through air pollutant emissions or CO_2, affecting more than the local population. Large scale hydropower developments causes the flooding of many hectares at the location of the proposed reservoir. This causes the displacement of population, impacts on animals and vegetation and changes to the river course. Also, conflicts often result over the use of land because such projects require large spaces to operate. Even large non-conventional renewable resources, such as solar or wind, are creating impacts because of low social acceptability given the impact on the landscape and animal migration.

[6] At 34.
[7] At 33.

The **transmission grid** consists of power lines suspended from poles and towers or insulated cables which run underground or submerged in water. They carry large volumes of electricity at high voltages because the higher the voltage, the lower the current, and the lower the current, the lower the energy losses. For this reason, transmission networks tend to use very high voltages, with the highest voltages utilised for the longest and most heavily loaded transmission lines. Usually, a transmission network is connected from the largest generator to either a few directly linked customers (large customers) or, more frequently, distribution systems. Globally, the voltages used for transmission range from 100 kV to as high as 1000 kV, with 132, 220, 275, 330 and 550 kV being the most common.[8] The transmission lines are interconnected with one another at switching stations and substations. There are also switching devices, reactive power control, monitoring, and control and communication devices. Therefore, the transmission networks customers are the larger generators, whose supply is transported through the system and the distribution lines and the large electricity customers such as large industries, e.g. dairy and steel industries, who consume largest amount of electricity.[9]

Given it is impossible to store electricity in traditional electricity systems, the system operator as a central control is in charge of constantly balancing supply and demand to ensure system stability and power quality. However, nowadays, due to the increasing use of distributed generation, imbalances and congestions may become more frequent at the distribution level and the management of these imbalances is becoming the responsibility of the distributor. Both transmission and distribution networks are natural monopolies because competition is neither sustainable nor desirable. [10]

Distribution lines take power at a limited number of points of connection within the transmission network and transport it and deliver it to a large number of geographically densely populated points in a given geographic region.[11] In consequence, distribution lines transport the energy to customers at a specific voltage level and are not used to

[8] Biggar and Hesamzadeh, above n 4, at 52.
[9] At 53.
[10] Biggar and Hesamzadeh, above n 4, at 53.
[11] Abdelhay A Sallam *Electric Distribution Systems* (IEEE Press, New Jersey, 2010) at 21.

dealing with generation of energy on the distribution side. Both transmission and distribution require continued investment to maintain reliability and quality of power.[12]

Consumer. The power is supplied to consumption points and the consumer pays an electricity bill for the power supplied, without interacting in any other way with the system. Dependant on the consumption level, they can be classified as large customers, e.g. industries, or end customers, e.g. households or small businesses. This distinction determines different services that one or another has access to. For instance, large customers are well integrated into the wholesale market, their production or consumption decisions are closely metered throughout the day being able to respond to the conditions of the market.[13] Unlike end or small customers who historically have being isolated from these conditions, as they do not receive price signals from the market and cannot adjust their consumption behaviour. The electricity consumed is measured by a manual meter that measures and records the energy consumption, and provides information to the system for planning, operation, and billing the consumer for the energy used.[14] Traditionally, the electromechanical or analogue meter is being used for these purposes, which is not highly accurate and the measurement requires manual or human reading (meter reader) which increases operational measuring costs for the electricity company.

Having explained the activities involved in the traditional electricity system, some questions remain. How are prices set? How are different actors involved in the process? Before answering these questions, it is important to recall that this research is focused on liberalised electricity industries. In doing this, it is vital to explore the main characteristics of this model to be able to understand not only what the features of a liberalised industry are but also how liberalisation interacts with a traditional-centralised power system.

1.1.1 Traditional-centralised and liberalised electricity industry

[12] Biggar and Hesamzadeh, above n 4, at 57; Sallam, above n 11, at 14.
[13] Biggar and Hesamzadeh, above n 4, at 66.
[14] F. D. Garcia, F. P. Marafão, W. A. d. Souza and L. C. P. d. Silva "Power Metering: History and Future Trends" (2017) IEEE <www.ieeexplore.ieee.org > at 27.

Together with the four sectors (generation, transmission, distribution and consumption), which in an interconnected system makes it possible to generate and transport the energy that is produced by the generators to consumers, there are two other important activities that are required for the electricity supply in liberalised electricity sectors: the wholesale market and the retail market. To be able to understand the importance of these markets and the way they are arranged to fit the purposes of the traditional and centralised electricity system, we will explain what a liberalised electricity industry is and how its values contrast with other regulatory models.

Liberalisation, as an economic ideology, was initiated in Chile and Britain in the last decades of the twentieth century and spread worldwide.[15] It aims to integrate free market principles for a fully competitive industry, reducing the state involvement. Liberalisation has been applied to different economic sectors, such as, water, gas, telecommunication or electricity. For the electricity sector, liberalisation involves the participation of the public and private sector under equal terms, open competition to activities in the sector that are not considered natural monopolies. It also requires the unbundling of activities, the development of wholesale and retail markets and the role of an independent regulator in promoting competition and regulating natural monopolies. Liberalisation of the electricity industry contrasts with other economic processes which represent a different political and economic view regarding the best way to supply electricity to the consumers. These other models are public monopoly and public utilities. Before proceeding to explore the values of liberalisation in the electricity industry, it will be necessary first to briefly introduce such contrasting models, to better understand the implications of liberalisation in the industry as opposed to other models.

A **Public Monopoly or Traditional State Ownership** is based on the central role of the state to satisfy the public objectives and general wellbeing. Some of the reasons why a state decides to follow a public monopoly model may include national sovereignty or political convictions that locate the country in a socialist regime or central decision-making over economic development and industrialisation.[16] Other

[15] Dieter Helm *Energy, the State, and the Market* (Oxford University Press, Oxford, 2004) at 15.
[16] Luis Ferney Moreno *Regulación del mercado de energía eléctrica en América Latina: la convergencia entre libre competencia e intervención estatal* (Universidad externado de Colombia, Bogotá, 2012) at

reasons, quite apart from the ideology, are historical reasons, in which the state was the first structure to manage the supply of public services. Public monopoly applied to the electricity industry implies the absence of free competition, the existence of a single buyer and vertical and horizontal integration of companies. The principal legal instruments underpinning this model are: public ownership of the utility companies; the possibility of private participation in activities not considered public services; planning and regulation within a single regulatory authority that controls the market and the existence of either one company or several public companies where natural monopoly predominates. [17] There are numerous historical examples of public electricity monopolies across the world. Some countries experienced public monopoly regimes at the beginning of the electricity industry, e.g. the United Kingdom[18] and other European or Latin-American[19] countries. Other monopolies resulted from the arrival of socialist or communist regimes such as Venezuela or China.[20]

45. (Translation: *Regulation of the electricity market in Latin America: the convergence between free competition and state intervention*).

[17] Luis Ferney Moreno Castillo "Los modelos de regulación de electricidad en América Latina y en particular el modelo de Colombia" in Luis Ferney Moreno (ed) *Derecho de la Energía en America Latina Tomo I* (Universidad Externado de Colombia, Bogotá, 2017) at 24.(translation: Electricity regulation models in Latin America and in particular the Colombian model in *Energy Law in Latin America*).

[18] In the UK, for most of the post-war period and until the government of Margaret Thatcher, the British state ran the energy sector through integrated monopolies which were characterised for the creation of single companies to span industries and to be locked together through the planning processes. This monopoly and integrated structures facilitated both long-term contracts, energy assets and cross-subsidies needed at the time. The British state was responsible for building the main part of the infrastructure that later became part of the privatisation process in the late 1980s and 1990s. Most of the nuclear and coal power stations were built within this framework, as well as the electricity grid and the gas transmission and distribution networks. Tom McGovern and Tom McLean "The genesis of the electricity supply industry in Britain: A case study of NESCo from 1889 to 1914" (2017) 59 Business History 667 at 670; Markku Lehtonen and Sheridan Nye "History of electricity network control and distributed generation in the UK and Western Denmark" (2009) 37 Energy Policy 2338 at 2339. John Vickers and George Yarrow "The British Electricity Experiment" (1991) 6 Economic Policy 187 at 191. Steve Thomas "A perspective on the rise and fall of the energy regulator in Britain" (2016) 39 Utilities Policy 41 at 42.

[19] In Latin America some electricity industry infrastructure were built as the result of the spontaneous growth of private companies in the first third of the twentieth century. However, the state began to intervene in rate setting around this time and also by being in charge of electricity planning. Given the Latin American financial crisis in the 1930s and the start of World War II in Europe, both of which affected power companies' investment capacity, the state had to intervene directly, placing huge financial resources into the industry. However, some of the resources were provided by financial institutions, such as the World Bank, which later pressured governments to liberalise different sectors including electricity. Since the 1990s, countries in Latin America are divided between those that continue following the public monopoly model and those following liberalisation. Carlos Batlle, Luiz A Barroso and Ignacio J Pérez-Arriaga "The changing role of the state in the expansion of electricity supply in Latin America" (2010) 38 Energy Policy 7152 at 7153. Moreno, above 17, at 37.

[20]Two of the key features that characterise the electricity industry in China are planned economy and decentralisation with provincial governments in control of generation assets and provincial grids. China is one of the current examples of significant state involvement, not because it is an example of purely public ownership, but for being a planned economy, where a private investor can participate but closely

On the other hand, in the United States, traditionally the model of **Public Utilities** has developed most of the energy infrastructure and supplies energy around the country. It is a private monopoly, where utility companies agreed to supply all the customers within a territory and, in return, were granted an exclusive service territory earning a reasonable rate of return and income. Thus, the twentieth century was characterised by large vertically integrated utility companies which controlled the entire supply chain, with the state overseeing the activity through Public Utility Commissions (PUCs).[21] Over time, this model progressively changed, sometimes allowing a more active role by the state to oversee the activity and provide the service though public agencies.[22] Later, in the 1990s, competition was introduced to the sector.[23]

Having explored other economic models which contrast with liberalisation, we are going to introduce the key implications of it in the electricity sector when aiming to promote competition such as: unbundling, the role of the regulator and the introduction of the wholesale and retail markets.

Unbundling is the separation of activities in the supply chain, identifying those activities where it is possible to implement competition from those which are natural monopolies.[24] The concept of unbundling comes in opposition to models where a single entity is in charge of carrying out all the supply chain activities in a vertical and horizontal integration of companies. This is the case in either public or private monopolies within the electricity industry. Thus, the importance of unbundling of activities in the liberalisation process is to encourage competition wherever it is possible and avoid anti-competitive behaviours by maintaining an independent network. Unbundling and non-discriminatory access to the network determines access

follow state plans. Qiang Wang and Xi Chen "China's electricity market-oriented reform: From an absolute to a relative monopoly" (2002) 51 Energy Policy 143 at 145; Chung-Min Tsai "The Reform paradox and regulatory dilemma in China's electricity industry" (2011) 51 Asian Survey 520 at 525.

[21] Inara Scott "Dancing backward in high heels: examining and addressing the disparate regulatory treatment of energy efficiency and renewable resources" (2013) 43 Environmental Law 255 at 261.

[22] Michal C. Moore "The issue of governance and the role of the regulator: lessons from the California deregulation experiment" (2002) 2 Journal of Industry, Competition and Trade 75 at 83.

[23] Daniel Hagan, Jane Rueger and John Forbush "United States" in *Getting the Deal Through Electricity Regulation 2018* (16th ed, Law Business Research, London, 2017) at 229.

[24] Barry Barton "Law and Regulation for Energy Networks in New Zealand" in Martha M. Roggenkamp and others (eds) *Energy Networks and the Law: Innovative Solutions in Changing Markets* (Oxford Scholarship, Oxford, 2012) 274 at 280.

to customers at a retail level. Then, the idea of unbundling is to separate distribution of generation and supply services, to avoid conflicts of interest between the distribution system operator and the production and the supply side.

Role of regulator. In a liberalised industry, the primary role of the regulation is the promotion of competition, regulation of monopolies and correcting market failures and is intended to be light-handed. However, as a result of changing needs and the failures of competition and free market, such regulation has become stronger and more detailed, involving more state control and oversight.[25] The role of the regulator and the role of regulation will be further explored in Chapter 3.

Markets. One of the most important mechanisms that came with liberalisation, beyond unbundling the activities, was the creation of the 'pool' or the wholesale market and the retail market.[26] In the wholesale market, large amounts of energy are traded, with active participation by large-generators, purchasers/retailers and more passively, the transmission company. In this type of market, larger power generators and loads are typically well integrated. Generators are usually paid the wholesale price for the amount they produce by submitting bids and offers directly to the wholesale market and take instructions from the market about how much to produce. Large customers may participate in the market directly or through an intermediary while small customers are passive and unresponsive to wholesale market conditions. The design of the pool in the liberalised electricity sector will differ from place to place and will have different characteristics dependant on the country and what is expected to be valued by the market. Conversely, the retail market refers to the sale of electricity from the retail company to consumers. If this market is liberalised, the consumer has the right to choose their supplier based on the various deals or offers available in the market.[27]
According to the above explanation, we are able to state the essential characteristics of the traditional centralised electricity system in a context of liberalisation:

- Reliance on large generating units located far away from consumption areas;

[25] Barry Barton "The theoretical Context of Regulation" in Barry Barton and others (eds) *Regulating Energy and Natural Resources* (Oxford University Press, Oxford, 2006) 12 at 17.
[26] Biggar and Hesamzadeh, above n 4, at 66
[27] Markus Burger, Bernhard Graeber and Gero Schindlmayr *Managing Energy Risk: An Integrated View on Power and Other Energy Markets* (Wiley, Sussex, 2014) at 23.

- Top-down and unidirectional energy flow;
- Electricity transmission and distribution networks are natural monopolies;
- Transmission companies are in charge of balancing the system;
- The system is designed to meet the highest level of demand which means that the system requires investment in capacity. During non-peak times, the system is underutilised;
- Distribution companies are not used to dealing with generation;
- Storage of electricity is not possible;
- There is a separation of activities, mainly distribution from retail;
- Small consumers hold a passive role in the industry, only paying for the power, in contrast to large customers, who can more easily respond to conditions of the market and the grid.

These characteristics remained unchanged for a long time. However, currently, these features are being challenged by new technologies, business models and, most importantly, a more active role of consumers. As a result, a more dynamic and complex approach is underway, which defies the traditional technical, legal and market settings. The next section is going to introduce the new functionalities and opportunities that emerging technologies allow and in particular those empowering consumers.

1.2 What could the future look like?

Imagine a power system where the customers not only buy energy from the electricity company and pay their power bill but also self-generate energy at their own installations or within their neighbourhood. A system where the customer can consume the energy that they produce and sell it back into the power system or to their neighbours, friends and families. One where a group of people, maybe neighbours, pursue an energy project to supply power for their own community and may also trade energy with close by neighbourhoods. Imagine a system that allows a person to decide whether to wash clothing now or later because there are financial incentives to consume power at a specific time. Imagine a system that enables people to do all these transactions in a two-way flow of power and data and in an interactive and easy way. This system that we are describing is now becoming possible, thanks to existing and emerging technologies

and business models that are working to further empower the customer and invigorate the power system. It results in new questions being raised regarding the role of the market in integrating these initiatives, dealing with increasingly more complex relationships between industry actors, efficient and safe management over the network to ensure a quality service, and industry and regulatory standards over new players. Therefore, the role of law is to integrate those new solutions while ensuring that the system as a whole does not become impacted negatively by the new possibilities. Let us start with each of those functionalities and some emerging technologies that enable it to do so.

1.2.1 Distributed generation

One can begin with the possibility of generating your own power. You may come across an advertisement: "It's your roof, your free solar energy. Harness what's yours." This is the slogan of a New Zealand solar company, Skysolar. The company offers a series of deals for residential or business customers who are interested in "powering your home with sunlight".[28] The customer can decide whether to depend 100% on solar energy and storage batteries or to stay connected to the network and use it when solar is not available and export the excess back to the network. This service does not sound like a traditional- centralised retail company which only sells power. This company is selling the means of generating and consuming your own energy. However, what is the main idea behind the business? What is the cost of such technologies? Who will be in charge of managing the impacts of increasing load on the distribution lines? What are the benefits on the industry and for the consumer? These are some of the questions we are going to explore in this section.

The power that is generated at the consumption point or near to it (as opposed to a traditional-centralised electricity system the generators are located far away from the consumption points), is called 'distributed generation'. It is also known in North America as 'dispersed generation' whilst in some parts of Asia and Europe it is known

[28] Skysolar "Residential Solar: Powering you home with sunlight" Skysolar <www.skysolar.co.nz>

as 'decentralised generation'.[29] Some authors use the term 'distributed energy resources (DER)', [30] which include energy storage and responsive loads.[31] Regardless of the terminology used, the main idea is that instead of consumers passively receiving energy from the grid, they can now inject energy into the system on the distribution side[32] (as opposed to the traditional centralised system where the injection of energy is only by large generators into the transmission grid) reducing the cost and dependency on transportation (mainly on the transmission grid).[33]

Different technologies are used for distributed generation. These include reciprocating engines with diesel or gas, gas turbines, micro-turbines, fuel cells, wind, thermal solar, small hydro, geothermal or ocean power in small-scale[34] and, of course, solar photovoltaic (solar PV). The technology involved in solar PV will be explained, as an example, to provide a better understanding of the implications of distributed generation.

Solar PV devices convert sunlight directly into electricity. They consist of two or more thin layers of semiconducting material, such as silicon. When this material is exposed to light, electrical charges are produced which later are conducted away by metal contacts as direct current (DC). The output from a single cell is small, so multiple cells need to be connected and encapsulated to form a module or panel. This is the reason why PV systems can be built in any size because more cells and more panels can be easily added to increase the energy output. Since its first mass production and commercialisation in 1963 by the Japanese company Sharp,[35] the price of buying a solar panel has dropped over time and more significantly since China started the large-scale manufacturing of PV panels.[36] According to data from the International Energy

[29] Nur Asyik Hidayatullah "Analysis of Distributed Generation Systems, Smart Grid Technologies and Future Motivators Influencing Change in the Electricity Sector" (2011) 2 Smart Grid and Renewable Energy 216 at 219.
[30] Ignacio Perez-Arriaga *From Distribution Networks to Smart Distribution Systems: Rethinking the Regulation of European Electricity DSOs* (European University Institute, Florence, 2013) at 3.
[31] JA Peças Lopes "Integrating distributed generation into electric power systems: A review of drivers, challenges and opportunities" (2007) 77 Electric Power Systems Research 1189 at 1189.
[32] W El Khattam and MM Salama "Distributed generation technologies, definitions and benefits" (2004) 71 Electric Power Systems Research 119 at 120.
[33] Johann Hernandez, Francisco Santamaria and Cesar Trujillo "Impacts of regulation in the development of distributed generation" (2015) 28 The Electricity Journal 83 at 84.
[34] Pepermans and Haeseldonck, above n 2, at 791.
[35] Sharp "Sharp History" <www.global.sharp>
[36] Soteris A Kalogirou *Solar Energy Engineering: Processes and Systems* (Elsevier, Oxford, 2009) at 10.

Agency,[37] distributed solar PV capacity is forecast to increase by over 250% during the 2019 to 2024, reaching 530 GW by 2024. Residential solar PV in 2018 was 58 GW and is expected to grow to 143 GW in 2024. Currently China is the largest growth market for solar PV, followed by the United States.[38]

There are two basic types of solar PV: the stand-alone and the grid-connected systems. A stand-alone system, as its name indicates, is able to be fully independent from the grid, a good option for off-grid areas. This kind of system usually consists of the PV module, batteries (to store surplus energy for later use), a charge controller and an inverter which converts the direct current (DC) generated by the PV to alternating current (AC) which is required by household appliances. In the case of grid-connected application, the solar PV is connected to the local network. In this system, when the energy is generated and is not self-consumed, theoretically it can be sold back to the power system. For instance, on weekdays, people are at work or school and therefore are consuming little energy at home. Compared to evenings when people are at home watching TV, washing clothes and have all the lights on. In this case, when the solar panel is generating energy during the day and the energy is not used, it can be exported to the network, whilst during the evening, if there is no battery to store energy during the day, users may have to take energy from the network.[39]

There are different aspects to consider not just in the installation of solar panels but also in relation to budgeting and financing this technology. Issues related to type, angle, dimension of the roof and even which direction they face, are important because they determine how much sunlight the solar panel can receive during the day. The most suitable roofs in New Zealand, for instance, should be facing the sun in the north,[40] whereas in the United Kingdom they should face the sun in the south.[41] Also, the number of residents and the average power usage define how many kW are needed and how many panels need to be installed to meet the domestic demand.

[37] IEA *Renewables 2019: Market analysis and forecast from 2019 to 2024* (IEA, Paris, 2019) at 22.
[38] At 23.
[39] Soteris A Kalogirou, above 36, at 36.
[40] At 54.
[41] The Renewable Energy Hub UK "How much electricity does a solar panel produce?" (2020) <www.renewableenergyhub.co.uk>

For instance, a young couple consume power from the grid, on average 200 kWh in a month. They decide to install a solar system at home. A solar company offers to install a 2 kW system which consists of six panels.[42] A 2 kW system, on average, generates 1,700 kWh of electricity per year. The young couple consume 7,000 kWh in a year. This means that the solar PV system will meet most of the house energy demand but the young couple will still need grid power, which they can buy from the retailer and pay for in the monthly power bill. Currently (2020), six panels (2 kW system) can cost between NZD 6,500 and NZD7, 500. Consequently, the young couple has to make a cost-benefit analysis between how much money they save on the power bill in the short and long term and the upfront cost of the solar PV system. Also, they need to assess the cost of purchasing energy storage options, such as batteries, to help them with their energy supply in the evenings.

Returning to the general issues regarding distributed generation, including roof-top solar panels, what are the benefits and challenges in integrating these to the power system? What is the impact on the power system and on the customers who decide to install them? The relevant literature[43] agrees that some of the benefits of distributed generation in the power system are limiting greenhouse gas emissions when using renewable energy and avoiding constructing new transmission grids and large generation plants. The result of these benefits could be to delay or remove the need for continuous and expensive upgrades of centralised energy systems. Other benefits include diversification of energy resources with sustainable resources to enhance energy security and the introduction of more competition into the market which provides an alternative for consumers to the traditional service. For instance, some economic studies demonstrate how increased use of rooftop PV reduces power bill costs

[42] Mercury "Your solar system" (2020) <www.mercury.co.nz>

[43] Lopes, above n 31, at 1190; Nirmal-Kumar C Nair and Lixi Zhang "Smart Grid: future networks for New Zealand power systems incorporating distributed generation" (2009) 37 Energy Policy 3418 at 3421; Martin Barry and Ralph Chapman "Distributed small-scale wind in New Zealand: advantages, barriers and policy support instruments" (2009) 37 Energy Policy 3358 at 3362; Ricardo Moura and Miguel Centeno Brito " Prosumer aggregation policies, country experience and business models " (2019) 132 Energy Policy 820 at 826. Paul Neetzow, Roman Mendelevitch and Sauleh Siddiqui "Modeling coordination between renewables and grid: Policies to mitigate distribution grid constraints using residential PV-battery systems" 132 Energy Policy 1017 at 1018; Angel A Bayod-Rújula "Future development of the electricity systems with distributed generation" (2009) 34 Energy 377 at 379.

and enhances competition in the market, reducing market power of big players.[44] Nevertheless, as is to be expected, this increase in distributed generation resources threatens the position of large and centralised players. For instance, Thornhill[45] shows how in Australia, one of the countries who have the most solar panels per capita in the world[46] (one in every four homes have solar panels), the business of the large-scale solar industry has been affected by roof top solar use. Distributed solar systems, while reducing grid demand, suppress wholesale electricity prices making it more difficult for large solar projects to compete in the market.

The literature also states that distributed generation may improve energy security when grid disturbances or blackouts affect the power system; for instance, when facing natural disasters. One example of this is the West Coast of New Zealand, which is constantly affected by storms, impacting road access, communication and the power grid. Some projects and individuals on the West Coast are looking at distributed generation as an energy solution to this relentless problem, relying more on local small-hydro.[47] Last but not least, distributed generation is a desirable solution for isolated or remote areas with no access to the power grid. At the same time, the consumer will benefit from distributed generation by being able to self-generate and trade their energy surplus to other users or to the network. There is also the potential for distributed generation to be used not only by individuals but for community projects, creating employment opportunities and enhancing community bonds. Moreover, the benefits of distributed generation are not just for the electricity sector but also for the thermal or heat sector (district heating). This includes thermal energy distributed generation systems, e.g. solar thermal panels or micro-combined heat and power (micro-CHP) generators.[48] Also, there is the opportunity to locally utilise the waste heat from

[44] Ribó-Péreza, Adriaan H Van der Weijde and Carlos Álvarez-Bela "Effects of self-generation in imperfectly competitive electricity markets: the case of Spain" (2019) 133 Energy Policy 110920 at 110921.

[45] James Thornhill "Solar vs solar: in Australia rooftop PV is pushing down prices for large-scale PV" (16 December 2019) Bloomberg <www.renewableenergyworld.com>

[46] The high penetration of rooftop solar PV in Australia is due to various factors such as: abundant sunshine, high electricity prices and policy support. Among the policies that have being implemented we found Small-scale Renewable Energy Scheme (SRES), the Solar Communities program, the Solar Towns Programme, and the Cities Power Partnership. Rohan Best and Stefan Trück "Capital and policy impacts on Australian small-scale solar installations" (2020) 136 Energy Policy 111082 at 111083.

[47] Steve Rotherham "Local hydro keeps the lights on after storm" Energy News <www.energynews.co.nz>

[48] MA Ancona and others "Smart district heating: distributed generation systems' effects on the network" (2015) 75 Energy Policy 1208 at 1209.

conversion of primary fuel to electricity by reciprocating engine generators, gas turbines, microturbines (MTs) or fuel cells (FCs) using small-scale combined heat and power (CHP) equipment.[49]

On the other hand, one should mention some of the challenges that the power system has to deal with when integrating distributed generation. Some of the challenges that the relevant literature has highlighted involves the increasing injection of energy into the distribution side which may impact the capacity of the network to manage it, leading to grid congestion, increasing peak loads and intermittency.[50] This means that distributed generation challenges the congestion management skills of the distribution company, which consist of a set of measures to solve a situation in which the network capacity is insufficient.[51] Although some scholars argue that the distribution company can decide to increase the capacity of the network, such a decision implies investment in infrastructure and more modern management equipment. The big question, however, is who should pay for these updates? The distribution company? The distributed generator? The system as a whole in form of subsidies? This increased costs would inevitably mean higher electricity bills for customers. This question will be partially answered in Chapter 4, regarding access to the network and the emerging role of distribution companies.

Another challenge for the distribution side is the voltage variation or distortion in network voltages by a failing or miscalculation of the inverters.[52] Solar panels use inverters to convert the direct current (DC) generated by the PV to alternating current (AC) which is the standard used by commercial appliances. Similarly, the inverter works as a gateway to the grid. If the inverter is not working well or does not have advanced utility controls, such as low-voltage ride, it cannot predict the output to the network.[53] For instance, in August 2018, in Queensland Australia, massive power disruption was worsened by various types of generators, including solar rooftop

[49] Nikos Hatziargyriou and others "Microgrids" (2007) 25 IEEE Power and Energy Magazine 78 at 79.
[50] Lopes, above n 31, at 1189; Barry and Chapman, above n 43, at 3359.
[51] Ricardo Mouraa and Miguel Centeno Brito "Prosumer aggregation policies, country experience and business models" (2019) 132 Energy Policy 820 at 827.
[52] Paul Neetzow, Roman Mendelevitch and Sauleh Siddiqu "Modeling coordination between renewables and grid: Policies to mitigate distribution grid constraints using residential PV-battery systems" (2019) 132 Energy Policy 1017 at 1018.
[53] Kathie Zipp "What is a solar inverter and how does it work" (18 April 2013) Solar Power World <www.solarpowerworldonline.com>

systems, not complying with standards for inverters by not reducing the output to the system.[54] Therefore, it is critical that distributed generation devices connected to the network comply with security and reliability standards that do not compromise the integrity of the system. This issue also raises concerns about who is responsible for ensuring distributed generators are complying with those standards.

Another important challenge relates to the cost for using the network. In the design of the current system, the cost of the distribution lines are shared among all the network users. In the hypothetical case where the use of distributed generation becomes significant and is not paying network costs, the price may increase for remaining traditional consumers and, hypothetically, more consumers may be forced to leave the grid and generate energy themselves. Their departure may result in further increased costs having to be met by the remaining consumers in a cycle which will leave the utility companies without sufficient customers to recover their fixed costs and pay back the cost of the electricity system's costs. However, this scenario, as Jacobs[55] states, is not likely to occur in the short term but, in my opinion, it is important to take into account such impacts in terms of whether distributed generators should pay, or not, for the use of the distribution network and to what extent. This question will be answered in Chapter 4 in relation to the price of distribution activities. A further important challenge is whether or not the current energy markets have the capacity to integrate the incoming energy from distributed generators among their products. This question will be answered in Chapter 5, relating to access to markets by prosumers.

For customers the costs of technology, such as the price of solar panels, also present a challenge or barrier. Although, according to the International Energy Agency (IEA), the price of solar panel systems has fallen drastically by almost two-thirds for residential systems since 2010, the price still does not appeal to low or middle income households compared to industry or commerce, where it is becoming a reasonable investment. [56] As shown in a previous example, a 6-panel system of 2 kW can cost around NZD6,500 to NZD7,500, and the system is still not able to fully meet the needs

[54] Steve Rothernham "Power supply disruption reveals solar inverter risks" (5 Dec 2019) Energy News <www.energynews.co.nz>
[55] Sharon B Jacobs "The Energy Prosumer" (2017) 43 Ecology Law Quarterly 519 at 525.
[56] IEA *Solar Energy: Mapping the road ahead (*International Energy Agency, Paris, 2019*)* at 14.

of a two person household, given the need to either pay for a bigger system, energy storage or continue paying power bills for the remaining energy needed. Having pointed out the multiple challenges of distributed generation, the question that remains is what is the role of law in addressing some of these challenges or is there any way the law can help to mitigate such impacts? This question will be answered in chapters 4, 5, 6 and 7.

1.2.2 Demand side management (DSM) or Demand Response (DR) and Aggregation.

Imagine being at home watching TV when suddenly you receive a text message on your phone: At 7pm the demand response event will begin and will last for 2 hours. Do you agree to participate?" You agree and prepare, which means a change of plans. You were thinking of washing clothes at 7pm but now it will be better to wash them at 10pm and read a book instead. For this decision you may get paid.

This decision is known as demand side management (DSM) or demand response (DR). Albadi defined it as "the changes in electricity usage by end-use customers from their normal consumption patterns in response to changes in the price of electricity over time".[57] This means a reduction in demand in response to a price signal from the grid. According to Jacobs,[58] the DSM programmes can vary depending on who gives the price signal used to encourage demand reductions.

The price signals can come from either the market or distribution companies in times of high wholesale market prices or when system reliability is jeopardized.[59] Jacobs[60] and Joel[61] pointed out that customers can participate in two kinds of programmes, depending on the signal to promote reductions. In Emergency Demand Response, customers agree to be on call to reduce electricity demand when the system requires it, mostly when the system is under stress. Customers are paid monthly to be available

[57] MH Albadi and EF El-Saadany "A summary of demand response in electricity markets" (2008) 28 Electric Power Systems Research 1989 at 1990.
[58] Jacobs, above n 55, at 515.
[59] MH Albadi and EF El-Saadany, above 57, at 1990.
[60] Jacobs, above n 53, at 518.
[61] Joel Eisen "Who regulates the smart grid? FERC's authority over demand response compensation in wholesale electricity markets" (2013) 4 San Diego Journal of Climate & Energy Law 69 at 74.

and, in return, customers must participate when the market needs them to reduce consumption. On the other hand, in Economic Demand Response, customers agree to reduce their consumption and are compensated based on the actual decrease in their electrical load (how many kW). Here price signals allow consumers to modify their demand when the wholesale market price is too high. Joel[62] argues that reducing demand for electricity is just as efficient as producing the same quantity of energy to meet the demand. Accordingly, we must wonder, should DR reductions also be a commodity in the energy market? And, if so, who can trade it? Either way, higher prices or economic rewards are used to influence consumer behaviour and incentivise reduced consumption at particular times, either as an emergency method to respond to an energy supply crisis or to improve energy consumption habits.

These types of programmes are widely supported, especially when dealing with large customers. Some of the advantages of DR mentioned in the literature are the improvement of electric grid reliability; offsetting the need to construct new electric power plants for peak load times and instead of generating more energy customers are required to consume less or shift consumption to a non-peak time and, of course, reducing consumption. [63] The latter has the same effect as generating energy, as Joel[64] affirms, but without the adverse effects of generating it, such as social and environmental issues, and air pollution or greenhouse emission, depending on the resource used.

The literature also mentions some of the barriers or main challenges regarding the remuneration of such reductions. There is no general agreement about the best way to pay demand response consumers.[65] Some schemes use the same rate as is set when producing energy (wholesale market prices) and others the cost that it saves the system for reducing the load.[66] After understanding the implications for the system and for the customers who self-generate and trade energy surplus back to the network or manage

[62] At 77.
[63] Bonnie Wylie Pratta and Jon D. Ericksona "Defeat the peak: behavioural insights for electricity demand response program design"(2020) 61 Energy Research & Social Science 101352 at 101353.
[64] Eisen, above n 61, at 77.
[65] At 76.
[66] Jacobs, above n 55, at 516.

the consumption of energy based on price signals from the market, we can add another emerging aspect: a system that enables those transactions to be coordinated in real-time.

1.2.3 Smart Grids

When we discuss 'the grid', this refers to the network composed by the transmission and distribution lines, the substation and the transformer that transports the electricity from the power plants to the consumption points. In the new context of digitalisation, computerised equipment and new technologies that diversify energy resources enable new functionalities in the system at decentralised points. The experts refer to the need for a 'smart grid'.[67]

For the IEA,[68] smart grids are electricity networks that use digital and other advanced technologies to monitor and manage the transport of electricity from all generation resources to meet the varying electricity demands of end-users. The purpose of a smart grid then is to coordinate the needs and capabilities of all the actors in the power system to operate it as efficiently as possible, minimising costs and environmental impacts while maximising system reliability, resilience and stability.

Therefore, smart grid is the series of technologies that allows the two-way flow of communication and electricity among the participants within the electricity system in an interactive and coordinated way, matching the energy needs and the capabilities of the electricity system in the most efficient way. These technologies can be applied to the transmission grid, distribution, markets and even the end-user. They include sensor equipment, communication equipment, sophisticated management systems, real-time control devices or advanced metering infrastructures.[69] The main benefits of these technologies include reduced outages or shorter response times to tackle them, delay of investment to update grids, proper integration of distributed resources outputs; monitoring failures and enabling remote maintenance in real-time.[70] Nevertheless, according to the IEA,[71] currently the investment in such technologies represents a small

[67] Hidayatullah, above n 29 at 221; IEA, above n 56, at 6
[68] IEA *Technology Roadmap: Smart Grids* (International Energy Agency, Paris, 2011) at 6.
[69] Hidayatullah, above n 29 at 221; IEA, above n 68, at 6.
[70] Hidayatullah, above n 29 at 222; IEA, above n 68 at 7.
[71] IEA "Tracking energy integration" (May 2019) IEA <www.iea.org>

share of investment in infrastructure globally. However, key challenges for smart grids identified in the literature are cybersecurity issues due to computer technology introduced into the grid which could expose the system to new problems regarding energy security; the lack of international standards which can slow down its deployment, increasing the cost of integration; and, the largest obstacle, financial constraints. [72]

Even though smart grid benefits are considerable and desirable and can produce savings and recovery in the long term, the related costs are also significant. According to the Electric Power Research Institute (EPRI) based on United States, the total cost of implementing smart grid technologies in the United States is between USD338 and USD476 billion, over 20 years.[73] Most of the investment is needed in distribution (USD231 to USD339 billion), some in transmission ($82 to $90 billion) and at the consumer level in terms of smart meters, home and building automation and electric vehicle charges (USD24 to 46 billion). These investments, the EPRI states, will result in benefits of over 1 to 2 trillion dollars. This raises questions that can be universally asked by any country deciding to engage in updating their network with smart grid technologies: Who will pay for it? Is it funded by the government? Depending on the activity that it is being deployed in, who should invest in it? For example, a distribution company investing in smart technologies deployed in the network. Will the consumer end up paying either directly (electricity bill increases) or indirectly (taxes)? Is it up to these actors to invest or should a duty or target be set by the government?

From the perspective of the consumer, which is the focus of this thesis, the importance of an advance meter infrastructure or smart meters which enable demand flexibility and consumer participation in the power system is highlighted. As Nghia Le and others asserted,[74] to realise smart grids, an advanced metering infrastructure of smart meters, is the key. The next section will focus on this point.

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[72] Hidayatullah, above n 29, at 228; Jeannie Oliver and Benjamin Sovacool "The energy trilemma and the smart grid: implications beyond the United States" (2017) 4 Asia & the Pacific Policy Studies 70 At 73; Biggar and Hesamzadeh, above n 4 at 371.

[73] EPRI "Estimating the Costs and Benefits of the Smart Grid" (29 March 2011) Electric Power Research Institute < www.smartgrid.gov> at 14.

[74] Trong Nghia Le, Wen-Long Chin and Dang Khoa Truong "Advanced metering infrastructure based on smart meters in smart grids" in Moustafa M Eissa (ed) Smart Metering Technology and Services-Inspirations for Energy Utilities (INTECH, Croatia, 2016) at 111.

1.2.4 Advanced Metering Infrastructure and Smart Meters

It is still common that even in the era of communication and technology in both developed and developing countries, reading and measuring how much electricity is consumed is done manually. A staff member from the electricity company is required to come to the house and read how much electricity you used since the last reading and based on usage the company will set an average power consumption per month. This is called manual data collection. This means the traditional meter does not provide an accurate measurement of real-time energy consumption. This type of meter is known as an 'electromechanical meter' or an 'analogue meter'.[75] Manual data collection creates significant operational costs for the utility company, which will be transferred to the consumer through the power bill. It also ensures inaccurate information over power usage.

However, thanks to the evolution of electronics over the last decade, in particular wireless networks, there are now electronic meters which allow electricity companies to remotely access the data generated by the meter at the point of consumption. The functionality is called Automated Meter Reading (ARM). Current technology allows us to go one step further through what is now called Advanced Metering Infrastructure (AMI), including 'smart meters', which not only enables the accurate and remote reading of meters but also communication between the company and the consumer.[76]

A smart meter is an advanced device that gathers more detailed information from the customer. Information, such as real-time consumption, voltage or frequency, is now available for the electricity company for better billing and monitoring. Smart meters will also allow disconnection or reconnection of certain loads and control a user's devices to monitor and control users' consumption.[77] Moreover, smart meters facilitate digitalisation, real-time data and a two-directional physical flow of energy and information at the distribution level. Therefore, the consumer can control over the

[75] FD Garcia, FP Marafão, WA d. Souza and LCP de Silva "Power metering: history and future trends" (2017) IEEE 26 at 29.
[76] At 30.
[77] Kixuan Zheng, David Wenzhong and Li Lin "Smart meters in smart grid: an overview" (2013) IEEE at 60.

consumption of energy, participate in demand response programmes and export energy to the grid.[78] As we can see, smart meters make new tariff models possible, facilitating real-time pricing, which enables a more efficient use of energy. They also allow distribution companies to make more efficient use of the network resources and to better manage peak-load times.[79]

It is possible to have access to all these functions by using a smart meter; however, the configuration of the meter determines the degree to which these functions are available. It is common to have a smart meter at home that only records the household's actual energy consumption and nothing else, which is more of an advantage to the retailer that the consumer. Hence, smart meters that are properly set and used are vital for integrating distributed generation and demand response programmes to transfer real-time consumer data and allow their participation in the power system.

Although the technology is ready, governments around the world are studying the way to roll them out and regulate them. As we can expect, sensitive topics are being discussed including data management, privacy, consumer data security, system information, and financial issues, such as who pays for the roll out of smart meters. According to the IEA,[80] more than one billion households and 11 billion smart appliances could participate in the interconnected electricity systems by 2040, thanks to smart meters and connected devices, but better interaction and intercommunication are needed in this more complex power system. The current average cost of the installation of smart meters is around USD600 per household.[81] This cost can either be paid by the government, the supplier or the consumer, the property owner or even the distribution company depending on the regulation and the market in each jurisdiction. This point will be the object of further study in Chapter 4, regarding the emerging functions of the distributor operator.

Smart meters also form part of the Advanced Metering Infrastructure (AMI) which is considered the first step towards smart grids. The AMI is the system that collects and

[78] At 58.
[79] At 59.
[80] IEA "Digitalization set to transform global energy system with profound implications for all energy actors" (6 Nov 2017) IEA <www.iea.org>
[81] Jared Mullane "How to get a smart meter" (1 March 2019) Canstar <www.canstarblue.com.au>

analyses data from smart meters, using two-way communication and allowing them to manage power and services based on that data. An AMI includes hardware and software at the customer premises, access points providing a communication network between customers and the distribution operator and retail companies. The data management systems allow the measurement, collection, management and analysis of the data for further processing, which enables the interaction of all industry participants to be coordinated.[82]

The benefits of an AMI include (i) active consumers controlling and managing self-generation and its impact into the grid; (ii) the traditional consumer having more accurate information over the consumption of energy, real-time pricing and enable demand response;[83] (iii) helping the distribution operators by providing real-time information about grid failures, online monitoring of the quality of the energy to improve the management and response to sudden congestions or detection of real-time outages or grid problems. In addition, AMI helps them to locally balance the distribution network avoiding congestion or loss in the system, e.g. load control, remote connection or disconnection of devices. It can also help to free capacity in the system, i.e. efficient management of the grid; [84] (iv) helps traders of energy by improving accurate billing, easing the detection of frauds and enabling them to offer different services to the grid. For instance, participation in demand response, depends on the innovation in pricing methodologies, e.g. the possibility of prepayment.[85]

However, legal questions should be raised regarding AMI and smart meters. How will the different actors involved in an AMI interact in relation to the responsibilities of each party? What about access to data by a third party? Who is in charge of managing the collected data? Who is in charge of the rolling-out of smart meters? Some of these questions will be explored in Chapter 4, regarding access to the network, while other questions are beyond the scope of this thesis and deserve special research as is the case with data management and privacy.

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[82] Nghia and Wen-Long, above n 74, at 111.
[83] Universidad Nacional de Colombia *Definición de Funcionalidades Mínimas de un Medidor Inteligente en Colombia* (University Nacional of Colombia, Bogotá, 2016) at 5. (Translation: *Definition of Minimum Functionalities of a Smart Meter in Colombia*).
[84] Electricity Authority *Guidelines on Advanced Metering Infrastructure* (Version 3.1, Electricity Authority, Wellington, 2016) at 2.
[85] Nghia and Wen-Long, above n 74, at 112.

1.2.5 Micro-grids and Community Energy Projects.

Aardehuizen in the Netherlands is a small neighbourhood of 23 houses with an earth-ship design located in a rural area. This community promotes low carbon impact, self-sufficiency and is eco-friendly. There are roof-top solar panels on every house, some heat pump, electric boilers, wood stoves and solar thermal panels to provide electricity and heat to the members. They are also considering creating a local smart grid within the community with the possibility of meeting demand and supply locally and, in the near future, to be able to be off-grid once they have become suitably self-sufficient.[86] The possibility that entire neighbourhoods are able to meet their own energy requirements for generation, supply and management of energy resources is called community energy based on 'micro-grids'. The micro-grid can also be integrated with larger micro-grids, allowing them to share energy with others and become more resilient and, in the same way, decide whether to be connected to the national grid or not.

A micro-grid is a localised network of electricity resources and loads that can be controlled to ensure reliable operation when the system is isolated or connected to the grid, but is able to operate in an island mode. While the traditional-centralised electricity system is constructed to meet peak demand, micro-grids can be escalated efficiently to reflect average electricity consumption. Micro-grids can also integrate other features such as dispatching and intermittent resources, energy storage and backup generators as well as software that monitors and manages generation and consumption or demand-side management. [87] These additional services help to maintain the safety, reliability and security of the transmission. Apperley[88] asserts by recognising the potential of micro-grids as a different approach to bottom-up planning. Microgrids

[86] Metabolic "New strategies for smart integrated decentralised energy systems" (August 2018) Metabolic <www.metabolic.nl>

[87] Jessica Wentz and Chiaara Pappalardo "Scaling up local solutions: creating an enabling legal environment for the deployment of community -based renewable microgrids" in Jordi Jaria i Manzano, Nathalie Chalifour and Louis J. Kotzé *(*eds*) Energy, Governance and Sustainability* (Edward Elgar Publishing Ltd, Cheltenham 2016) 99 at 113.

[88] Mark Apperley "Modelling energy balance and storage in the design of smart microgrids" (2017) IARIA at 35.

based on localised energy balance can meet local generation with local demand, reducing dependence and impact on the grid, translating in reduced load.[89]

However, there are challenges for the development of micro-grids. Two of the main issues are financial concerns about attracting resources to invest in these projects and the difficulties around accessing technical expertise and spare parts for the correct operation and management of the grid.[90] In the case of the latter problem, technical training programmes and capacity building efforts are useful for filling gaps in managing local resources.[91] A further challenge is the development of appropriate technical standards and connection procedures to ensure that micro-grids do not compromise grid reliability.[92] One legal question that is raised in the context of liberalisation and the use of unbundling to promote competition is whether unbundling rules are applicable into micro-grid projects. Micro-grids work on the basis that the community engages in generation, distribution and supply, so the question is whether that is possible within the applicable rules. Another practical and legal question is whether it is possible to supply energy from the community project to members of the community. These questions will be explored later in Chapter 6 discussing community energy.

1.2.6 Emerging perspectives of the power system

So far, this chapter has explored emerging concepts and a range of technologies that can solve old paradigms, problems and challenge traditional characteristics and ways of thinking. The characteristics of the electricity system are no longer clear. A more dynamic and complex system is emerging. Some of the traditional thinking that may be challenged and issues that can be resolved with new perspectives have been identified by the literature :

[89] At 36.
[90] Wentz and Pappalardo, above n 87, at 114.
[91] Juliana Zapata Riveros, Merla Kubli and Silvia Ulli-Beer "Prosumer communities as strategic allies for electric utilities: Exploring future decentralization trends in Switzerland" (2019) 57 Energy Research & Social Science 101219 at 101220.
[92] John Roman and others "Lessons from international experience for China's microgrid demonstration program" (2014) 67 Energy Policy 198 at 202.

- Transportation costs: generator units located close to consumers or on-site will lessen the demand for long distance transportation of electricity.
- The consumer can respond to wholesale market conditions: with the increasing growth of distributed generation, demand response and smart appliances. There is a greater ability for small customers to respond to wholesale market conditions.
- Increasing management and consumption which is autonomous and self-sustainable: for people and communities who geographically, economically, technically and financially can install sufficient renewable capacity and energy storage that does not require them to be connected to the grid, it will enable them to be self-sufficient. This segment will probably remain relatively small.[93]
- The active role of consumers: consumers that remain connected to the grid can be active providers of energy services to the grid and manage their own consumption.
- Peak demand: as previously stated, the electric power infrastructure is designed to meet the highest demand level, which means that the system requires investment in capacity. During non-peak times, the system is underutilised. Smart grids demand response and deployment of renewable energy which can reduce peak demand by either providing more flexibility through renewable resources or by providing information and incentives to consumers to enable them to shift consumption away from periods of peak demand.[94]

Rethinking the traditional structure of the power system also challenges the relationship between the different agents. One of the agents that will drastically change its role is the consumer, who will become more active and engaged.

1.3 Key points

This chapter has compared the characteristics and main features of traditional-centralised power systems with emerging concepts that enable consumers to be more active thanks to a series of technologies and business ideas, in the context of

[93] Yael Parag and Benjamin K Sovacool "Electricity market design for the prosumer era" (2016) 1 Nature Energy 1 at 2.
[94] IEA, above n 68, at 24.

liberalisation of the electricity industry. Firstly this chapter has shown that the electricity industry was built based on the best available technology at the time and, in order to guarantee universal access, centralised models were developed. These are characterised by a limited number of generators located far from consumption points, large grids located through the country and multiple points of consumption, where the consumer is merely passive. Each activity is separated and, as described, is subject to different legal frameworks. The role of the state and the private sector in such developments differs across the systems and corresponds not only to the chosen regulatory model but also to the needs of each country. In a context of liberalisation of the electricity industry, it introduces new characteristics to the industry. These include the need to promote competition as a way of achieving better prices and services for consumers. Also, unbundling rules to encourage more competition among sectors where it is possible to do so (generation, wholesale and retail market), and ensure that networks are available for industry participants. Moreover, the introduction of market mechanisms (wholesale and retail market) to supply energy at competitive prices.

Nevertheless, these traditional characteristics are being challenged by a more active role for consumers. This is now possible thanks to distributed generation technologies, smart grids, demand response, smart meters and advanced metering infrastructures that enable consumers to produce their own energy, manage their consumption patterns, sell the energy back to the system and interact with other industry participants. All of these possibilities integrate a bottom-up or decentralised approach into the industry and create multiple benefits for the system and consumers. However, they also create challenges. These range from financial constraints because of the high up-front cost of such technologies, congestion in the network challenging management skills of distribution companies or setting of markets which are used to deal with large and centralised players. In the next chapter, we will encounter some of the legal challenges that the coexistence of a traditional-centralised perspective of the electricity industry and emerging technologies create.

Chapter 2: Coexistence of the Traditional-Centralised Power System Regulation and Emerging Technologies Regulation – Overview

To better understand the coexistence of characteristics and legal frameworks of both tailor-made traditional-centralised power systems and the emerging systems' features, this chapter introduces the key regulatory frameworks in the three chosen jurisdictions relating to the electricity industry's different activities. This chapter is divided into four sections, each one analysing one of the chosen jursdictions (New Zealand, Colombia, the Netherlands and the European Union). For each jurisdiction, an analysis will be provided including some background about the profile of the country, the energy related institutions and some comments on their electricity regulation history. This will be followed by consideration of the main regulations applicable to generation, transmission, distribution, wholesale and retail market and the role of consumers in each jurisdiction. The overall analysis will also introduce some of the early regulation of emerging concepts such as the active consumer, distributed generation, smart grids, smart meters and demand response.

For comparative reasons, each section will explore the following issues:

- Generation: entry to the market and whether any special legal provisions promoting renewable energy generation exist.
- Transmission: whether there are any rules regarding non-discriminatory access.
- Distribution: unbundling rules, special provisions for renewable energy and the existence of rules for third parties.
- Wholesale market: who can participate in the market?
- Retail market: whether a supply licence is needed or not.
- Consumer: rights and duties of consumers.
- Active consumer: whether a category exists that includes a consumer who is generating their own energy and wants to sell any energy surplus. Also, a general consideration in terms of access to the network and access to the market.
- Smart grids and Advanced Metering Infrastructure: whether roll-out targets exist and who is responsible for the roll-out.

- Smart meters: whether roll-out targets exist or not, who is responsible for them and what are the desirable or mandatory functions of the meter.
- Demand Response: is it regulated by the regulatory authority or is it market-driven.

2.1 European Union

The European Union (EU) is a political and economic supranational entity of 27 countries, not including the United Kingdom that left the EU on the 31st of January 2020 and will no longer be bound by any EU rules and regulations at the end of the transition period, which at the time of writing is the 31st of December 2020.

The concept of integration among European countries started with the 1951 Coal and Steel Community which provided supranational governance of coal. In 1957, the Atomic Energy Community was established, also attempting to unite European countries economically and politically after the turmoil created by the Second World War.[1] This agreement was a way of ensuring there would be no repeat of the two world wars and in that sense, ensuring future peace through closer economic and political co-operation and a 'common market'.[2] They evolved into the Treaty of Maastricht which came into force in 1993, and formally created the European Union and established the single market including the free movement of goods, services, capital and people.[3] The Treaty also provided for electricity and gas supplies to be exempted from the free movement rules and the free market where their application could obstruct their performance.[4] In 1996, the EU adopted Directives to create an internal energy market; further Directives replaced these in 2003. The Directive 2003/54/EC transformed the electricity and gas sector organisation, introducing more competition and breaking up vertically integrated industries and companies, this will be explained later.[5]

[1] European Union "The history of the European Union" (2017) <www.europa.eu>.
[2] Desmond Dinan *Even Closer Union : an Introduction to European Integration* (4th ed, Lynne Rienner Publishers, Colorado, 2010) at 34.
[3] Hanneke Eijken *The role of European Citizenship in the Constitutionalisation of the European Union* (Europa Law Publishing, Groningen, 2015) at 48.
[4] EU legislation can be either a directive (which needs to be transferred into national law) or by regulation which has direct effect in the Member States.
[5] Martha Roggenkamp and others "EU Energy Law" in *Energy Law in Europe: National, EU and International Regulation* (Oxford University Press, Oxford, 2016)188 at 190.

In terms of the European electricity mix in 2019, the proportion per resource was 7% coal, 22% natural gas, 25% nuclear energy, lignite 7.8%, other fossils 3.6 and 34% renewable energy. Among the renewable resources, wind is 13.4%, solar 4.2%, biomass 6.2% and hydro is 10.8%.[6] Most of the energy and environmental matters follow ordinary legislative procedure, known as co-decision, where the European Parliament and Council approves EU legislation based on a proposal from the Commission. [7]

The European Union has introduced four electricity directives since 1996: Directive 96/22/EC, Directive 2003/54/EC, Directive 2009/72/EC and the 'Clean Energy for All Europeans Package' of 2018 and 2019. The evolution of these packages illustrates the process of liberalisation and the formulation of a free energy market, and the need for decentralisation and more sustainable energy solutions for all Member States. The following will mention the main characteristics of each Directive and its relationship with the active role of consumers.

The first electricity package, Directive 96/92/EC, focused on more regulation of network operators and moved towards the unbundling of the sector, albeit with a limited level of oversight. This Directive required companies to keep separate accounts for production, transmission, distribution and supply activities. In terms of customers, the Directive defines them as the buyer of electricity for their own use who cannot carry out transmission, generation or distribution functions.[8] Alongside the Directive refers to the customer merely as a passive actor who is supplied with energy.

The second electricity Directive, Directive 2003/54/EC, is important for opening up the market, speeding up liberalisation joined to public service objectives, environmental protection and security of supply. This Directive is recognised for producing the benefits of lower prices, better service standards and also for correcting problems in the previous Directive concerning unbundling, third party access and the establishment of an independent regulator.[9] In terms of customers, the Directive mentions, for the first

[6]Agora Energiewende "The European power sector in 2018. Up-to-date analysis on the electricity transition: Analysis" (2018) <www.agora-energiewende.de> at 25.
[7] Roggenkamp and others, above n 5, at 190.
[8] Directive 96/92/EC (EU), art 2 (8) and (9).
[9] Roggenkamp Martha "Introduction to energy transition and the law" (Solving the Energy Puzzle, University of Groningen. 2018); Roggenkamp and others, above n 5, at 191.

time, that among the expected outcomes of the principle of free movement of goods and services, consumers have the right to freely choose their suppliers, meaning that from that point, the retail market should be unbundled.[10] The Directive also states that households have the right to be supplied with energy of a specified quality for transparent and reasonable prices, known as universal access, and special protection for vulnerable customers.[11] Despite these provisions highlighting specific electricity customer rights, the treatment of the customer remained as passive actors.

Directive 2009/72/EC aimed at further liberalisation of the national energy markets and greater market integration at European and regional levels by establishing the European Network of Transmission System Operators for Electricity (ENTSO-E).[12] Also adjusted the unbundling regime and gave the Member States the option to choose among the following three models. The first is ownership unbundling, where producers and suppliers cannot own companies operating transmission networks and vice versa. The second introduces an Independent System Operator (ISO) where the owner of the transmission system does not run the network itself but appoints an ISO to do so. The last option is an Independent Transmission Operator (ITO), where the network company remains legally unbundled but its independence requires it to follow a set of strict rules to prevent the mother company from interfering in the decision-making process of the network company.[13] In terms of consumers, once again the Directive protects the right of consumers to freely choose their supplier,[14] universal access[15] and protection of vulnerable customers.[16] For the first time, it gives consumers the right to have access to representation and dispute settlement mechanisms[17] and access to objective and transparent consumption data.[18] Although this last provision opens the door to smart metering, the overall treatment of customers continues to see them as passive actors in the liberalisation process.

[10] Directive 2003/54/EC (EU), recital (2)(20) and Annex A.
[11] Directive 2003/54/EC (EU, recital (24), and art 3.
[12] Roggenkamp and others, above n 5, at 190.
[13] Roggenkamp, above n 9.
[14] Directive 2009/72/CE (EU), recital (3), (45), art 3(4).
[15] Directive 2009/72/CE (EU), art 3 (3).
[16] Directive 2009/72/CE (EU), recital (53), art 3 (7).
[17] Directive 2009/72/CE (EU), recital (42), art 3 (13).
[18] Directive 2009/72/CE (EU), recital (50), art 3 (9).

Finally, in 2018, the 'Clean Energy for All Europeans' package was enacted. This energy package included multiple Directives and regulations relating to energy performance in buildings,[19] governance regulation, energy efficiency,[20] renewable energy and electricity market design. We will focus our attention on the Directives regarding renewable energy and market design because it changes the electricity market paradigm including a more active role of consumers.

Directive 2018/2001 promotes the use of energy from renewable resources. The European Parliament decided to favour the development of the market for renewable energy while including the benefits of self-consumer and renewable energy communities for the first time. It recognised the need to define these concepts and create a special legal framework to empower them.

The following year, the European Parliament enacted Directive (EU) 2019/944, on the internal market for electricity, with the purpose of invigorating the market. It recognises that consumers have an essential role in achieving the flexibility necessary to adapt the electricity system to an increasing use of variable renewable energies. New technologies, such as smart meters and system management that allows real-time pricing are fundamental to boost consumer participation in demand response programmes. The Directive also introduced new actors and concepts such as active consumers and a citizen energy community. The explanation of these concepts and implications will be part of the next section.

The European Union has slowly and progressively developed an awareness of the importance of integrating an active role for consumers in the systems which will finally be achieved by the increasing use of new technologies and new possibilities. This new reality makes it essential that the regulatory framework is updated and adapted to provide a more dynamic and flexible system. The next section will explore how electricity industry activities are currently regulated by the European Directives and how emerging concepts of active consumers are being integrated into such legislation.

[19] Directive 2018/844/EU amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.
[20] Directive (EU) 2018/2002/EU amending Directive 2012/27/EU on energy efficiency.

2.1.1 Regulation of activities in the European Directives

In relation to the *generation* of electricity, the Directives indicate that production can be subject to prior authorisation, although in the Directive 1996/22/EC, a Member State could choose between authorisation and a tendering process.[21] Currently, Member States are obliged, as a general rule, to make use of an authorisation procedure for constructing new plants and can only establish a tendering process in exceptional circumstances. Tendering was limited because it was considered part of the centrally planned system which is no longer encouraged by the European Commission. The only situation in which the European Union set of rules allow the tendering procedure is when there is a market failure in providing sufficient generation capacity or when the existing authorisation procedure is insufficient to generate the required capacity for environmental protection and the promotion of new technologies.[22] Such authorisation procedures tend to establish technical and financial requirements that only big players can fulfil. There is also a special regime for promoting the generation and integration of renewable resources, which started with Directive 2009/28/EU and Directive 2001/77/EC and continues with Directive 2018/2001. These Directives introduced special treatment for renewable energy in the European legislation in terms of promotion, a guarantee of origin, administrative procedure, access to the network and remuneration schemes. Although Directives 2009/28/EU and 2001/77/EC focused on promoting large generation projects based on renewables, Directive 2018/2001 incorporates a more decentralised approach that recognises the importance of large and small self-generators and distributed generation. It also introduced new provisions regulating its integration. The importance of Directive 2018/2001 is discussed in more depth in the section related to consumers.

In *transmission and distribution,* the unbundling process is a key element of the current market approach to market liberalisation. Although transmission and distribution remain a natural monopoly, the role of the system operator and their independence play an essential role for liberalisation. The system operator should assure that producers and suppliers can freely trade electricity and have access to grids. The operator's

[21] Directive 96/92/EC (EU), art 4.
[22] Roggenkamp and others, above n 5, at 192.

primary responsibilities are to ensure non-discrimination between users, ensure the long-term ability of the system and manage the information provided by the grid users to ensure secure and efficient operation. The Directive requires that grid tariffs must be objective, non-discriminatory and cost-reflective and should be approved by the National Regulatory Authorities.[23]

As described above, the Directive establishes the obligation to provide all system users with access to the grid which does not mean, *per se,* a right to be connected. Roggenkamp states that the right to have access implies the ability to have energy transported or transmitted through the network, requiring that network capacities be available and technically facilitate transportation, including the necessary system services required.[24] In this context, the principle included in the European Directives about non-discriminatory access to the grid ensures general access to the grid but the Member State manages the way in which the users are connected to the grid. The Directives do not expressly mention the condition for the connection of distributed generation.

Directive 2009/28/EU, in promoting renewable energy, includes requirements on Member States to take the appropriate steps to develop the necessary infrastructure for access to grids for electricity from renewable resources. The state must ensure that the system operator guarantees the transmission and distribution of renewable electricity and provides for either priority access to the grid or guaranteed access. This point will be further explored Chapter 4, relating to access to the network and functions of the distributor operator in the European Union and the Netherlands.

In relation to *consumers*, this Directives establish the protection of consumer rights such as choosing and changing their supplier, universal access and recognition of energy poverty. This right applies mainly to small and household consumers with the Directives requiring that a customer has a right to enter into a contract. The conditions need to be fair and well known in advance, and any intention to modify the contract should be given with adequate notice. Customers need to be offered a full and non-

[23] Roggenkamp and others, above n 5, at 194.
[24] Roggenkamp and others, above n 5, at 196.

discriminatory choice of payment methods and will not be charged for changing supplier. Although, in practice, they can be penalised by 'exit fees' if they want to change supplier during the contract period. Consumer protection rights include mechanisms for dispute settlement and an energy ombudsman or consumer body protecting consumer rights. In general, Member States are called to ensure a high level of consumer protection and to take measures to ensure that contractual terms and conditions are transparent. Consumer protection rights will be further explained in Chapter 5, relating to prosumer rights.

After the Clean Energy for All Europeans package was enacted, new categories relating to a more active role for consumers were introduced. They are the 'active consumer',[25] 'renewable energy communities',[26] 'renewable self-consumer', [27] and citizen energy community.[28] The discussion on this energy package started in 2016, when the European Parliament adopted the Resolution on 'Delivering a New Deal for Energy Consumers' which called for a European Union wide common operational definition of a more active consumer. In a Resolution on 13 September 2016, the European Parliament repeated the request, asking the European Commission to include a new chapter on active consumers in the Directive 2018/2001, addressing the main challenges and boosting the investment in self-generation of renewables. [29] Finally, in 2018, these request were met and the 'Clean Energy for All Europeans package' was enacted. This energy package contains multiple directives and regulations regarding energy performance in buildings,[30] governance regulations, energy efficiency,[31] renewable energy and electricity market design. As Vidlička correctly argues, this long-awaited package sent a signal to the industry for customer empowerment and adaptation of the system to the developments of the modern era such as decentralisation and digitalisation. [32]

[25] Directive 2019/944/EU, art 2 (8).
[26] Directive 2018/2001/EU, art 22.
[27] Directive 2018/2001/EU, art 2 (14).
[28] Directive 2019/944/EU, art 2 (11).
[29] European Parliament *Electricity Prosumers* (European Parliament, Brussels, 2016) at 8.
[30] Directive 2018/844/EU amending Directive 2010/31/EU on the energy performance of buildings and Directive 2012/27/EU on energy efficiency.
[31] Directive 2018/2002/EU amending Directive 2012/27/EU on energy efficiency.
[32] Richard Vidlička "The EU's Clean Energy for All Europeans Package creates new perspectives for DSOs" (2019) 8 European Energy Journal 65 at 67.

In Directive 2018/2001 on the promotion of the use of energy from renewable resources, the European Parliament decided to favour the development of the market for renewable energy while including the benefits for self-consumers and renewable energy communities for the first time. The Directive therefore clarifies those concepts and introduces a special legal framework to empower consumers. The Directive incorporates two new concepts: renewable self-consumer and renewable energy community. The former refers to consumers who generate renewable electricity for their own consumption and the energy surplus can be stored or sold.[33] The renewable energy community is considered a project that is owned by members or shareholders located close to the project whose primary purpose is to provide greater environmental or communal benefit than economic profits.[34] This concept is further explained in Chapter 6, regarding community energy projects.

For the first time, this Directive establishes special treatment for active consumers in the form of 'renewable self-consumers'. Member States should ensure that individually or through an aggregator, self-consumers are entitled to generate energy, consume it and store or sell the excess. Trading can take place through peer-to-peer trading or power purchase agreements, receiving a fair remuneration for it without being subject to discrimination or disproportionate procedures that are not cost-reflective. At the same time, they maintain their rights as an end consumer.[35] However, the self-generator can be subject to proportionate charges and fees if it becomes a burden on the system's long term financial sustainability or when the installed capacity is more than 30 kW.[36]

Jointly acting renewable self-consumers also should be entitled to engage in joint activities of self-generation, trading or storage.[37] In addition, Member States should address the current unjustified barriers that are facing self-consumers, such as accessibility and financial barriers, especially for low income households, tenancy arrangements, access to the grid and access to support schemes.[38]

[33] Directive 2018/2001/EU, art 2 (4).
[34] Directive 2018/2001/EU art 2 (16).
[35] Directive 2018/2001/EU, art 21.
[36] Directive 2018/2001/EU, art 21 (3) (c).
[37] Directive 2018/2001/EU, art 21 (4).
[38] Directive 2018/2001/EU, art 21 (6).

At the same time, Directive (EU) 2019/944 on the internal electricity market, as well as trying to invigorate the market, recognises that consumers have an essential role in achieving the flexibility necessary to adapt the electricity system to include increased participation of a variety of renewable energy resources. Hence, new technologies, such as smart meters and smart grids in allowing real-time pricing, are fundamental to boost consumer participation in demand response programmes. This Directive uses a different terminology from Directive 2018/2001. It refers to 'active customer[39] instead of renewable self-consumers. It also uses the term 'citizen energy community'[40] instead of 'renewable energy community' and includes new actors such as the aggregator[41] as well as demand response[42] and the smart metering system.[43] Similar to the rules established in the Directive 2018/2001, related to 'renewable self-consumers', the 'active customer' is also entitled to self-generate, store energy, receive a fair remuneration and not be subject to disproportionate procedures or charges.[44] In addition, this Directive is more technical and further highlights the active customer's role in providing flexibility to the system by being financially responsible for the imbalances caused in the system[45] and by participating in demand response programmes.[46] Both scenarios require Member States to deploy and ensure the interoperability of smart meters. [47] A further analysis of Directive 2019/944 and Directive 2018/2001 will be included in the following chapters, especially chapters 4, 5 and 6.

Finally, special mention deserves provisions regarding smart grids and smart meters. Directive 2009/72/EC establishes that Member States should encourage the modernisation of distribution networks, such as through the introduction of smart grids that should be built in a way to encourage decentralised generation and energy efficiency.[48] The Directive requires Member States to assess the long-term costs and benefits of rolling out smart meters for the market and consumers. Based on this

[39] Directive 2019/944/EU, art 2 (8).
[40] Directive 2019/944/EU, art 2 (11).
[41] Directive 2019/944/EU, art 2 (18), (19).
[42] Directive 2019/944/EU, art 2 (20).
[43] Directive 2019/944/EU, art 2 (23).
[44] Directive 2019/944/EU, art 15.
[45]Directive 2019/944/EU, art 15 (2)(c).
[46] Directive 2019/944/EU, art 17.
[47] Directive 2019/944/EU, art 19.
[48] Directive 2009/72/EC, recital (27) and art 3 (11)

assessment, Member States have to prepare a timetable for the implementation of smart meters. If the assessment supports it, at least 80 percent of all consumers must be equipped with a smart meter by 2020.[49] In accordance with this mandate, Member States have committed to rolling out around 200 million smart meters for electricity and 45 million for gas with a total potential investment of €45 billion by 2020.[50] The roll-out progress is behind schedule with only 72 percent of customers with a smart meter; this means that the 80% target has not been achieved entirely.[51] Among the leading countries in the roll-out target are Italy, Sweden, Finland and the Netherlands which have already reached the target and are working beyond the agreed targets. [52]

Similarly, the Directive 2019/944 recognises the vital role of the smart metering system and, once again, promotes its deployment subject to cost benefit assessment and interoperability, best practice and importance for the developing the energy market.[53] The Directive also states that the customer should contribute to the associated costs related to its deployment in a transparent way while taking into account the long term benefits for the whole value chain. Finally, article 20 describes all the functions that the smart meter should provide, such as actual time of use or cybersecurity protection. In relation to active customers, it shall account for the electricity fed into the network and consumed, and information about the smart meters full potential.

The above provisions regarding smart meters and smart grids are important in promoting decentralisation while recognising the ability for self-production and exportation of energy surplus by removing technical and legal barriers that will allow smart meters' functions to be fully used. However, the success of these policies depends largely on what Member States decide, not only in terms of financial viability of the roll-out (the cost of a smart metering system averages between €200 and €250 per customer),[54] but also in terms of infrastructure and the regulatory framework for a viable interoperability and data security.

[49] Directive 2009/72/EC, Annex I about Measures on Consumer Protection, (2).
[50] European Commission "Smart Metering deployment in the European Union" (11 March 2020) <www.ses.jrc.ec.europa.eu>
[51] Padraig Scully "Smart Meter Market 2019: Global penetration reached 14% – North America, Europe ahead" (13 November 2019) IOT Analytics <www.iot-analytics.com> at 2.
[52] At 3.
[53] Directive 2019/944/EU, article 19 (3).
[54] European Commission, above n 50.

Overall, this first approach to European regulation in the electricity sector suggests that European legislation has progressively evolved from a centralised perspective, where the main focus was the development of a free regional energy market, to a more dynamic standpoint, seen in the latest energy package, which has shown the intention to incorporate emerging realities values and a more active role for consumers. The Clean Energy for All Europeans package is an international example of a common effort to develop a framework for the integration of decentralisation, digitalisation and the empowerment of consumers. The evolution within the EU could be described as the first steps in the development of a common approach to dealing with such initiatives and include in the European agenda the discussion of common approaches and solutions created by new perspectives may create. In the next section we will analyse how these main Directives and principles are incorporated into the domestic legislation of the Netherlands.

2.2 The Netherlands

The Netherlands is an advanced economy which has a constitutional monarchy and parliamentary democracy. It is a densely populated country on low lands with a population in March 2020 of 17,124,477 people[55] living in an area of 41,500 square kilometers.[56] The Netherlands is the second-largest producer of natural gas in Europe.[57] It has a modern energy system and well developed energy markets. According to 2018 data of electricity generation, out of the 3,115 petajoules generated, the Dutch electricity mix is dominated mainly by fossil fuels (92%) of which 40.3% comes from natural gas, 37.8% from crude oil and NGL, 13.7% from coal and 5.1 from renewable energy. Most of the renewable energy comes from bioenergy which accounts for 75% of the renewable energy production, followed by wind at 18% and 3.6% of solar PV.[58]

[55] World Population "World Population Review: Netherlands" (2019) <http://worldpopulationreview.com>.
[56] IEA *Energy Policies of IEA Countries: Netherlands 2014* (International Energy Agency, Paris, 2014) at 8.
[57] IEA "The Netherlands" (2016) <www.iea.org>.
[58] Bioenergy IEA "*The Netherlands – 2018 update*" (2018) < www.ieabioenergy.com> at 2.

One of the Netherlands' key energy institutions, is the Ministry of Economic Affairs, among whose primary responsibilities is to establish the Dutch energy policy through the Directorate General for Energy, Telecommunications and Competition. At this ministerial level, the Ministry of Infrastructure and Environment is involved in developing the energy infrastructure and determining the environmental impact. Other important institutions are the Authority for Consumers and Markets which is responsible for the oversight of competition in several sectors and the enforcement of consumer protection laws, and the energy regulator, which is in charge of regulation and compliance in the electricity sector.[59]

The electricity sector's legal framework in the Netherlands is contained in the Electricity Act of 1998, which follows the provisions of the Directive 1996/22. This Act was amended several times to include the 2003/54 and 2009/72 Directives. [60] The main purpose of the Electricity Act 1998 is liberalisation, followed by legal unbundling, and requiring a legal separation between transport and supply, where all supplies companies need to appoint an independent network operator. The system operator is in charge of establishing the tariff structures and access conditions based on a joint proposal by all networks operators. Furthermore, the Electricity Act created the independent regulator, who sets the tariff and monitors the process of liberalisation.[61] In the next section, we will explore how the activities involved in the electricity industry are currently regulated in the amended Electricity Act of 1998 and how the emerging concepts of active consumer are being integrated into further regulations.

2.2.1 Regulation of activities

Although electricity *generation* in the Netherlands is a fully liberalised activity, there are some instruments of indirect control of the outcome or resource choice. For instance, the Electricity Act obliges generators to promote an efficient and environmentally responsible production of electricity. In this sense, when a generator

[59] Martha Roggenkamp "Energy Law in the Netherlands" in *Energy Law in Europe: National, EU and International Regulation* (Oxford University Press, Oxford, 2016) 725 at 733.
[60] Roggenkamp and others, above n 5, at 195.
[61] At 198.

produces more than 10GWh per year, it must submit a report every two years to the Minister of Economic Affairs on the generation resource used.[62]

Large projects which use renewable resources for electricity generation can receive financial support. There is a scheme of certification operated by Certi Q which shows that the energy produced comes from renewable resources. This certificate is used by generators to show that they are eligible for subsidies: by suppliers to prove the origin and the characteristics of the energy they sell and by traders to buy and sell energy certificates in the EU.[63] There are support mechanisms to promote renewable energy projects providing both guarantees and risk reductions via subsides through tendering scheme, so the most cost-effective projects and those with the ability to realise the size of projects tendered by the government will be supported.[64] Usually large renewable projects have benefited from this mechanism because larger capacity projects are the norm, which clearly shows a disadvantage for small renewable distributed projects in this regard.

Electricity *network operators* are obliged to provide every person, on a non-discriminatory basis, with a connection to the grid at the required voltage level and an estimate of the costs involved whenever requested. Connection over 10MW is restricted to tendering procedures.[65] Following the three options given in the Directive 2009/72/CE (ownership unbundling, independent system operator and independent transmission operator), the Netherlands chose ownership unbundling.[66] This means that the Netherlands applies the strictest rules for unbundling to ensure that the network operator is independent from the user. As we will explain later, this may be a challenge for communities who want to engage in energy projects.

Additionally, the increase of renewables in the Netherlands has impacted on access to the grid because some of these projects are connected to the distribution network instead of the transmission grid. The Netherlands has introduced a system of congestion

[62] At 199.
[63] At 200.
[64] Catapult Energy Systems "Netherlands renewable energy support schemes. Rethinking decarbonisation incentives – Policy case studies" (2018) <www.es.catapult.org.uk>
[65] Roggenkamp, above n 59, at 735.
[66] Roggenkamp and others, above n 5, at 199

management to provide priority or guaranteed access to the network. Congestion management means that network operators may require that electricity production in a congested area be scaled back, while production outside the congested area will have to rise simultaneously.[67] We will further explain this topic in Chapter 4 when discussing access to the network. However, it is worth noting that increasing integration of distributed generation into the distribution network is challenging the management skills of distributor operators, which is an important topic when discussing a more active role for consumers and their self-generation.

In the *electricity market*, electricity can be traded on a bilateral basis or via market exchange. In the Netherlands, this wholesale market occurs at the Amsterdam Power Exchange APX, where all participants deal with APX and not directly with each other.[68] Large generators, suppliers and large connected customers are the market participants.[69] Smaller actors do not have the financial and technical capabilities to either participate in them or fulfil the obligations that come with participating in this market. This topic will be further explored in Chapter 5, regarding access to relevant markets by prosumers.

The retail market has been open since 2004, and since then consumers have been able to choose suppliers.[70] However, the Electricity Act of 1998 requires that suppliers have to hold a supply licence, and only those who can demonstrate financial and technical capabilities are awarded the licence. [71] The supplier determines the tariff to be charged to the customer. This tariff is submitted first to the regulator who decides whether or not it is reasonable following an economical assessment. If the price is not reasonable the regulator may set the tariff instead. The final invoice by the supplier also includes the network cost on behalf of the network operator. Suppliers are required to specify on their bills the contribution of each energy resource to the overall fuel mix over the preceding year.[72]

[67] Roggenkamp and others, above n 5, at 200.
[68] Roggenkamp and others, above n 5, at 201.
[69] Electricity Act 1998 (The Netherlands), art 1.1.
[70] Machiel Mulder and Bert Willems "The Dutch retail electricity market" (2019) 127 Energy Policy 228 at 229.
[71] Electricity Act of 1998 (The Netherlands), art 95(a).
[72] Roggenkamp and others, above n 5, at 198.

However, the requirement to have a supply licence means that if a consumer decides to install a solar panel and intends to sell the energy surplus, the consumer cannot sell it to other consumers, unless they have a licence. In practice, this means that the active consumer can only sell his or her energy surplus to the contracted supplier and cannot participate directly in the retail market. Suppliers are obliged to accept the offer of energy from the consumer. In exchange, the supplier must pay a reasonable tariff which cannot be lower than the markets purchase price. If the consumer is dissatisfied with the tariff, the alternative is to switch to another supplier who might offer a higher resupply tariff.[73]

In relation to *consumers*, the Electricity Act 1998 distinguishes between wholesale (industrial customers) and retail customers (domestic customers). While wholesale customers are considered commercial parties operating in a liberalised market, domestic customers are subject to a special protective regime which includes a right to change supplier and quality of service. This topic will be further explored in Chapter 5, regarding traditional rights of consumers.

Regarding to the concept of *active consumers* in 2009, the Dutch government established *Taskforce Smart Grids* to investigate the emergence of smart grids and new ways of generating energy including self-generation by consumers and communities. By 2011, those efforts resulted in 12 smart grid pilot projects (IPIN-Projects Innovatieprogramma Intelligente Netten) initiated by the Dutch government to investigate the integration of DG, storage, demand-response and the development of new services and products. These projects lasted four years and the results showed the importance of governance and the need to make changes to the legal framework.[74] Following this project, a decree allowing experimental derogation of some of the provisions of the Dutch Electricity Act was made on 1 April 2015. This regulation will be further explained in Chapter 6, related to 'community energy'. Nonetheless, it is worth saying that the Dutch allow for experimentation allowing free space for new initiatives to be carried out with the oversight from the government.

[73] Roggenkamp and others, above n 5, at 199.

[74] Imke Lammers and Lea Diestelmeier "Experimenting with law and governance for decentralized electricity systems: adjusting regulation to reality?" (2017) 9 Sustainability 1 at 4.

Smart meters and Advanced Metering Infrastructure. In 2014, the Dutch government decided to go ahead with the roll-out of smart meters because the economic analysis forecast a positive scenario for reaching 80% of roll-out by 2020. Nevertheless, the Bill enabling the roll-out was amended due to concerns about personal data protection. The amendments meant the roll-out was limited to new construction or renovation projects and the replacement of old meters would be only at the explicit request of the consumer who could also refuse the installation.[75] The provisions were amended again, requiring the network operator to offer all customers the possibility of having a smart meter installed but customers could also reject the offer or decide not to make use of all the functions of the meter.[76] This target was achieved before 2020 and the government is working on further roll-outs.[77]

There are currently three different reading modes for smart meter: the 'default' mode where meters are read bimonthly for supply purposes at any rate required; the 'administratively-off' mode, where the smart meter is set to switch off, forcing it to function as a traditional meter; and the 'consent mode', where the consumer gives their consent for more frequent readings to be taken.[78] It is not clear whether other functions of the smart meter, such as bidirectional exchange of information or real-time price control that allow consumers to respond to market prices are available and already in use. In this scenario, the 'consent mode' is the one appropriate for more active consumers because it allows them a more detailed and frequent data to lower their costs or increase their revenue in case of participation in demand response or the sale of energy surplus. It remains to be seen to what extent the smart meter will achieve its full potential in practice because although the Netherlands has already reached the roll-out target, some meters are not working at their full potential but working simply to allow remote and accurate readings to retailers.

[75] Martha Roggenkamp and HK Kruimer *EU Climate Regulation and Energy Network Management* in E Woerdman, MM Roggenkamp and M Holwerda (eds), Essential EU Climate Law (Edward Elgar, Cheltenham**,** 2015) 235 at 248.
[76] At 20.
[77] Padraig Scully "Smart Meter Market 2019: Global penetration reached 14% – North America, Europe ahead" (13 November 2019) IOT Analytics <www.iot-analytics.com>at 2.
[78] Lea Diestelmeier and Dirk Kuiken "Legal framework for prosumers in the Netherlands" (2018) 12 European Energy Law Report XII at 40.

The distributor system operator (DSO) is responsible for installing smart meters and collecting the meter reading. With the introduction of smart meters came a new party: the independent service provider (ISP) who uses meter readings to offer additional services, i.e. giving insights to businesses about better energy use. Because the DSO is responsible for collecting metering readings, the reading has to be shared with the supply company for billing purposes. To do this, the DSOs have an energy data service to facilitate this process. This system was already in use with analogue meters where the data was collected manually. The standards around smart meters are incorporated in the Dutch Smart Meter requirements.[79]

The smart grid development is in its first stages and limited to 26 pilot projects with different objectives. Some aim to enable prosumers to trade energy freely (Powercity matching in Hoogkerk). Others focus on the introduction and use of smart meters (Social Energy in the Hague and Utrecht)[80] or are experimenting with local energy communities and micro-grids.[81] Some of the partial outcomes of these projects will be further discussed in Chapter 6, regarding community energy.

Although the principles and provisions from the Clean Energy for All Europeans package relating to active consumers and decentralisation have not yet been included within the Dutch legislation because the Directives are quite recent, the Netherlands has long ago pursued such concepts with interesting experimentation processes.[82] This experimentation will bring remarkable outcomes in terms of what is needed in terms of regulation. The fact that traditional legal requirements — centralised tailor-made (e.g. strict unbundling rules, mandatory supply licence, participation of only larger generators and large consumer in the market) can be subject to derogation in specific cases to allow experimentation, results in interesting questions in terms of the need or not for entry barriers. In this sense, to what extent does the current setting of these entry barriers make decentralisation difficult? While such requirements might make sense for larger and centralised projects, they may not make sense for decentralized ones. At the same time, how can we ensure the system's safety by allowing everyone who wants to

[79] Pol Van and Aubel Erik Poll "Smart metering in the Netherlands: what, how, and why" (2019) 109 International Journal of Electrical Power & Energy Systems 719 at 722.
[80] Roggenkamp and Kruimer, above n 75, at 735.
[81] Van and Poll, above n 79, at 723.
[82] Diestelmeier and Kuiken, above n 78, at 39.

enter and participate in the market to do so? We are starting to identify some important questions that come with emerging technologies and a more active participation of consumers in the system. Some of those questions will be answered in Chapter 4 and 5.

2.3 New Zealand

Aotearoa (the Māori name for New Zealand), is an island state located in the Pacific Ocean. It is a constitutional monarchy and parliamentary democracy. Located in a long and narrow area of 268,021 km2, New Zealand's population, in 2019, was 4,957,400.[83] The country has a significant indigenous population known as the Māori. The Māori people are a strong indigenous community numbering 744,800 people. They compromise 15.1% of New Zealand's total population.[84]

New Zealand is a developed country with robust economic growth and macroeconomic stability. Given its geographical isolation, it has try to ensure its energy security with domestic energy resources. In 2018, the electricity generation production was 43 GWh of which 26 GWh came from hydro power (60%). Geothermal generated 7.5 GWh (17.4%), followed by gas production of 6.6 GWh (15%), wind energy with 2 GWh (4.6%) and thermal-coal generation of 1.13 GWh (2.3%).[85] New Zealand is composed of two mains islands, the North Island and the South Island. Each island has large generation projects that attempt to ensure energy supply to their respective geographic area. A transmission line connects both islands, known as the Cook Strait Cable or HDVC (high voltage direct current). Because the major electricity generators are located in the South Island, this line is mostly used to transport electricity from the South Island to the North Island.[86]

According to data from the Electricity Authority, distributed solar PV generation is increasing exponentially, going from 7 MW in 2013, to 56 MW in 2016, and 98 MW in 2019. [87] This means a dramatic increase between 2013 to 2016 of over 6 times and a

[83] Stats NZ "Population" (March 2019) <www.stats.govt.nz/topics/population>.
[84] Stats NZ "Māori population estimates" (June 2018) <www.stats.govt.nz>.
[85] MBIE "Electricity statistics" (June 2019) <www.mbie.govt.nz>.
[86] Electricity Authority *Electricity in New Zealand* (Electricity Authority, Wellington, 2018) at 27.
[87] MBIE, above n 85.

much more modest increase between 2016-2019 of around two times. The cost of renewable generation from wind and solar has fallen faster than expected and it is anticipated that the growth of distributed solar generation will become a significant trend in the next few decades.[88] In January 2019 there were 22,000 small scale solar panel installations (less than 10 kW) of which 21,000 were residential. [89] Rebecca George,[90] a board member of the Sustainable Energy Association of New Zealand (SEANZ), affirms that every 18 minutes, a solar PV system is installed, which means that 385 systems are installed monthly. Although the solar energy growth is more significant among businesses where the average system size is 33.5 KWp (kilo watt peak) and the average resident system is 3.71 kWp,[91] roof-top solar power can be expected to also become a common choice for households.[92]

In terms of relevant institutions in the electricity sector, the Ministry of Business, Innovation and Employment (MBIE) is in charge of establishing energy policy and energy legislation; the Electricity Authority (EA), regulates the sector and the obligations of the industry participants are set out in the Electricity Industry Participation Code, and is also in charge of administering the electricity market in terms of rules and compliance; the Commerce Commission is responsible for establishing and enforcing competition law across the different economic sectors, including electricity, by regulating monopolies in terms of revenues for the distribution companies and Transpower, the transmission company. It is also important to mention the Energy Efficiency and Conservation Authority (EECA), which oversees energy efficiency programmes and the use of renewable resources of energy.[93]

The electricity sector's main legal framework is contained in the Electricity Industry Act 2010 (EIA) and Electricity Industry Participation Code 2010 (EIPC). The Resource Management Act 1991 regulates the management of natural resources. Under this Act, energy projects must comply with various requirements for using resources in the

[88] MBIE *Electricity demand and generation scenarios: scenario and results summary* (Ministry of Business, Innovation and Employment, Wellington, 2019) at 21.
[89] At 22.
[90] Craig Greaves "More Innovation, collaboration to make solar shine: SEANZ" (8 Nov 2019) Energy News <www.energynews.co.nz>
[91] At 1.
[92] MBIE, above n 88, at 26.
[93] IEA *Energy Policies of IEA Countries- New Zealand 2017 Review* (International Energy Agency, Paris, 2017) at 25.

country. This legislation is particularly relevant in terms of the use of water or geothermal resources.

Before the Electricity Industry Act of 2010, the electricity industry progressed through four different stages identified by Barton as:[94]

(1) Political control: before 1986 the electricity industry was under political control where electricity was generated by government departments and local government was in charge of local distribution. A national policy focusing on developing large-scale natural resource known as "Think Big" was promoted.

(2) Corporatisation: relates to political and economic problems regarding cross-subsidising and bad planning of the expansion of the electricity sector, together with an international trend promoting liberalisation. Both were the context for the promotion of corporatisation enabled by the State-Owned Enterprises Act 1986. Corporatisation implied that state enterprises should be operated as a successful commercial business.

(3) Promotion of competition: introduction of market competition to correct energy prices, and light-handed regulation through the use of competition law. This process developed with the Energy Companies Act 1992 turning power boards of publicly owned distribution entities into a corporate form. Furthermore, the Electricity Act 1992 abolished the local franchise for exclusive supply and the supplier licensing and removed wholesale and retail price control. It was established that the only role for state intervention was through safety regulations and information disclosure.[95] Years later, in 1998, the Electricity Industry Reform Act was enacted, and the industry took a further step towards liberalisation with more competition within generation and supply. The Act required the full separation between the ownership of distribution and supply and gave consumers the ability to switch retailers. This period is characterised by structural reform to create competition but not regulatory reform.[96] The consequence of these reforms was higher electricity prices, with small consumers paying higher

[94] Barry Barton "From public service to market commodity: electricity and gas law in New Zealand" (1998)16 Journal of Energy & Natural Resources Law 351 at 356.

[95] Barry Barton "Electricity regulation in New Zealand: the early stages of a new regime" (2008) 26 Journal of Energy & Natural Resources Law 207 at 209.

[96] At 212.

electricity bills. Also a prolonged power failure in Auckland brought the efficiency of light handed regulation into question.

(4) Regulatory Reform: began with the creation of the Electricity Commission which regulated some aspects of the sector under the oversight of the Government. In 2010 the Electricity Industry came into force and established the Electricity Authority replacing the Electricity Commission. The Electricity Authority was entrusted with specific electricity industry regulation, which became a reality in the Electricity Industry Participation Code 2010 (EIPC) and amendments.

Having explained the gradual process of liberalisation in New Zealand, the next section will describe and analyse the structure of the industry and the main regulations over each activity, which is contain in the Electricity Industry Act of 2010 and the Electricity Industry Participation Code 2010.

2.3.1 Regulation of Activities

Generation in New Zealand is mainly done by five large generator companies, Contact Energy, TrustPower, Genesis Energy, Meridian Energy and Mercury, who between them own 98 of over 200 power stations in New Zealand generating around the 88% of electricity.[97] Generation is a fully liberalised activity which does not require a licence to operate other than those relating to environmental issues or land use. New Zealand does not have a specific remuneration or promotion scheme to boost renewable energy generation and these resources compete in the market and follow the same requirements and procedures as non-renewable resources.

Regarding *transmission*, there are 11,349 kilometres of high-voltage transmission lines. The national transmission grid is owned and operated by Transpower acts as the system operator and coordinates supply and demand. The system operator is responsible for planning the activity attempting to meet demand and supply, coordinating generation and transmission outages and ensuring generation complies with the code to keep

[97] Electricity Authority, above 86, at 28.

system reliability.[98] Both the Electricity Authority and the system operator are in charge of ensuring security of supply. The system operator assesses and monitors long-term (over the next decade) and short-term security (up to 18 months ahead) and provides stakeholders and consumers with information on risks to hydro-lake storage and changes in energy consumption patterns. [99]

Regarding *distribution*, in New Zealand there are 29 distribution companies that own a total of 39 networks. The largest distribution company is Vector, but most are owned by consumer trusts,[100] community trusts,[101] and mainly in rural areas by local councils.[102] The distributor depends on the use of comprehensive, written use-of-systems agreement which is a contract between a distributor and a retailer that allows it to trade on the distributor's local network.[103] These agreements cannot discriminate in favour of other businesses or discriminate between customers of the retailers and other retail customers.[104] According to a High Court decision,[105] the Electricity Authority has the authority to standardise these agreements and ensure specific content as a default agreement.[106] This decision will be further analysed in Chapter 4, regarding access to distribution networks; however, we can start by saying that if the retailer and the distribution company do not reach a voluntary agreement, the default agreement would be binding. Moreover, given that distribution activity is a natural monopoly, distribution companies are also subject to information disclosure requirements. Some are also subject to price-quality regulation by the Commerce Commission and the unbundling rules. In general, the unbundling rules apply to the separation of distribution from generation and retail sectors, but it depends on the size of the generation and retail project, which means that small capacity projects can be bundled. Both aspects will be explained further in Chapter 4 and 5 respectively.

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[98] *Bay of Plenty Energy Ltd v Electricity Authority* [2012] NZHC 238 at [15].
[99] Electricity Authority, above n 86, at 26.
[100] Consumer trust is a trust where at least 90% of the income beneficiaries comprise persons who are connected to the distributor lines, who buy electricity from the retailer connected to that distribution line and at least 90% of the income distribution are paid to those beneficiaries.
[101] According to the interpretation section of the Electricity Industry Act, a community trust is a trust where at least 90% of the income beneficiaries comprise persons who their domicile or location is within the geographic area or the distribution operation and at least 90% of the income distribution are paid to those beneficiaries. This trust can also take the form of a cooperative.
[102] Electricity Authority, above n 86, at 22.
[103] Electricity Industry Act, s 77.
[104] Electricity Industry Act, s 79.
[105] Vector Ltd v Electricity Authority [2017] NZHC 1774.
[106] Vector Ltd v Electricity Authority [2019] NZAR 60 at [58]

The *wholesale electricity market* is composed of spot and hedge markets. The wholesale hedge market consists of bilateral contracts that allow a fixed price to avoid spot markets volatility. Whereas in spot markets a generator bids amounts of energy at a specific price and at a particular node for a specific trading period. This period means that each day is divided into 48 trading periods of half an hour each. New Zealand has 225 nodes located throughout the country where electricity is taken from or supplied to the national grid. Offers may be submitted up to five days before the supply is needed and a generator can cancel or change a bid up to two hours before the demand. Market participants upload their bids and offers into a system called the Wholesale Information and Trading System (WITS). The role of the systems operator (Transpower) is to accept an offer to supply, taking the lowest offer and moving up the scale until the demand is met. The highest generator's offer, if accepted, becomes the price paid for all the electricity bought in that trading period. The highest price is called the 'market clearing price'. The prices depend on the season, time of day and the node location. The system operator decides which offers to accept, the pricing manager calculates and publishes the spot price of the market transactions and the clearing manager ensures that market participants are paid the correct amount for the electricity consumed or generated.[107] Only generators producing more than 10 MW can bid in the spot market to satisfy demand.

The *retail market* consists of over 48 different retail brands, countrywide, and consumers can freely choose their suppliers. Some of the biggest generators are also involved in the retail business and they are known as 'gentailers'. Most retailers buy energy through the hedge market for a fixed price and variable supply, although some have exposure to spot prices.[108]

Finally, regarding *customers*, there are three types: residential, commercial and industrial. The residential customer accounts for about 85% of all customers but only consumes 32% of electricity produced; 24% of energy is consumed by commercial users and 44% by industrial users.[109] Every customer has the right to change supplier.

[107] *Bay of Plenty Energy Ltd v Electricity Authority*, above n 100 at [29].
[108] At [34].
[109] Electricity Authority, above n 86, at 5.

Residential customers have the right to an acceptable quality of electricity, the ability to change supplier and a fair procedure for disconnection. This topic will be further explored in Chapter 5 regarding traditional rights of consumers.

In New Zealand a more *active consumer*, i.e. a residential solar installation, fits the category of 'distributed generator'. The Electricity Authority in the EIPC regulates distributed generation participation, which should comply with connection requirements, is included in Part 6 of the Code and Work-safe installation requirements. Distributed generation (DG) is defined as a generating plant that is connected or intended to be connected to a distribution network.[110]The connection of DG to the distribution network is essential for the widespread development of the DG market. In New Zealand this procedure is regulated by the Electricity Authority in Part 6 of the EIPC. A further explanation of this framework will be part of Chapter 4, regarding 'Access to the network'.

Distributed generators can only sell their energy to the clearing manager or to a retailer trading on the local network where the generation device is located.[111] Nevertheless, there is no duty to purchase the electricity or control how much will cost. This value, called the 'buy-back rate', is set by the retailer and is often less than the retail price. The rates vary from retailer to retailer, and finding the best price available is the DG owner's job.[112] Access to markets is restricted and the retailer defines conditions for selling energy surplus without prosumers having any significant bargaining power or access to any conventional regulation dealing with such issues. Although, by December 2018, rooftop solar PV had an installed capacity of 75 MW, being a tiny fraction of the total generation, its capacity has been increasing steadily since 2013.[113] This increase in uptake of solar PV as a distributed generation resources has raised questions about the system's ability to integrate them in the network. The Electricity Authority is also undertaking a project to address issues around the ability of the current distribution arrangements to promote the integration of new decentralised technologies which

[110] EIPC, s 6.1.
[111] EIPC, s 14.4.
[112]Energywise EECA *Power from the people: a guide to micro-generation* (EECA Energywise, Wellington, 2010) at 25.
[113] EMI "Installed distributed generation trends" (29 Feb 2020) <www.emi.ea.govt.nz>

include distributed generation. A further explanation of such new approaches will be a part of Chapter 4.

Demand response. Although demand response itself is not included in the Electricity Act or Code, one of the related business roles is known as a load aggregator and is included as an industry participant.[114] The definition is included in the Interpretation section of the Electricity Industry Act 2010, as a person who contracts with consumers to voluntarily change their consumption level. The aggregator can then offer an increase or reduction of consumption to consumers as collectives in the wholesale electricity market or their energy contracts. However, the aggregator cannot directly aggregate load over several retailers or several grid exit point, which challenge its market possibilities. In New Zealand the only aggregator company is ENERNOC, a United States-based company, whose focus is promoting the reduction in demand by industrial and commercial customers rather than by residential customers.[115]

Although demand response is not regulated, some industry participants are starting programmes to engage in demand response. Current demand-response programmes are undertaken by some distributors and Transpower, who operate congestion pricing with higher variable network charges, sending signals to reduce consumption in peak times and move load to off-peak times. However, these are individual programmes and based mostly on managerial decisions to manage peak loads trying to avoid high investment in peak capacity. These examples will be further explored in Chapter 5, regarding the participation of demand response in the market. Such programmes historically have been used and applied to large commercial and industrial users, who, for a long time, have been able to respond to price. This differs from small consumers or small businesses, who have limited physical access to the wholesale market, a very low load to shift and no access to real-time pricing.

The regulatory response to these programmes was, initially, passive and later, after an express request from Transpower for guidance in dealing with demand response programmes. The EA decided to set out some principles, this is known as principle-

[114] Electricity Industry Act 2010, s 7 (f)
[115] IEA, above n 93, at 70.

based regulation. The principles apply to demand response initiatives, but they are not binding, nor enforceable.[116] The content of this principle will be further explored in Chapter 5, regarding demand response. However, we can state that a principles-based regulatory approach raises questions whether there are legal consequences if one of these programmes does not follow the principles.

In 2017 the Electricity Authority published a consultation document on its work to enable greater participation by the consumers. Work continues with updating regulations and opening the system and market for new possibilities.. However, as a result, in June 2019, the Electricity Authority decided to implement real-time pricing, which is fundamental to boosting consumer's participation and adapting consumption behaviour according to the market signals. The importance of real-time pricing will be further analysed in Chapter 5, regarding access to markets. This new system replaces the existing system where spot prices are indicative. The implementation of this new system will be staged and the process is expected to be completed in September 2022.[117]For real-time pricing to become a reality for traditional market participants and consumers using new energy technologies, the implementation of smart grids and smart meters is fundamental so industry participants can have access to more accurate market signals.

Smart meters. The regulation of meters relies on establishing standards, installation, and testing accuracy of the equipment and security of metering data, which are included in Part 10 of the Electricity Industry Participation Code. The regulation does not specify which metering technology applies, whether it is an analogue meter or smart meter. Consequently, most of the regulation refers to one-way data and communication, measuring the consumption of energy and not energy that is injected. Retailers have undertaken the roll-out of smart meters not because of a legal duty, but because market conditions have encouraged them to do so.[118] In New Zealand switching suppliers is quite popular and encouraged by the Electricity Authority. Retailers have some

[116] Electricity Authority *Demand response guiding regulatory principles* (Electricity Authority, Wellington, 2015).
[117] Matt Ritchie "Real-time pricing gets the green light" (June 2019) Energy News <www.energynews.co.nz>.
[118] EIPC, s 10.24.

incentive to keep their services competitive and thus lead to smart meter installation.[119] The roll-out of smart meters is done at no extra cost to consumers unless additional work is required.[120] According to the Electricity Authority, this market-led roll-out has resulted in 1,516,327 smart meters being installed into residential homes which accounts for 83% of all NZ residential connections. [121] The retail companies leading the way on roll-out are Genesis Energy, Contact Energy and Mercury, accounting for more than 80% of such installations.[122]

In terms of Advanced Metering Infrastructure (AMI), although there is no legally binding regulation, the Electricity Authority has published 'Advanced Metering Guidelines' intended to assist rather than regulate operators in implementing such technologies and functions.[123] These guidelines are recommendations relating to the functionality of the AMI and factors to consider when installing advanced meters for consumers. The guidelines require the AMI provider has to consult distribution companies and retailers on the required functionality, terms of use and formats needed. It is clear that the emerging relationship between the AMI provider and the retailer or distributor contracting with the AMI provides benefits to their particular part of the supply chain. Most of the installed smart meters are basic models which only inform to the power company how much energy is consumed not cost-reflective tariffs and real-time monitoring of power use.[124] On this point, in 2009, the Parliamentary Commissioner for the Environment recommended the Electricity Commission, the regulator at the time, require companies to install and set up fully functional smart meters that were useful for consumers as well as retail companies when enabling remote reading.[125] However, the Electricity Commission and the Government declined.[126] Therefore, there is no special provision in terms of who is responsible for installation

[119] The importance of meters and the control of them by retailer companies is shown by recent litigation in [*Intellihub Ltd v Genesis Energy Ltd and Advanced Metering Services Ltd* [2020] NZCA 344]. The decision concerns an interim injunction, not a final disposition of the proceedings.

[120] Electricity Authority "Smart meters – information for households" (2013) <www.novaenergy.co.nz>.

[121]Electricity Authority "What are smart meters?" (2015) <www.ea.govt.nz>

[122] EMI "Metering snapshot" (29 Feb 2019) <www.emi.ea.govt.nz>

[123] Electricity Authority *Guidelines on Advanced Metering Infrastructure Version 3.1* (Electricity Authority, Wellington, 2010) at 8.

[124] Consumer "Smart meters" (14 August 2015) <www.consumer.org.nz>

[125] Parliamentary Commissioner for the Environment *Smart Electricity Meters: How Households and the Environment can benefit (*Parliament Commissioner, Wellington, 2009*).*

[126] Electricity Commission *Advanced Metering Infrastructure in New Zealand: Roll-out and Requirements* (Electricity Commission, Wellington, 2009) at 14.

or providing meters, but rather it depends on market signals and the intentions of other industry participants, mainly retail and distribution companies to provide these services.

The current roll out of the advanced metering infrastructure is undertaken voluntarily by the industry. The possibility of regulation has been explored several times, for instance, as we pointed out above, in December 2009 by the Electricity Commission which declined to regulate,[127] and later by the Energy Efficiency and Conservation Authority (EECA) based on Smart Grid Forum studies, which outcomes will be discussed later. Both concluded that, there was no need to regulate and advance the rolling out of AMI because it has taken place without regulatory intervention within an acceptable timeframe. It is evident that even though the results of such market-driven roll-out has been commendable in respect to smart meters, it is not the same in terms of other aspects of the advanced metering infrastructure in other parts of the grid. That is because decisions depend on distributors making investments which are based on the analysis of the costs and benefits of those technologies. Most of the distribution companies are small entities for whom it is not clear how such technologies can make their business more efficient.

In the same way, in terms of the implementation of other smart grid technologies along the grid, New Zealand has chosen a market-led approach, leaving market participants and customers to interact without regulatory intervention. This scenario is seen as likely to be the most dynamic approach and there are concerns that a market intervention may have negative consequences.[128] According to the EECA,[129] based on conclusions provided by the Smart Grid Forum,[130] setting a prescriptive target relating to the uptake

[127] At 15.

[128] Energy Efficiency and Conservation Authority *Unlocking Our Energy Productivity And Renewable Potential: New Zealand Energy Efficiency and Conservation Strategy* 2017- 2022 (MBIE, Wellington, 2017) at 23.

[129] At 24.

[130]In 2014 the Ministry of Business, Innovation and Employment with the support of the Electricity Networks Association, created the Smart Grid Forum to bring together relevant parties from business, scientific and academic circles, along with policy makers, regulators and consumers to share information and increase awareness about the development of a smart electricity network in New Zealand. In this context, and with supporting studies by Otago University's Centre for Sustainability, four documents were released: Prosumer collectives: A review, Smart Grid Edge Technologies; Case Studies of Early Adopters; Smart homes: What New Zealanders think, and want; and Relative Progress of Smart Grid development in NZ. To look closer at the analysis and conclusions of such reports: Rebecca Ford, Juliet Whitaker and Janet Stephenson *Prosumer collectives: a review A report for the Smart Grid Forum* (University of Otago — Centre for Sustainability, Dunedin, 2016). Rebecca Ford *Smart Grid Edge Technologies Case Studies of Early Adopters* (Centre for Sustainability University of Otago, Dunedin,

of smart grids or new technology is not recommended nor is specific market intervention. According to the Smart Grid Forum considers that New Zealand has a different approach to smart grid development than other countries. While some countries have chosen to provide subsidies, New Zealand has a largely market led-approach. [131] The Forum also considered "that New Zealand is fortunate to have avoided the potential pitfalls of broad subsidies, and does not consider that consumers are likely to benefit in the long-term from taking on that cost and risk". The Forum pointed out that there are difficulties for parties in evaluating the options available, so investment or business ideas have not been pursued given the complexity associated with new technologies. The Forum draws attention to the importance of thinking about a more flexible electricity system and the role of pricing to encourage such initiatives. Regardless of whether the best method for smart grid adoption is market-driven or not, there are some obstacles that the competent authority needs to address such as complexity, lack of interoperability, reduced governance arrangements, certainty over the functionality of smart grids, uncertainty regarding who bears the cost and how this cost will be later paid by the customer. Another issue is around energy poverty, in which smart grid cost should not involve increasing cost for already vulnerable customers.

Although smart meters, AMI and, in general, smart grids have been market-driven, the Electricity Authority undertook a consultation process to identify the problems that the industry has faced in implementing such technologies and have started to work closely with multiple actors in improving relationships among them. One example of this initiative is the Innovation and Participation Advisory Group (IPAG), delegated by the Electricity Authority to address issues such as whether parties wanting to use electricity networks are treated equally, can compete on a level playing field, or whether the current arrangements are enough to promote competition.[132]This initiative will be to further in Chapter 4.

2016). Rebecca Ford and Rana Peniamina *Smart Homes What New Zealanders Think, and Want* (Centre for Sustainability University of Otago, Dunedin, 2016).

[131] New Zealand Smart Grid Forum *Relative Progress of Smart Grid development in New Zealand* (New Zealand Smart Grid Forum, 2016) at 64.

[132] Electricity Authority *Enabling Mass Participation Response and next steps Decision* (Electricity Authority, Wellington, 2017) at 2.

From the initial approach of New Zealand regulation of the electricity sector and the emerging approach to new concepts, we can conclude that some matters are more heavily regulated than others. This is the case in respect of access to the network (connection of distributed generators) which plays a special part in the EIPC, distinct from other areas that are briefly regulated as is the case for access to markets by distributed generators (e.g. solar panel owners) who are only allowed to sell the surplus energy to retailers. Other emerging aspects (smart meters, AMI, smart grids, demand response) are market-driven and the role of the Electricity Authority has been in providing guidance and consultancy rather than defining a clear path through conventional regulation. We can also demonstrate how some aspects emanating from a traditional-centralised perspective of the power system can be considered a barrier for emerging concepts, such as allowing only large-generators access to the energy market. Other aspects of the current regulation can be considered an advantage for emerging concepts, e.g. no need for a supply licence, nodal pricing, no strict unbundling rules or the use of written system agreements by distributors. All these aspects will be further discussed in Chapter 4, regarding access to the network and Chapter 5 about access to markets.

2 .4 Colombia

Colombia is a constitutional unitary republic with political centralisation and administrative decentralisation. It is a developing economy and is the fourth largest country by area in Latin America behind Brazil, Mexico and Argentina. Located in an area of 1,141,748 kilometers, Colombia's population, in 2019, was 49,648,685.[133]

In 2019, the generation of electricity had an installed capacity of 16.6 GW,[134] of which 70% came from hydropower, 10% coal and 18% natural gas. Only 1% of the installed capacity comes from alternative renewable resources such as biomass, wind and solar which, according to the IRENA,[135] is expected to reach 17% by 2030. Solar PV

[133] World Bank "Colombia" (2018) <www.data.worldbank.org>.
[134] EIA "Colombia: Executive Summary" (January 2019) <www.eia.gov>.
[135] IRENA *Colombia Power System Flexibility Assessment* (IRENA, Abu Dhabi, 2018) at 46.

generation only accounts for an estimated 20 MW of the distributed generation and there is only one solar connected grid plant of 9.8 MW.[136]

The authorities in charge of electricity issues in Colombia are (i) The Ministry of Mines and Energy (MME), which is responsible for the developing of national energy policies. (ii) The Mining and Energy Planning Unit (UPME), which is responsible for determining energy needs and ways to satisfy domestic demand considering available resources and socio economic aspects through the preparation of National Energy Plans and Electricity Expansion Plans. (iii) The Energy and Gas Regulatory Commission (CREG) is an independent regulatory authority in charge of overseeing the electricity and gas sector regarding quality, cost and promoting competition. The CREG is also in charge of establishing rates for access to the electricity grid and calculating prices for electricity sales to final consumers. (iv) The Planning and Promotion Institute for Energy Solutions to non-interconnected zones (IPSE) is in charge of developing programmes to provide electricity in remote or off-grid areas. (v) Superintendence of Industry and Commerce (SIC) is in charge of promoting competition in all the economic sectors including electricity through regulation, conflict resolution and enforcing consumer protection laws.[137]

The electricity industry in Colombia is liberalised. A brief explanation on how this process evolved follows. Before 1990, the electricity industry in Colombia was centrally planned and owned by the state through public utility companies that generated, transmitted and distributed energy. The Constitution of 1991, which is the primary law in Colombia, sets out the political and administrative structure, political and economic principles and different general policies regarding civil, economic and social rights and measures to underpin them. For the first time, after what had been a centralised and paternalistic Constitution from 1886, the Colombian state decided to open up to the free market, aiming to attract more investment from the private sector and to build a better infrastructure to supply the needs of the increasing Colombian population. The most important principles in the new Constitution, applicable to the

[136]Solar Future "State of the Colombian Solar Market" (September 2018) <www.colombia.thesolarfuture.com>.

[137] Margarita Teresa Nieves Zárate and Augusto Hernández Vidal *Colombia Energy Investment Report* (International Energy Charter, Brussels, 2016) at 28.

electricity sector in relation to economic activity, included the free market, free enterprise and state intervention to promote the public interest. In addition, natural monopolies are regulated by the state, promoting competition where possible and the state guarantees quality and aims to ensure a non-interrupted and continuous supply of public utilities (electricity is considered a domestic public utility). The latter duties can be delegated to others but always under the state's permanent oversight and regulation. In 1994, laws 142 and 143 came into force, enabling the introduction of the basics of the free-market into the electricity industry. Law 142 of 1994 regulates the domestic public utilities and, includes energy supply as a public utility. Whilst Law 143 of 1994 regulates the electricity sector and each of its activities. Together with the constitutional principles and the regulation set by the electricity regulator (CREG), these laws are the legal framework underpinning the electricity industry in Colombia.

There are two electricity systems in Colombia, with different legal regimes: the grid-connected system and the off-grid areas. The off-grid areas (ZNI) are vast geographical areas with no access to energy supply through the grid-connected system. These zones are located in remote and underdeveloped regions of the country that are difficult to access. They have a special regime, different from the one for grid-connected areas, granting exclusive service areas to suppliers. Suppliers of energy in off-grid areas are usually vertically integrated, enabling them to simultaneously develop generation, distribution, marketing and supply based on regulated prices. There is no wholesale or retail market.

In contrast, the grid-connected system (SIN) comprises of generation plants and equipment, the interconnection network, the regional and interregional transmission networks, the distribution network and the electricity charges to the users, all which are interconnected. This interconnected system is located, predominantly, in the most populated and more developed areas. The system is based on free competition and unbundling of activities. The analysis in terms of regulation of each activity regarding the grid-connected system follows.

2.4.1 Regulation of Activities

In respect of *generation,* there is no special title, licence or authorisation required to enter into the generation market, beyond the environmental, land or commercial requirements. However, it is mandatory to establish a public utility company.[138] The mandate applies to all the supply chain activities, with as a consequence, companies who want to be involved in producing, supplying, selling or transporting electricity, have to establish themselves as a public utility company. This implies specific legal, financial and technical procedures, the consequences of which are mainly related to ensuring security of supply. These requirements make it difficult for anyone other than the large players to access the market; they are the traditional-centralised system's legacy. Shutting down generators or leaving the generation business requires notification to the electricity authority, which is responsible for taking the appropriate measures to ensure security of supply.

Although there are no entry barriers to the generation activity, there are four ways that an investor can enter the generation business. These alternatives are public-private partnership, at their own risk, Firm Energy Obligation and auctions for non-conventional renewable resources. The focus of our attention is on the last two mechanisms.

The Firm Energy Obligation (OEF) is a commitment granted by the state to generation projects, which agree to be available to produce energy during scarcity periods.[139] The scheme's main objective is to encourage companies to engage in new generation projects and, therefore, expand the installed capacity of generation, providing extra generation for peak times. The generator who is granted the OEF allocation receives a regular compensation payment for a specific period (25 years) called a Capacity Payment and, in exchange, agrees to deliver a pre-determined quantity of energy when the energy spot price is higher than the specified level of the scarcity price. The capacity payment allows the generator to maintain financial viability with little operation during periods of average hydrology, so they will dispatch only when water levels are low. Ultimately this revenue is paid for by the consumers. In Colombia, these bids are designed to encourage generators with central dispatch and with an installed capacity

[138] Law 142 of 1994 (Colombia), art 18.
[139] Resolution CREG 071 of 2006 (Colombia), art 1.

higher than 20 MW. Thus, capacity payments have encouraged investment in energy firms who provide hydroelectric or thermoelectric energy.[140] It seems that the regulation and use behind the capacity payment scheme is based on the legacy of the traditional- centralised system which promotes large generation projects. The scheme is also based on ensuring energy for peak times where more capacity is needed to meet peak consumption, underutilising the capacity of the system. As can be seen from this scheme, the generator must deliver a determined quantity when the system is under stress or when base-load plants are not generating enough energy. It would be preferable to integrate non-conventional renewable energy resources and distributed generation to respond to peak times in a more efficient way without having to spend considerable resources in increasing capacity to meet only peak times or scarcity times.

The *promotion of renewable energy* is focused on encouraging investment in non-conventional renewable resources such as solar, wind, geothermal, small-hydro or biomass. Law 1715/2014 establishes real incentives, both financial and market-based, to boost generation projects based on non-conventional energy resources. The mechanisms introduced allow bargaining for energy surpluses generated by self-generators, special tax treatment, exclusion of value-added tax (VAT) and exemptions for customs tariffs of assets related to non-conventional resources projects. Furthermore, the government established a general public policy to implement and promote power purchase agreements for electricity projects based on renewable energy.[141]

The Colombian government identified the need to diversify the electricity mix, mitigate the impact of climate change and leverage the potential of non-conventional energy resources, e.g. solar power, geothermal, wind, small-hydro. With these objectives in mind, the government formulated a public policy to promote long-term contracts for such resources. The policy was included in the current government plan (President Ivan Duque) and incorporated in law 1955 of 2019. In this sense, the auction mechanism

[140] Daniela Aguilar Abaunza *The Role of Renewable Energy in Meeting the Climate Change Targets in Brazil and Colombia* (Universidad Externado de Colombia, Bogota, 2017) at 38.
[141] Decree MME 570 of 2018 (Colombia), art 1.

was established in order to allocate power purchase agreements (PPA) or long-term contracts for 15 years, for those renewable resources. [142]

The current regulation of the auction of non-conventional renewable resources is incorporated in Resolution 40590 of 2019 and has two special characteristics: (i) It promotes the purchase of energy from generation projects larger than 5 MW.[143] This disposition recognises the participation of smaller generation projects which could not participate in previous auctions. For instance, the previous auction held in February 2019, only allowed participation for generation projects larger than 10 MW.[144] (ii) It does not consider the annual capacity of generation projects, which the previous auction did, but instead, the generators offer is set in an hourly basis.[145] As a result, the purchasing of energy takes into account real-time generation and pricing, recognising the benefits of variable renewable energies. As opposed to annual capacities that may benefit larger generators of conventional resources such as hydropower and thermoelectric. The auction was held in October 2019, where eight projects with a total effective capacity of 2,250 MW were awarded: three solar photovoltaic projects and five wind projects representing the 82.61% of the assigned capacity.[146] The power supply obligations will initiate on January 1st 2022 and the contracts are for 15 years.[147] The auction results are expected to increase the capacity of alternative renewable energy to 40% and reduce the price of electricity, which is expected to benefit the consumer.[148] The projects will be connected to the transmission network to supply energy to the grid-connected system. Although this is the first time that Colombia has implemented an effective mechanism to promote investment in solar and wind farm projects, such efforts are oriented to centralised projects. Neither the Firm Energy Obligation nor the auction of non-conventional renewable energy long-term contracts applies to distributed energy or small scale projects. In Chapter 5, we will explore

[142] Resolution MME 40591 of 2019 (Colombia), art 4.
[143] Resolution MME 40590 of 2019 (Colombia), art 22.
[144] Resolution MME 40791 of 2018 (Colombia), art 19 y 31.
[145] Resolution MME 40590 of 2019 (Colombia), art 20(b) (I).
[146] Dinero "Colombia se la juega por las energías renovables" (23 October 2019) <www.dinero.com> (translation: Colombia is at stake for renewable energy)
[147]Resolution CREG 40591 of 2019 (Colombia), art 4
[148] Colombian Presidence Oficce. "Con nueva subasta, Gobierno Nacional superó en más del 50% la meta en energías renovables" (22 October 2019) <www.id.presidencia.gov.co> (Translation: With a new auction, the National Government exceeded the renewable energy goal by more than 50%).

further auctions and other remuneration schemes that promote investment in prosumer initiatives.

In relation to *transmission*, the legislation includes the principle of non-discriminatory access to the grid, with some technical and economic requirements. Generators, distribution networks and the non-regulated consumer have the right to be connected according to specific technical and economic conditions contained in the Connection Code. The generator and the transmission company agree to a connection contract where the price is consensual in exchange for a guaranteed transmission capacity. To be part of the transmission activity, the state, when appropriate, sets the tendering procedures. The granted investor does not contract directly with the state to perform the transmission activity but is granted the specific project extension in the transmission system and an annual remuneration.[149]

Distribution is regulated as an essential public service and a natural monopoly. The distribution includes a regional transmission system (STR) and a local distribution system (SDL). The regional distribution corresponds to the 32 regions. The distribution companies are public and private companies such as EPM (Public Utilities of Medellin), Codensa or Union Fenosa. Overall, the regulation for distribution addresses issues such as remuneration for the activity, quality, and continuity of the service and access rules for third parties.[150] Even though art 74 of Law 143 of 1994 requires the unbundling of the vertically integrated electricity companies, there are some exceptions to this general rule. The first is the integration between generation and retail or distribution and retail, where the same company can develop those combined activities by themselves or through subsidiary companies. The second allows companies constituted before 1994 to continue as integrated companies but with accounting unbundling.[151] Given most of the electricity assets were built before 1994, the majority of electricity companies are covered by the exception and are vertically integrated. The unbundling rules in Colombia are not strict, requiring only accounting unbundling, in which the third party

[149] Luis Ferney Moreno Castillo "Los modelos de regulación de electricidad en América Latina y en particular el modelo de Colombia" in Luis Ferney Moreno (ed) *Derecho de la Energía en América Latina Tomo I* (Universidad Externado de Colombia, Bogotá, 2017) at 16. (Translation: Electricity regulation models in Latin America and in particular the Colombian model in *Energy Law in Latin America*).
[150] Law 143 of 1994 (Colombia), arts 39 and 40.
[151] Law 143 of 1994 (Colombia), art 80.

access is important to maintain grid independence. These less strict unbundling rules *a priori* mean an advantage for community projects that want to undertake the full chain of energy activities. This point will be further explored in Chapter 6.

In terms of the *wholesale market*, Colombia has two ways of trading energy: bilateral-long term energy contracts and spot market or pool. The long-term contracts are bilateral contracts between producers and retailers who freely agree on the price, amount and conditions of the energy transaction. These contracts are registered with the market operator. On the other hand, the spot market is the market where the generator and trader sell and purchase energy and capacity for the interconnected system. This pool is neutral, so it does not take into account what kind of resource is used to produce energy and only considers the cheapest energy resource that meets the demand for electricity. In this instance, the market acts on behalf of generators and suppliers who do not contract directly but are represented by the market operator. In Colombia, the market operator is XM (Expert in Markets). Participation is mandatory for the large generator (more than 10 MW) and works on a bid-day basis.[152] Consumers cannot participate directly in this market, and large consumers or non-regulated consumers can only participate through a retail agent as an intermediary.[153]

Retail Market. Although the principle of the free market was included in the wholesale and retail market, it is only in the wholesale market where it has been successful. Moreno[154] asserts this is due to market and regulation failures to encourage more competition at the retail level, requiring the regulator to intervene in retail energy prices through a tariff methodology. Although the retail market is open and a supply licence to operate is not mandatory, retail companies are required to constitute a public utility company.[155] To exit the market, the retailer needs to notify the municipality so it does not undermine the security of supply of the area.[156] On this point, it is problematic when there are no other competitors in the area who can supply electricity. As previously explained in respect of the particular characteristics of unbundling in Colombia, the industry has different types of retailers, generator-retailer, distributor-retailer or

[152] Moreno Castillo, above n 147, at 22.
[153] Resolution CREG 024 of 1995 (Colombia), art 1.
[154] Moreno Castillo, above n 147, at 87.
[155] Resolution CREG 156 de 2011 (Colombia), art 5 and art 6.
[156] Law 142 of 1994 (Colombia), art 61.

independent retailer. For instance, in Bogota, the leading retailer, Enel-Codensa is also the distribution company and is part of the generation business through Enel-Emgesa.

Consumers can be regulated or non-regulated. Regulated consumers are those households and small consumers of energy who, due to their restricted bargaining power because of their size, are required to have a contract of uniform conditions with the retailer. These customers are regulated and specific rights and duties due to their unfair position within the supply contract. Among these rights are: the right to choose their supplier, quality of the service, the right to ask for information, the right to be measured and have the tariff regulated by the electricity regulator.[157] Non-regulated consumers are large consumers of energy who can bargain with generators or suppliers in a supply contract following commercial and civil law principles. The prices for these transactions are consensual.

Active Consumers. In Colombia, self-generation and distributed generation fit the purposes of active consumers. Law 1715 of 2014 provides a legal framework for the integration of non-conventional renewable energy into the national interconnected system and, in so doing, also regulates different topics related to active consumers such as self-generation, large scale self-generators, small scale self-generators, distributed generation, bidirectional metering and demand response. The law defines self-generation as the production of energy by a natural or legal person to mainly supply their own needs. In the case of an energy surplus, this can be exported to the grid according to regulatory authority terms. Prior to this law, self-generators were not able to sell back any energy surplus to the grid.

Law 1715 and further regulations[158] established a distinction between large self-generators (more than 1 MW) and small self-generators (1 MW or less) in terms of access to the grid and access to markets regarding who can buy their energy and the remuneration scheme. These regimes will be explained further in Chapter 4 in the section on 'Access to the network' and Chapter 5, regarding the active role of consumers and remuneration schemes. We can anticipate that small self-generators

[157] Law 142 of 1994 (Colombia), art 9.
[158] Decree 348 of 2017 (Colombia), art 1.

have access to simplified procedures and net metering. Whilst large scale self-generators have longer and stricter procedures, they can sell the energy surplus to a retailer or generator for a price agreed by the parties and enter into a back-up contract with the grid operator.[159] Neither small nor large-scale self-generators can participate in the wholesale market and should always be represented by a retailer or generator.[160]

Regarding *demand response*, although law 1715 of 2014 provides a definition[161] it does not incorporate the different measures needed to incentivise demand response and energy efficiency along the interconnected national system but authorises the CREG to determine these mechanisms.[162] Arguably, to give a clearer picture of what the legislator expects, it would have been much better if the law itself defined the demand-response mechanisms for further regulation by the CREG instead of allowing the definition and rules to be set by the electricity authority. Nevertheless, the President, in keeping with this legal framework, established the national policy for demand response in Decree 2492 of 2014. This Decree establishes that the regulatory authority, CREG, defines the required elements for remuneration in transmission and distribution activity. These definitions shall include components that incentivise more efficient use of the electricity infrastructure and the elements that allow consumers to receive real-time pricing. The latter is only applicable to users who have smart meters which enable real-time pricing.[163] The CREG formulated such regulation in 2015 in resolution CREG 011 of 2015 which regulated emergency demand response programmes and which will be later explained in Chapter 5.

Smart grids, AMI and smart meters. After a series of studies[164] developed by the Planning Energy Authority (UPME) regarding the implementation of smart grids in Colombia, the Ministry of Mines and Energy (MME) enacted several resolutions which are expected to be expanded by the electricity Authority CREG. For instance, Resolution 40072 of 29th of January 2018 by the MME amended by Resolution 40483

[159] Regulated in Decree 1073 of 2015.
[160] Decree 1073 of 2015 (Colombia), art 2.2.3.2.4.4.
[161] Law 1715 of 2014 (Colombia), art 5.
[162] Law 1715 of 2014 (Colombia), art 6 and art 31.
[163] Decree 2492 of 2014 (Colombia), art 1.
[164] UPME *Smart Grids Colombia. Vision 2030* (UPME, Bogota, 2016); Other studies are "Definition of minimum functionalities needed for smart meters in Colombia" and "Implementation project for smart metering infrastructure" which make an analysis of cost and benefits of a hypothetical massive roll out of smart meters.

of 30th of May 2019 establishes the mechanism for the implementation of the advanced metering infrastructure. The main objective of this resolution is to facilitate energy efficiency, demand response and real-time pricing. Together with the correct integration of distributed generation, self-generation, energy storage, electric vehicles, thereby invigorating competition in the retail market and creating space for emerging markets and services.[165] The resolution also established the basic functions of the AMI,[166] bidirectional flow of information, storage of data, cybersecurity arrangements, synchronisation, local and remote reading. Also, support for real-time pricing, connection and disconnection to enable demand response programmes, bidirectional metering of consumption and injection of energy in the case of self-generation devices and prepay services.

The current roll-out target for AMI is 75% of grid-connected users by 2030.[167] On this point it is important to note that in the first version of resolution (2018) the Ministry established a target of 95% of grid connected users and 50% of off-grid users. As can be seen, such a big difference in the target responds to a more realistic, even though still idealistic target. This resolution is about AMI, which not only refers to smart meters but hardware and software that enables a more coordinated and efficient operation of the distribution network. These technologies imply further costs that distribution companies may not be able to achieve within 20 years, always keeping in mind that the cost of such investments will end up being passed on into the electricity bill or the CREG will have to think of a new remuneration scheme for such investments.[168] Lopez Rodriguez[169] rightly noted that Colombia is a country where most of the population has a low income and a considerable percentage live in substandard settlements where an advanced metering infrastructure may not be a priority or it would not be feasible to recover the investment over the lifetime of the meter because it will not produce much of a difference in its use. As he suggests, it may be better to initially implement to customers with a higher demand for energy and higher incomes where energy savings produce more benefits for the system and customers. [170] Nevertheless, Rodriguez fails

[165] Resolution MME 40072 of 2018 (Colombia), art 4.
[166] Resolution MME 40072 of 2018 (Colombia), art 5.
[167] Resolution MME 40483 of 2019 (Colombia), art 4.
[168] Resolution MME 40483 of 2019 (Colombia), art 5.
[169] Rubén López Rodríguez and Renato Céspedes "Challenges of advanced metering infrastructure implementation in Colombia" (2011) IEEE 1 at 4.
[170] At 5.

to recognise the importance of introducing new technologies for vulnerable customers, especially distributed generation devices that enable them to produce their own energy and, in that context, smart metering and AMI are vital tools for interacting with the system. In addition, although smart metering and AMI are useful for theft detection, the energy policy should be oriented towards ensuring vulnerable customers have access to energy in safe and quality conditions instead of only being used for the detection of illegal use of energy. The importance of making technologies available for vulnerable customer will be the subject of further explanation in Chapter 5.

Following guidelines established by the Ministry of Mines and Energy, the CREG issued Resolution 131 of 2020, which is currently in the consultation process. It mandates that the distribution companies are in charge of the implementation of AMI, in terms of installation, administration, operation, maintenance and repositioning. [171]In this resolution, the CREG also establishes requirements around cybersecurity, and the use and protection of data while defining the procedures for third party access to the data, following legislation and standards on data protection.[172]

There have been some pilot projects implementing AMI in Colombia in the cities of Bogota, Cali and Medellin. One example of such an initiative is a project developed on the campus of the National University of Colombia campus, located in Bogota. Several technological and electric companies are participating in this pilot project and have donated or contributed with smart metering equipment to be installed on the campus of the University to establish the functions, benefits and challenges of some smart devices.[173]

In conclusion, the initial approach to regulation of the electricity industry in Colombia suggests that the country has specific legislation regarding emerging concepts, such as self-generation, demand response, smart meters and AMI regarding access to the grid, consideration of access to markets and special targets. However, there are several

[171] Resolution CREG 131 of 2020 (Colombia), art 11.
[172] Resolution CREG 131 of 2020 (Colombia), art 13.
[173] Universidad Nacional de Colombia *Informe de Instalación y puesta en Servicio de Medidores Inteligentes en el Campus Universitario de la Universidad Nacional de Colombia* (Electrical Machines & Drives, EM&D Electric and Electronic Engineer Departament, Bogotá, 2016) at 14. (Translation: *Report on the installation and commissioning of smart meters on the university campus of the National University of Colombia*).

traditional-centralised regulatory features which challenge the correct integration of the emerging concepts in the power system. For instance, the need to establish a public utility company to generate, supply or transport electricity can be seen as a disproportionate barrier for smaller players. Also, only large-generators are allowed to participate in the wholesale market, and not individual consumers, can be seen as an entry barrier. The fact that remuneration mechanisms promoting investment in new electricity generation are focused on large-centralised projects and the same happens for incentive mechanisms for renewable resources is problematic. However, regulation can benefit emerging concepts such as having non-strict unbundling rules, not needing a supply licence, and the possibility that future auctions promoting alternative renewable energy may also encourage decentralised energy projects and third party access rules on distribution.

2.5 Key points

This chapter has explored the coexistence of a traditional-centralised legal framework with new regulation that attempts to integrate the emerging technologies and concepts that empower consumers. To do this, I have drawn upon the experience of the selected countries and the major findings are the following:

In terms of generation, there are tendering procedures to promote the building of new capacity which are tailor-made to promote large projects. Regarding distribution, it is vital to analyse more deeply the rules applicable to distributed generation regarding third-party access, right to access the network and for some countries like the Netherlands, guaranteed prior access to renewable energy projects. Moreover, it is interesting to note that the mandatory unbundling of activities could challenge the development of community projects that may need to develop vertically integrated activities.

Regarding the markets, an interesting constant feature found is only allowing participation in the wholesale market to large generators (normally more than 10 MW) which raises the question of access to the market by new or smaller actors or the need to create new markets for them. In respect of the retail market, sometimes there is a legal requirement to hold a supply licence and the ability to demonstrate financial and

technical capabilities. This restriction may be an obstacle for active consumers or community energy projects who want to engage in supply activities. The research also confirms that the consumption level of consumers determines the different rights, duties and level of participation in the electricity industry. For example, the industrial consumer can participate in the wholesale market through intermediaries while residential consumers cannot.

Emerging concepts have been progressively regulated in different ways. For instance, regulation of distributed generation and self-generation focuses more on the rules of connection to the distribution network. Participation of distributed actors in the market is still restrictive. In relation to demand response, the regulation is mostly market-driven. The introduction of smart grids, AMI and smart meters have tended to be either market-driven (New Zealand) or regulated somehow by defining roll-out targets (the Netherlands and Colombia). In both scenarios, pilot projects are being used to understand the implications of these technologies for selected parts of the system.

All these findings suggest that the coexistence of a traditional understanding of the electricity system and emerging concepts create some legal barriers and gaps that diminish the active role of consumers in the market and participation in the system. However, before proceeding to a closer examination of these legal challenges, it will be necessary to understand the values, political context and theoretical constructions around a more active role for consumers. This more active role not only responds to new available technologies but is also a consequence of a worldwide impetus for a more bottom-up approach in the industry.

Chapter 3: Law and Society: How the Active Role of Consumers Fits into the Broader Context.

The electricity sector is on the verge of significant change because of technological innovations that are shaking conventional energy supplies, together with an increasing awareness of climate change. Nowadays, the option is available to create a more complex, dynamic system that allows the participation of new actors, enabling a two-way flow of energy and information. To provide context and a better comprehension of the many reasons behind this shift, and the regulatory response to it, this chapter is divided into three main sections. Firstly, the multiple socio-political constructions that have foreseen consumers become more active and their political and market relevance will be analysed. In this sense, we will explore the origin and significance of 'prosumers', the sharing economy and the concept of localism and bioregionalism.

Secondly, the current drivers demanding change in the way that electricity is generated, supplied and consumed will be introduced. These drivers respond to current and future needs that require addressing and inclusion in the current energy policy debate around the production and supply of electricity. Such drivers are climate change, more community involvement, energy security, energy transition, energy democracy, energy justice and energy efficiency.

The third section explores and contrasts the multiple regulatory perspectives that must be taken into account when undertaking a legal and regulatory study of active consumers. Such perspectives should recognise the role that regulation plays, the various reasons that justify regulation, the multiple regulatory instruments and the existential question of who can regulate an activity. This study will be followed by an analysis of the relationship between regulation and technological innovation and the concept of smart regulation. These multiple regulatory perspectives constitute the theoretical framework which not only will be considered and reflected throughout the thesis but, in Chapter 7, serve as a foundation to answer the core research question regarding the role of law in shaping electricity systems in liberalised countries, allowing for an emerging and more active participation by the consumer.

3.1 Active Consumers and the Multiple Socio-Political Constructions

In this section, we will explore interesting concepts originating in the social sciences which attempt to explain, and sometimes even forecast, the social and economic consequences of the emerging relationships resulting from a more active role for consumers. This active role resonates in the economy, in social and political organisations and even in what were previously hierarchical relationships.

3.1.1 The Prosumer Society

There are different perceptions in social science around consumers. Slater[1] refers to two images, the 'hero' and the 'dupe'. The consumer as a hero is the one principally identified in economic literature, as the active and rational person who acts in a way to maximise the utility obtained in purchasing goods or services. The 'dupe', on the other hand, is characterised by social science scholars when criticising the mass-production society, seeing the consumer as a manipulated, passive individual who is exploited by market forces. Nevertheless, another more recent image of the consumer is the one who is self-conscious of the symbolic meaning attached to a product, so selects them in a way to identify themselves or as a lifestyle.[2] Another perception is suggested by Campbell[3], called the 'craft consumer', someone who wants to engage in creative acts of self-expression or own and individualise mass produced products. The growth of the DIY (do-it-yourself) movement is an example of it, driven by home ownership and security of tenure and has increased in popularity thanks to new products on the market, social media and user-content creation on the internet, e.g. YouTube or TikTok.

A further step in the concept of the consumer in social science has been the introduction of the term 'prosumer'. This term refers to the combination of production and consumption in one entity, the prosumer. The term was coined by the famous social scientist and futurist Alvin Toffler in 1980, in his book *The Third Wave.*[4] According to Toffler, as society moves towards a post-industrial age, the number of 'pure consumers'

[1] Don Slater *Consumer Culture and Modernity* (Polity Press, Cambridge, 1999) at 64.
[2] Mike Featherstone *Consumer Culture and Postmodernism* (Sage Publication, London, 2007) at 132.
[3] Collin Campbell "The craft consumer: culture, craft and consumption in a postmodern society" (2005) 5 Journal of Consumer Culture 23 at 38.
[4] Alvin Toffler *The Third Wave* (Bantam Books, New York, 1980) at 125.

will decline and will be replaced by prosumers, people who produce many of their own goods and services.[5] Alvin Toffler[6] and Philip Kotler[7] were the first authors discussing this symbiosis (producer-consumer) anticipating the development of prosumers decades ahead.

Nevertheless, although the term is new, prosumption is not. Toffler[8] distinguishes three stages, what he called waves, in human history. In the first wave, humans were prosumers by nature, being involved in agricultural activities, hunting and gathering. They produced their own food, created their own tools and built their own shelters. A second wave, according to Toffler, started with the Industrial Revolution with the factory as the main institution. Here, the dominant processes are industrialisation and marketization. People specialised in specific tasks and were not able to produce anything else, so they needed to engage in transactions to obtain goods and services.[9] Since the Industrial Revolution, the separation between producer and consumers is existential and economists have followed that distinction for the analysis of economic activity.

A third wave, according to Toffler, is the synchronisation of the first and second wave, the prosumer era. For him, the main institution will be 'home' where people carry on their own production and consumption making the less important. This wave, according to Toffler, would be characterised by de-marketisation and demassification. The important nexus are locality, family and neighbourhood. However, what were the reasons behind Toffler's prediction? He argued that society would be different because the working week would reduce, allowing more leisure time; highly educated people would not want boring or stable jobs and would aspire to self-grow and self-actualisation resulting in a shift away from mass-produced goods, preferring custom-made goods of a better quality and personalised; the rising cost of skilled labour driving people to do their own work and advancing technologies which would ease the path for

[5] George Ritzer, Paul Dean and Nathan Jurgenson "The coming of age of the prosumer" (2012) 56 American Behavioural Scientist 379 at 385.

[6] Toffler, above n 4, at 130.

[7] Philip Kotler "The prosumer movement: a new challenge for marketers" (1986) 13 Advances in Consumer Research: 510 at 513.

[8] Alvin Toffler, above n 4, at 138.

[9] George Ritzer, above n 5, at 382.

production at home. He observed that such changes would create problems and a frustrated future for marketers. [10]

One should remember that the prediction of the 'Third Wave' was made in 1980, and forty years later we can see how some of these drivers are happening. For instance, the current trend mostly among highly educated people with medium and high incomes, is to want to grow their own food, make their own clothes and be more environmentally friendly, e.g. the hipster culture. Another suggested driver is the high-cost of labour, which is already a reality, especially in developed countries, where the wages of an electrician or builder is not that far from salaries of professionals. In addition, advancing technologies allow us to do things that previously were only able to be done by industry. This is called 'democratisation of technology', which refers to cutting-edge machines that make it easier to manufacture goods allowing not only industrial sites but also households to become sites of production, e.g. 3D printers. There is even a social movement or culture called 'the maker movement' [11] which is promoted by engineers, designers and technicians who believe in enabling people to be able to make almost anything. In this point, one may think fitting the new technologies that allow a more active role of electricity consumer within this trend. However, it should be stated that the prediction of a frustrating future for markets has not become a reality, rather the opposite appears to be the case. New markets are emerging and traditional market spaces and industries have to compete in order to survive by offering new services and adapting their business models to meet contemporary demands. As such, from my perspective, the idea of prosumerism within the third wave is becoming a reality among industrialised societies; however, this might not be the case in developing countries where some are still engaged in the second wave while others are still in the first wave.

After *The Third Wave* was published, Philip Kotler, known as the father of modern marketing, wrote an article in 1986[12] identifying further marketing implications for the potential role of prosumers. Kotler started by analysing the characteristics of an activity that is likely to attract consumers to become prosumers. There has to be high cost savings, require minimal skills, consume little time and effort and yield high personal

[10] Alvin Toffler, above n 4, at 138.

[11] Susie Elliott and Mark Richardson "The maker movement" (2016) 142 Arena Magazine 38 at 39.

[12] Philip Kotler, above n 7, at 512.

satisfaction. Based on these characteristics, he predicted that house painting, car repairs, cooking or baking, even the participation of consumers in designing personalised cars or houses, would be likely be done by prosumers.

In Kotler's opinion, "instead of marketers fighting prosumers, they should look for opportunities to facilitate prosumption activities".[13] One way is by creating better tools for prosumers to use, e.g. to sell all the equipment needed to do gardening; or simplify the product or process to make it easier for the consumer to do things themselves, such as adhesive wallpaper instead of paint and brushes. Another way is developing instruction markets which provide a training course where people pay to learn how to do certain things or provide services, e.g. how to fix a car. Kottler called these markets prosumer-oriented marketers.[14] As a specialist in marketing, Kottler also foresaw that such changes would be opposed by "threatened interest groups" who will use the law to prevent people from producing certain goods or services themselves.[15] Such reflections are interesting and should call attention to businesses such as traditional-centralized energy companies to face the new era and innovation from a more flexible perspective and understanding of what the future holds. With cutting-edge technologies that will enable us to undertake a wide range of activities, businesses will have to adapt to survive and be able to compete using new technologies.

Nevertheless, the emergence of prosumers not only brings independence, autonomy and knowledge to individuals, but prosumers can also be exploited. From a Marxist perspective, Ritzer and Jurgenson[16] argue that capitalists have found another group of people to exploit: the prosumer. According to the authors, initially, capitalists exploited labour by generating value from underpaid work; this was conceptualised by Marx. Later, capitalist exploited consumers by overcharging them for goods, creating a culture of overconsumption and growth in the use of credit, which was theorised by Braudillard.[17] Since 2007, after the global recession both consumption and production declined and a new group emerged to be exploited: the prosumer society. For Ritzer

[13] At 512
[14] At 513
[15] At 512.
[16] George Ritzer and Nathan Jurgenson "Production, consumption, prosumption the nature of capitalism in the age of the digital 'prosumer'" (2010) 10 Journal of Consumer Culture 13 at 19.

[17] Jean Baudrillard *The Consumer Society: Myths & Structures* (Sage Publication, London, 1998).

and Jurgenson, this society started putting consumers to work, turning them into prosumers. For instance, in fast food restaurants, where customers carry their meals, clean their table, put garbage in the bin or, the use of self-service tanks at fuel stations. In this scenario, instead of paying low salaries to employees, consumers are working whilst capitalists are not paying at all. For Ritzer, these are examples of traditional forms of prosumption, as distinct from the new form of prosumption associated with Web 2.0. In Web 2.0 (user-generated content, e.g. Facebook, YouTube, Twitter, Wikipedia), the content produced for the user, now also prosumers, can create more profit than they would get from exploiting workers or overcharging consumers. This surplus value is generated because prosumers usually are not getting paid[18] for the work they provide to the network and for the valuable information every user provides.[19] The capitalism in prosumption has unique characteristics and can constitute a new form of capitalism, what they called prosumer capitalism.[20] The second issue highlighted by Ritzer and Jurgenson relates to data. For several years there have been scandals over the sale of private information of Facebook users to corporations, or Google making a profit from selling information from its users to advertisers, both without the knowledge or consent of users. As Ritzer[21] wisely points out, such databases are the factories of the twenty-first century.

The above perspective raises questions, particularly in relation to prosumers who consume and produce their own energy, about the best way to empower them and ensure they can access the benefits of the industry that they are participating in, without excessive burdens and without being taken advantage of by bigger players. This leads to questions about remuneration for the services that active prosumers provide to the system and to questions about the information that is generated and stored by smart meters, in terms of who will manage such information, who has legal access to it and who can sell it to marketing companies. It should be noted that the information provided by smart meters if used to their full potential, is as private or even more so, than information provided by internet users. This information is not sporadic or anecdotal

[18] Some online prosumers can get revenue from such activities. For instance, prosumers who have reached certain level of online relevance, e.g. high number of views, can get paid from companies to advertise their products. The industry now calls those people 'influencers'.
[19] George Ritzer and Nathan Jurgenson, above n 8, at 23.
[20] At 26
[21] George Ritzer, above n 5, at 371.

but is step by step of everyday life. For example, it shows what time the user watches TV, has a shower, and makes a coffee Information says a lot about each household's consumption patterns and can be use strategically by third parties.

Ritzer[22] also discusses another interesting issue, suggesting that prosumer capitalism is based on a system where output is abundant whilst the traditional capitalism is based on scarcity and where the need to maximise efficiency and production is the rule. In a prosumer era, Ritzer states, there is no longer scarcity because prosumers are devoting so much of their time and are producing so much. Capitalists, in a prosumer scenario, are not concerned with efficiency but effectiveness, i.e. quality. Although this analysis by Ritzer relates to digital prosumers and the potential of the Web 2.0, it arguably can also have implications for active consumers or 'energy prosumers'. If an increasing number of residential consumers want to produce and supply their energy surplus or other services to the network, it would be essential to set quality standards for the devices that are used. Hypothetically, for instance, in the future there would be no fear of a black-out as a result of a scarcity of energy but of power disruption and local congestion because the voltage of the network can be compromised, challenging the role of the operator of the distribution network. We recall the massive power disruption in Australia which was made worse because some generators, including solar rooftop systems, did not comply with the standards for inverters and therefore were unable to reduce their output to the system.[23]

After understanding the origin and the political and social relevance of prosumers, we are able to identify the similarities with an active consumer in the electricity sector. A consumer decides to produce their own energy, participating actively in the industry by providing services or supplying energy surplus. As a result, the literature has developed the concept of the 'energy prosumers'.[24] Energy prosumers can refer to either individuals or group initiatives whose main objective is the production, management and consumption of electricity, independent or less reliant on large producers and suppliers of energy. In this sense, we are able to connect the emerging concepts

[22] George Ritzer and Nathan Jurgenson, above n 8, at 20.

[23] Steve Rotherham "Local hydro keeps the lights on after storm" Energy News <www.energynews.co.nz>

[24] Sharon B Jacobs "The Energy Prosumer" (2017) 43 Ecology Law Quarterly 519 at 523; Yael Parag and Benjamin K Sovacool "Electricity market design for the prosumer era" (2016) 1 Nature Energy 1 at 2.

(distributed generation, self-generation, demand response and the importance of smart meter) with the concept of the 'prosumer', a common term that reflects the consequences of such technologies. The term 'energy prosumer' will be used alternatively from now on to refer to active consumers.

3.1.2 Sharing economy

Historically, there has always been a sharing of goods among friends, relatives or acquaintance where money may or may not be part of the transaction. Borrowing a car from an uncle and spending some days in a friend's house at the beach is possible thanks to social conventions among friends and family, where money may be part of the transaction. In an industrialised society, people can also obtain goods and benefits from service providers, who formally provide the service in exchange of money and comply with the applicable legal requirements. However, one of the most significant developments over the past 10 years, according to Frenken,[25] is that thanks to online platforms, consumers have started to borrow or rent goods from other consumers, frequently strangers. Through the use of online platforms such as Uber or Airbnb, instead of dealing with formal service industries such as the hotel industry or taxi companies. This is called the 'sharing economy'. The challenge for the state is that these transactions do not necessarily obey market regulations or deliberately avoid traditional regulations to run businesses, e.g. ignoring the need for licence, worker rights, tax regime and other regulatory frameworks. So to what extent should such regulations be adapted?

The sharing economy is defined by Frenken[26] as the practice in which consumers grant each other temporary access to their under-utilised consumer goods in exchange for capital assets. However, the author overlooks one important aspect that should be included in the definition. An online platform works as an intermediary, bringing together customer and provider, e.g. Uber or Airbnb. Therefore, the concept of the sharing economy means that the person that used to be considered a consumer now can act as a service provider for other consumers thanks to online platforms. Online

[25] Koen Frenken "Political economies and environmental futures for the sharing economy" (2017) 375 Royal Society 1 at 2.
[26] At 3.

platforms empower consumers to be providers and participate actively in the economic benefits of the activity and compete actively with the industry. For instance, 10 years ago, we only used to check hotels or bed and breakfasts (fully regulated businesses) to arrange accommodation; now we also check Airbnb to see who offers a more competitive deal.

Although the sharing economy provides benefits economically (increasing competition), environmentally (reducing waste, and socially (increasing incomes for some), it can also be disruptive with regard to its impact on traditional service providers and the legal challenges it presents to industry regulations such as licenses to operate, tax regimes, safety regulations competition law and labour rights. An example of this is the debate as to whether Uber drivers are employees or "business partners".[27]

For Frenken,[28] there are different ways of regulating sharing economy platforms. For instance, regarding taxes, for redistributive purposes, government can shift taxes from labour and usage of goods to capital and ownership of goods. For example, by taxing real estate at a higher rate when used to make capital gain rather than for personal use. However, this can by passed through the use of virtual currency, such as bitcoin, for tax avoidance. Regulating the profits that platforms make and not just the user is another way to regulate sharing economy platforms. As such, it is important for governments to have the ability to control such virtual transactions.

How are energy prosumers or active consumers related to the sharing economy? There are emerging business models through online platforms that allow peer-to-peer trading, where an energy prosumer can sell energy directly to another consumer. These alternatives raise legal questions such as, is a supply licence needed? Is there compliance with safety and quality regulation? What terms govern the relationships with other relevant actors, such as distributor operator and supplier? Is the online platform acting as a supplier? Is the platform an industry participant? Some of these questions will be explored in Chapter 5, regarding access to markets.

[27] Lana Pepić "The sharing economy: Uber and its effect on taxi companies" (2018) 16 Acta Economica 128 at 130.
[28] Koen Frenken, above n 25, at 9.

3.1.3 Localism and bioregionalism

In a globalised and consumerist society where mass production, mass consumption, and fast-speed, far-reaching production and trading are the norm, the return of a local perspective can be disruptive. This local perspective, known in the literature as 'localism', is a critical environmental approach promoting the relocation of social, economic and ecological grounds.

Although industrialisation and globalisation has meant unprecedented growth of material wealth and comfort for many societies, it has also made a considerable impact on the environment, increased greenhouse emissions and affected the rights of many vulnerable people around the world. Litfin[29] argues that localism is an adaptive response to the defective consequences of globalisation. This means growing locally, producing locally, knowing where our waste goes, where our energy comes from, being independent from international relationships, e.g. oil crisis, and in this way, makes a more just, sustainable and resilient world. She also asserts that, if localism only focuses on local sustainability it will lose its progressive potential while ignoring the globalised infrastructure that our modern lives are dependent on. [30] This is certainly true for most of the daily life products coming from China; the exporting of developed countries waste to Asian countries; importing of out-of-season food because consumers want to keep consuming them regardless of which local products are available, e.g. when local avocados are not available in New Zealand and are imported from Mexico. In addition to these examples, even the fight against climate change is a global fight and cannot be easily addressed by only local initiatives. In this scenario, it is important to mention the work of DeYoung and Princen[31] who distinguished between positive localisation and negative localisation. A positive approach is one associated with cooperation and healthy communities working together. However, negative localisation, relates to survival and the fragmentation of communities, which can create inequality and hegemonic domination. This is the case for villages preparing for a 'mass extinction': stockpiling food, toilet paper, oil and guns, as we have experienced during Covid 19

[29] Karen Litfin "Localism" in Carl Death (ed) *Critical Environmental Politics* (Routledge, London, 2013) 156 at 158.
[30] At 159.
[31] Raymond DeYoung and Thomas Princen *The Localization Reader: Adapting to the Coming Downshift* (The MIT Press, Cambridge, 2012) at 73.

times. As Litfin[32] asserts, localism, as with any human invention, can be used in desirable and undesirable ways.

In the 90s there was a popular slogan, 'Think globally, act locally', which implied that when people really care about world problems they can start by doing something about it at home or in their small communities. This meant recycling, using public transportation, buying local and organic food. This approach, however, was rightly criticised by DeYoung and Princen,[33] who argued that although the premise is well intentioned, it can never counter the globalised power of multinational corporations, and local action is not likely to have a significant impact. The authors suggested a new slogan: 'Think and act, globally and locally'. Developing this premise, one can connect this perspective with that intended by Greta Thunberg and the worldwide social movement demanding more action in terms of climate change. This growing movement demands that individuals change their behaviour in terms of consumption and challenges political and economic leaders on their inability in tackling climate change. Therefore considering global perspectives without forgetting the relevance of local outlooks to recognise the impacts to both and the multiple factors to consider in dealing with climate change problems. In this sense, the participation of the majority of individuals as well as also recognising the leading and decisive role of policy and decision makers and the private sector are vital.

Localism is also related to 'bioregionalism' which, according to Dodge,[34] refers to the biological and cultural realities of people locally promoting the diversity of biosocial (interaction of biological and social factor) experimentation. The concept means working with the multiple factors available within the local environment. For instance, from an environmental perspective, a local economy can lower energy requirements by reducing transportation or mass-production and therefore may be more ecologically friendly. This is known in the literature as 'small is beautiful'.[35]

[32] Karen Litfin above n 29, at 164.
[33] Raymond DeYoung and Thomas Princen, above n 31, at 87.
[34] Jim Dodge "Living by life: some bioregional theory and practice" in John S Dryzek and David Schlosberg (eds) *Debating the Earth: the Environmental Politics Reader* (Oxford University Press, Oxford, 1998) at 365.
[35] Raymond DeYoung and Thomas Princen, above n 31, at 80.

How is localism related to energy prosumers? One answer is when active consumers provide energy and services to the network, many of the relationships and repercussions are local, e.g. community energy projects, buying energy from local generators, management of the local network. A more complex answer refers to consequences that may appear local but also resonate within the whole energy system, for example, increasing local energy impacts on local grid management. However, the increasing local load also needs to be integrated in the planning for the whole system made by the transmission operator, thereby requiring the coordination of local and global perspectives for better grid management. Another example is the importance of local initiatives in demonstrating the relevance of some concepts to a wider audience. This is the case of highlighting the importance of local renewable energy projects with smaller capacity within a national policy of promoting renewable energy generation. Such an example, regarding renewable energy will be further explored in Chapter 6, regarding community energy.

3.2 Context and Values for the Active Role of Consumers

This section will introduce the traditional and new values that are important to consider when planning the energy sector. The new values introduce a more sustainable, environmental, democratic and efficient way of supplying energy which is also consistent with a more active role for consumers. Drivers such as climate change, more community involvement, energy security, energy transition, energy democracy, energy justice and energy efficiency are the main topics that need to be considered when analysing new approaches to electricity regulation and policy. This section will describe each of those drivers in terms of definition, characteristics and the way that how achieved by implementing emerging technologies that challenge the paradigm, providing solutions to traditional problems and creating a more dynamic system.

3.2.1 Climate change

The provision of energy services is a primary cause of climate change and, at the same time, climate change creates challenges for the energy sector.[36] This vicious circle affects both energy supply and energy demand. On the supply side, the industry faces increased risks that threaten energy security in the short and long term which, depending on the region, includes vulnerability and exposure to hazards. For instance, the increased occurrence of extreme weather events, such as droughts, threatens the supply of electricity for systems that rely on hydropower,[37] or changing weather patterns can threaten network infrastructures, e.g. high winds, falling trees, storms and floods.[38]

On the energy demand side, rising temperatures alter seasonal demand patterns, decreasing demand for heating and increasing demand for cooling systems. At the same time, given the impact on the supply side, such impacts also mean that society cannot rely on the delivery of energy services.[39] The importance of enhancing the resilience of the energy sector against climate change goes beyond protecting energy companies but also involves protecting the current and future supply of energy services, and anticipating the likely rise in temperatures into the future.[40]

Awareness of climate change and a desire to reduce the participation of the energy sector in the emission of greenhouses gases has resulted in a growing international policy debate regarding the phasing out of fossil fuels, the removal of subsidies to this sector and relocating them in other technologies or cleaner energy. For instance, Sovacool,[41] when supporting such phasing out and a transition to cleaner resources, accurately pointed out that even if fossil fuel depletion were avoidable, the threat of climate change forces the current and future policies to reduce and eliminate the

[36] William Moomaw and Francis Yamba *Renewable Energy and Climate Change* (Cambridge University Press, Cambridge, 2011) at 161.
[37] IEA *Energy, Climate Change and Environment 2016 Insights* (International Energy Agency,. Paris, 2016) at 73.
[38] Torben Mideksa and Steffen Kallbekken "The impact of climate change on the electricity market: A review" (2010) 38 Energy Policy 3579 at 3582.
[39] IEA, above n 37, at 75.
[40] Leal Filho and others *Climate Change Adaptation, Resilience and Hazards* (Springer, Switzerland, 2016) at 242.
[41] Benjamin K Sovacool "How long will it take? Conceptualizing the temporal dynamics of energy transitions" (2016) 13 Energy Research & Social Science 202 at 210.

consumption of fossil fuels, which is important for the energy sector, and other sectors such as infrastructure, clothing and pharmaceutical.

Governmental concerns over climate change were first highlighted in the United Nations Framework Convention on Climate Change in 1992 and subsequently in the Kyoto Protocol in 1997. Unfortunately, problems with the Kyoto Protocol meant that it was not fully accepted by the parties. Further negotiation eventually led to the Paris Agreement in 2015 which, for the first time, resulted in a global commitment to decarbonisation of the global economy and to keep global temperatures rise this century below 2.0 degrees Celsius above pre-industrial levels and to pursue efforts to limit the temperature increase even further to 1.5 degree Celsius.[42] The agreement is based on a polycentric and multi-stakeholder bottom-up approach that asks all countries to establish a target to reduce emissions after 2020. These targets are known as Intended Nationally Determined Contributions (INDC). The Paris Agreement set ambitious long-term temperature targets, establishing a pathway to advance renewable energy deployment worldwide. Over 90 parties have proclaimed renewable energy a priority in their INDCs and over 70 countries have promised specific national targets for renewable energy deployment and energy efficiency.[43] The implementation of these goals by every country could result in an acceleration of the global energy transition to cleaner ways of satisfying human needs while protecting the environment and the earth from climate change.[44]

As mentioned previously, New Zealand, signed the Paris Agreement, committing to reduce GHG emissions to 30% below 2005 levels by 2030 with a long-term target to reduce emissions to 50% below 1990 levels by 2050.[45] In its submission New Zealand recognises that most of the GHG emissions come from the agriculture sector (48.4%), followed by the energy sector (21.9%), transportation (17.2%), industrial processes

[42] United Nations Framework Convention on Climate Change- Paris Agreement (opened for signature 22 April 2016, entered into force 4 November 2016).
COP *Adoption of the Paris Agreement* (United Nations Framework Convention on Climate Change, Paris, 2015) at 5.
[43] IEA, above n 37, at 75.
[44] Florian Kern and Karoline S Rogge "The pace of governed energy transitions: agency, international dynamics and the global Paris Agreement accelerating decarbonisation processes?" (2016) 22 Energy Research & Social Science 13 at 14.
[45] *New Zealand's Intended Nationally Determined Contribution* (Ministry for the Envrironment, Wellington, 2015) at 5.

(6.3%) and waste (6.2%).[46] It also acknowledges and addresses the need to target all economic sectors including the energy sector. Moreover, the submission states that, given New Zealand's abundance of renewable energy resources, electricity be generated predominantly from geothermal and water and claims that the country is making progress towards reaching a target of 90% of electricity coming from renewable resources by 2050. It also recognised that transformation of the transport and agricultural sector would take longer than the period to 2030.[47] The current government (Prime Minister Jacinda) are committed to achieving 100% renewable electricity by 2035 and zero carbon emissions by 2050.[48]

On the other hand, Colombia intends to reduce its greenhouse gas emissions by 20% based on the projected business as usual (BAU) scenario by 2030. There is a condition that notes that increasing the target requires the provision of international support which, if provided, would allow Colombia to increase its target to 30% based on BAU by 2030.[49] Most of the GHG emissions come from agriculture (58%), followed by energy, including transportation (31%), waste (6.1%) and industrial processes (3.8%).[50] Colombia also has a clean electricity generation structure in which 70% comes from hydropower. This BAU scenario includes efforts to increase energy efficiency in the industrial, residential and commercial sectors, and a reduction in fugitive emissions due to the deceleration of oil and coal production and deforestation trends under post-conflict scenarios. It is also important to note how the INDC submitted by Colombia highlights the role of appropriate adaptation and mitigation measures to enhance the peace-making process and post-conflict process that Colombia is currently experiencing.

The Netherlands also signed the Paris Agreement and targeted a reduction of 49% of emissions by 2030, compared to 1990 levels, and a 95% reduction by 2050.[51] In contrast to New Zealand and Colombia, most of the Netherland's greenhouse emissions come

[46] At 8.
[47] New Zealand Productivity "Commission low emissions economy final report"(August 2018) <www.productivity.govt.nz>at 383.
[48] Megan Woods "NZ embracing renewable electricity future" (16 July 2019) <https://www.beehive.govt.nz/release?>
[49] Colombia Government "Colombia Intended Nationally Determined Contribution" (December, 2015) <www4.unfccc.int> at 4.
[50] At 5.
[51] Government Netherlands "Climate policy" (2018) <www.government.nl>.

from the energy and industrial sector (51% of the emissions), while agriculture only contributes 13% and transportation 20%.[52] Most of its electricity is generated from fossil fuels (92%), with 40.3% from natural gas, 37.8% coming from crude oil and natural gas liquids and 13.7% from coal. In consequence, the government is targeting a carbon-free electricity system by replacing the current carbon portion with renewable energies. They are also placing special importance on large-scale offshore winds, community energy projects based on renewables and, hydrogen projects.[53]

As can be concluded from the above both Colombia and New Zealand have a relatively clean electricity mix, which means they do not make significant GHG emissions, both are highly exposed and sensitive to the impacts of climate change given their geography and economy, which depends heavily on the climatic conditions and the use of natural resources. Thus, the importance of seeking energy alternatives to provide stability and resilience in the power generation network is a priority. At the same time, there is a need to promote alternative energy in areas which are not connected to the grid and who currently depend on diesel, coal or wood. In the case of the Netherlands, because of its geographical situation and availability of natural resources, it has a heavily dependent energy mix on fossil fuels, current policies and regulation are attempting to both promote renewable energy generation and local initiatives that help the national government to reach the target and clean the energy mix.

An active role for consumers by generating energy using renewable energies such as solar, or by off-grid solutions, micro-grids, self-management of energy needs and incentives to reduce or move consumption are important in diversifying energy supply. Those concepts recognise climate change and their primary objectives are to mitigate such impacts in the electricity supply and, at the same time, adapt the electricity system to the new challenges that climate change may bring in the medium and long-term. The localism that those concepts provide should be part of the multiple strategies to address climate change by allowing individuals and local initiatives to impact the system in a positive way by setting an example of sustainability that can be replicated for more projects around the country.

[52] Ministry of Infrastructure and the Environment "Climate change, how does the Netherlands take action" (2019) < http://climateagenda.minienm.nl/>
[53] Climate Agreement "Climate Agreement 2019" (28 June 2019) <www.klimaatakkoord.nl> at 186.

3.2.2 Community involvement in the electricity industry

The relationships between community and energy resource activities are long and diverse. McHarg[54] identified three historical approaches to that relationship. The first is a traditional approach, which recognises the impacts that economic activity may create within the community through compensation regimes where the risks and liability are assigned to the energy companies. Examples include compensation for land use, compensation for expropriation and loss of amenity or environmental impact assessments. In the second approach, the law attempts to incorporate public participation as an essential requirement that a company must comply with to obtain the permits needed to pursue a project. The main purpose of the permit is to not only ensure participation of the community in the project but also to mitigate some of the impacts from earlier stages. For instance, the right of prior consultation with indigenous communities, environmental and social licence, public consultation, sustainable development agreements, local benefits agreements or consensus.[55] This approach is increasing in popularity.

Finally, another approach recognises that the relationship between energy and community is about more than mitigating or communicating impacts but also sharing the cost and benefits with people. Some examples include ownership of energy resources and production and management of their own consumption needs. This new approach develops relationships between law, community and governance, challenging the participation of the consumer in the industry. This approach addresses individual or communal attitudes, where the foundation of energy communities is also essential and where promoting a demand-side engagement may become more than merely a strategy to increase the public acceptability of energy projects but a way of integrating bottom-up approaches in the industry.

[54] Aileen McHarg "Community Benefit through Community Ownership of Renewable Generation in Scotland" in Lila Barrera-Hernández and others (eds) *Sharing the Costs and Benefits of Energy and Resource Activity: Legal Change and Impact on Communities* (Oxford University Press, Oxford, 2016) 297 at 314.

[55] Barry Barton "Underlying Concepts and Theoretical Issues in Public Participation in Resources Development" in Donald M. Zillman, Alastair Lucas, and George (Eds) *Human Rights in Natural Resource Development* (Oxford University Press, Oxford, 2002) 78 at 80.

Households, businesses and companies can get benefits from the emerging technologies and business ideas. Communities, as groups of people sharing identity, mutual bonds and resources, want to work together to pursue a common objective and gain group benefits. Thus, the new approach to the relationship between people and energy encourages the direct participation of communities and individuals in the management of their consumption needs while creating solutions that allow those who are isolated or vulnerable to access to sustainable and clean energy. We will explore further relevant aspects regarding community energy initiatives in Chapter 6.

3.2.3 Energy security

This is an ongoing value or objective of the electricity system which will continue to be relevant in the emerging electricity system. Energy security according to Barton, Redgwell and Rønne[56] is the condition in which a nation, its citizens and businesses have access to sufficient energy resources at reasonable prices for the foreseeable future, free from the severe risk of major disruption of service. The priorities in terms of energy security differ from country to country and requires different approaches or measures, depending on the energy resources of the country. Consideration has to be given to the country's reliance on national or imported resources, geography, internal circumstances and international relationships past, present and future.[57] These factors may result in different solutions or measures that may include developing alternative resources, diversifying the energy matrix, military involvement to protect the energy infrastructure or intervening in other countries where the resources are more plentiful (Middle East crisis). In addition, the concept of energy security and the concerns that need to be addressed depend on the relevant energy sector. In the electricity sector, the idea of energy security includes reliability and continuity.

Reliability refers specifically to the interconnected bulk power system related to adequacy and security. Adequacy is seen by the North American Electric Reliability Corporation (NERC)[58] as the ability of the bulk power system to supply the aggregate

[56] Barry Barton, Catherine Redgwell and Anita Rønne "Introduction Energy Security: Managing Risk in a dynamic legal and regulatory environment" Barry Barton and others (eds) in *Energy Security: Managing Risk in a dynamic legal and regulatory environment* (Oxford University Press, Oxford, 2004) 4 at 6.
[57] At 6.
[58] IEA *Technology Roadmap: Smart Grids* (International Energy Agency, Paris, 2011) at 15.

electrical demand and energy requirements of its customers at all times, taking into account scheduled and reasonably expected unscheduled outages of system elements. This means a balance between supply and demand. Security includes all other system disturbances that result in the unplanned and/or uncontrolled interruption of customer demand, regardless of cause.[59] Continuity, on the other hand, means ensuring that a service is provided despite bankruptcy, liquidation, intervention, weather or other similar events.[60] It, however, excludes scheduled technical disruptions or those due to a fault on the part of the user, force majeure or acts of God. The characteristics of energy security in the electricity sector include the management of a complex infrastructure, growth in the international trade in energy, market competition, environmental concerns and climate change impacts in the electricity mix.[61]

Conversely, there is currently a diverse range of threats to the current energy security. These can emanate from cyber-attacks, scarcity and/or unaffordability of resources and peaks in demand followed by shortages. For example, Barton[62] identified that the geography of New Zealand raises particular energy security issues. The terrain is often a challenge to the construction and maintenance of electricity networks and, due to a small and dispersed population and small economy, there are few competitors in the energy market. Another example is Colombia which, at the beginning of the twenty-first century, faced several challenges in the electricity sector as a consequence of multiple attacks on the electricity infrastructure (transmission grids) by FARC guerrillas,[63] together with the occurrence every couple of years of El Niño Phenomenon.[64] Attacks on the energy infrastructure have decreased due to the peace agreement reached between the FARC guerrillas and the Colombian government in 2016. The 'climatic Phenomenon del Nino' has been a constant risk in Colombia and neighbouring countries which, particularly in dry seasons, threatens the energy supply.

[59] At 18.
[60] Lila Hernandez Barrera "The Andes: So Much Energy, such Little Security" in Barry Barton and others (eds) *Energy Security: Managing Risk in a Dynamic Legal And Regulatory Environment* (Oxford University Press, Oxford, 2004) 218 at 240.
[61] Barton, Redgwell and Ronne, above n 56, at 237.
[62] Barry Barton "Reaching the limits of what the market will provide: Energy Security in New Zealand" in Barry Barton and others (eds) *Energy Security: Managing Risk in a dynamic leagl and regulatory environment* (Oxford University Press, Oxford, 2004) 374 at 374.
[63] The rebel group used to target energy infrastructure to push companies out of the area.
[64] Hernandez Barrera, above n 60, at 220.

On the demand side, when consumers are motivated to reduce their consumption or generate their own energy they are creating solutions to the concerns over energy security. This approach reduces demands on the system and diversifies the resources of energy, helps when natural events disturb the electricity supply as well as assisting those in isolated areas to access electricity services without the high cost of the transmission infrastructure. Localised energy systems can offer increased security since they are often based on renewable energy, backed up with energy storage. Where this is the case, there are zero fuel costs and, therefore, they are not vulnerable to fluctuation in prices. Any failure in the centralised system does not affect them, given the energy is generated on-site and often involves the use of more than one resource or conversion system, providing the option of switching when there is a shortage.[65]

3.2.4 Energy efficiency

Energy efficiency means using less energy to perform the same activity. This means increasing the amount of service from every unit of energy. This differs from energy conservation, which is a reduction in the energy used affecting the performed activity, whilst in energy efficiency, the same service or business is provided but uses less energy because the energy is used more efficiently.[66]

Throughout the history of industrialisation, there have been different drivers for research and the implementation of energy efficiency measures. After the oil embargo imposed by OPEC during the 1973 Arab-Israeli War, developed countries began to implement energy efficiency measures to reduce their dependency from imported resources. Today, such measures are also related to reducing the impact of climate change and lowering energy demand and energy cost savings.[67]

Energy efficiency currently is the main mechanism for reducing CO_2 emissions in the energy sector, beyond the share of renewables or demand-side management, and it is the most cost-effective means available for reducing emissions in both the short and

[65] Doug Clover, Reece Martin and Nick Potter *Get Smart, Think Small: Local Energy Systems for New Zealand* (Parliamentary Commissioner for the Environment, Wellington, 2006) at 37.
[66] IEA *Capturing the Multiple Benefits of Energy Efficiency* (International Energy Agency, Paris, 2014) at 55.
[67] At 65.

long term. According to the International Energy Agency,[68] CO_2 emissions relate not only to the amount of carbon intensity in the energy supply but also to the amount of energy that is consumed. For example, energy efficiency in end-use will contribute to 38% of global emission reductions by 2050 as a result of reducing power consumption. The relevant literature[69] has also highlighted that the benefits and advantages of pursuing energy efficiency in the energy sector, and particularly in the electricity sector, include reduction of expenditure on energy and energy imports, decrease of GHG emissions and reduction of infrastructure investment in the electricity system. Moreover, it helps energy providers to deliver better services to their customers while reducing their operating costs, improving margins and mitigating risks and decreases demand for energy services which also promote reduction in energy prices.

Some of the challenges related to energy efficiency are described in the literature as a 'rebound effect', and an 'energy efficiency gap'. On the one hand, a rebound effect means that energy efficiency is used to access more goods and services rather than reduce energy demand. This means that energy efficiency measures may increase consumption rather than provide the same service at a lower cost. It may also create a spending effect, in which users spend their financial savings from energy efficiency to buy other energy consuming goods.[70] The reluctance of customers to make energy efficiency investments is explained as the energy efficiency gap which implies a difference between the levels of energy efficiency the user is expecting, compared to the efficiency they gain resulting in a reluctance to invest.[71]

Recognising both the advantages and challenges, energy efficiency is part of the service that is offered by emerging technologies and business models. For instance, we can recall that the core of demand response is that reducing demand for electricity is just as efficient as generating it. Also the purpose of smart grids includes enhancing the operation of all parts of the grid as efficiently as possible. [72] The same applies to the

[68] At 80.
[69] IEA, above n 66, at 62; Marcel Eusterfeldhaus and Barry Barton "Energy efficiency: a comparative analysis of the New Zealand legal framework" (2015) 29 Journal of Energy & Natural Resources Law 431 at 433; F Kern, P Kivimaa and M Martiskainen "Policy packaging or policy patching? The development of complex energy efficiency policy mixes" (2017) 23 Energy Research & Social Science 11 at 16; IEA *Energy Efficiency Market Report 2016* (International Energy Agency, Paris, 2016).
[70] IEA, above n 66, at 71.
[71] Eusterfeldhaus and Barton, above n 69, at 435.
[72] IEA, above n 66, at 30.

advanced metering infrastructure which attempts to make more efficient use of the grid resources and better manage peak load times.[73] These measures are important mechanisms in addressing concerns over climate change and encouraging energy savings while managing the grid in a more efficient way.

3.2.5 Energy justice

Heffron and Talus[74] consider that energy law has passed through four stages. Each stage has been motivated by a particular concern that required deeper development of energy law to address that issue. The first stage was safety, due to the harsh conditions endured by coal miners. This was followed by energy security in the aftermath of the Second World War and the management of energy resources. This led to the establishment of what is today known as the European Union, whose main objective was to maintain peace and shared prosperity by creating an interdependency between Member States. The next stage was economics, resulting from the oil crisis of 1970 and bringing competition and market liberalisation to the energy sector. The fourth and final stage was driven by the need for energy infrastructure development to incentivise a new energy infrastructure. According to the authors, the final stage is energy justice which focuses on sustainable use of energy and balancing the benefits for society.

Heffron and Talus rightly argue that energy policy and law has changed according to historical concerns, requiring a different level of intervention and engagement from either the state, the private sector or society. The changes of drivers have taken place because of changes in societal preferences and historical needs. After analysing and explaining each stage, Heffron and Talus affirm that currently we are living in the energy justice stage which has introduced a revolution in the management of energy resources, where resources are expected to be managed efficiently and equitably. [75] Arguably, these cycles are not universal and are mainly based on experiences of industrialised countries and may not be strictly applicable to other countries. For instance, developing countries are still struggling and finding solutions for safety

[73] Jixuan Zheng, David Wenzhong Gao and Li Lin "Smart Meters in Smart Grid: an overview (2013) IEEE Green Technologies Conference 57 at 60.
[74] Raphael J Heffron and Kim Talus "The evolution of energy law and energy jurisprudence: insights for energy analysts and researchers" (2016) 19 Energy Research & Social Science 1 at 5.
[75] At 6.

issues, for promoting investment in infrastructure to provide energy to more people and to the most remote areas, and for energy access to people living in slums and formalising their illegal energy supply. Although the phases and drivers may be different, the five suggested phases may be influential in the political agenda of other regions and can work as a guideline of which interest should be preserved and managed correctly.

In this sense, what is energy justice? The literature has identified three main principles: distributional justice, procedural justice and recognition of justice.[76]Heffron[77] applies these principles to the energy supply chain to show the importance of assessing justice within it. This analysis can help to value an energy resource at full cost, affecting how a nation chooses its energy mix. This choice will also affect climate change goals and energy security.

Distributional justice started as a concept developed mainly by Rawls[78] who considered that social justice should be fairness in distributing goods and advantages. Distributional justice has been thoroughly discussed by scholars from all academic disciplines, but only until in the last decade has it been applied in energy matters. Some authors[79] refer to it when discussing the distribution of economic and social benefits of energy projects among the host community and at national and international levels. Others[80] discuss to what extent the physical allocation of resources leads to distributional injustices. This scenario discusses the reasons why the siting of an energy infrastructure in a specific location may lead to injustices and more burdens in the poorest and vulnerable sectors.

[76] Raphael J Heffron "The concept of energy justice across the disciplines" (2017) 105 Energy Policy 658 at 659.

[77] Raphael J Heffron and Darren McCauley "Achieving sustainable supply chains through energy justice" (2014) 123 Applied Energy 435 at 436.

[78] J Rawls *A Theory of Justice* (Harvard University, Cambridge, 1971).

[79] Noel Cass and Gordon Walker "Emotion and rationality: The characterisation and evaluation of opposition to renewable energy projects" (2009) 2 Emotion, Space and Society 62 at 63; Komali Yenneti and Rosie Day "Distributional justice in solar energy implementation in India: The case of Charanka solar park"(2016) 47 Journal of Rural Studies 35 at 36.

[80] Heffron and McCauley, above n 77, at 436; R Cowell, G Bristow and M Munday **"**Acceptance, acceptability and environmental justice: the role of community benefits in wind energy development" (2011) 54 J. Environ. Plan. Management 539 at 541.

Procedural justice refers to equitable procedures that engage the different stakeholders in a non-discriminatory way in the decision making process. These values are also related to information disclosure, e.g. the public should know what subsidies each energy resource receives.[81]

The recognition of justice demands that individuals are fairly represented and offered full and equal political rights. Thus, it calls for the recognition of the different perspectives existing in society. One example applicable to the energy sector is energy policy recognising the specific needs of social groups to energy access, e.g. vulnerable customers.[82]

According to those three components, one can argue that a more active role for consumers can be considered part of the agenda of energy justice. The possibility of self-generation and self-management can tackle spatial disparities on access to energy. It is also important to recognise the principle of energy justice here, which enables consumers, especially households or small consumers, to access financial schemes allowing them to purchase devices to combat energy poverty. One example is net metering, which may create distributional injustice where people who can afford solar panels are subsidised by those who cannot (usually low income population or with other financial priorities). This may cause injustice, which will be explained later when analysing net metering in Chapter 5. Another example is procedural justice where the demands of groups of consumers to be able to have more active participation in the electricity industry is heard in the regulatory process. The importance of energy justice as a relevant value for this research will also be mention in Chapter 7.

3.2.6 Energy transition

The aim of this research is looking at the role of law in shaping the electricity sector to a more active role for consumers, and therefore it is important to identify precisely

[81] Heffron and McCauley, above n 77, at 436.
[82] At 437.

where this transformation is heading. The emerging market perspective is moving towards a more sustainable, environmentally and socially friendly way of both generating and consuming electricity. Therefore, this section will explore the concept of energy transition and the multiple issues faced in other transitions in the energy sector and the lessons that can be learned from them.

Sovacool and Geels have systematically studied the energy transition through the perspective of 'sociotechnical system transition'. This perspective from the social sciences has helped to shape a multidisciplinary and multilevel approach to the study of energy transition. A socio-technical system refers to the interlinked mix of technologies, infrastructures, organisations, markets, regulations and user practices that together deliver societal functions.[83] These systems have developed over a long time and that makes them difficult or resistant to change**.**[84] According to this perspective, for a socio-technical transition to happen, not only is the adoption of technologies needed but also investment in new infrastructure, the establishment of new markets, the development of new social preferences and the adjustment of user practices.

Socio-technical systems can be understood by analysing the relationships involved in a multi-level perspective. There are three components of the multi-level perspective: socio-technical regimes, niche innovation and socio-technical landscape. The regimes refer to the mainstream, existing technologies, infrastructure policy and scientific knowledge. Niche innovations are novel advances that disrupt the current socio-technical systems, which are created in technological niches that "act as an incubation room protecting novelties against mainstream market selection"[85]. Finally, socio-technical landscape refers to the macro environment such as cultural patterns, economics and political developments that influence the socio-technical regime. The transition comes, following a multi-level perspective, with the right interaction at three levels.[86] (1) niche innovation can create internal momentum through the learning

[83] Frank W Geels "From sectorial systems of innovation to socio-technical systems: insights about dynamics and change from sociology and institutional theory" (2004) 33 Research Policy 897 at 913.

[84] Frank W. Geels and BK Sovacool **"**Sociotechnical transitions for deep decarbonisation" (2017) Science 1242 at 1242.

[85] Frank W Geels and Johan Schot "Typology of sociotechnical transition pathways" (2007) 36 Research Policy 399 at 340.

[86] At 341.

process, improvement of performances and support from powerful groups); (2) changes at the landscape level can create pressure on the regime, for instance, if the regime is confronted with problems or tensions that cannot be adequately solved by the regime and, therefore (3) the destabilisation of the regime creates opportunities for niche innovation to be part of the socio-technical configuration that can deal with the changes at the landscape and create further opportunities for the niche innovation[87]

Therefore, an energy transition can be defined as a change in an energy system, usually to a particular fuel resource, technology or prime mover. For instance, the World Economic Forum[88] states that the adoption rate of grid edge technologies is likely to follow the typical S curve seen with previous technologies such as television, white ware appliances (fridge, washing machine and microwave) or the internet. The length of time to reach the point of mass adoption has, on average, decreased to between 15 to 20 years.

Geels and Sovacool[89] wisely argued that to accelerate a sociotechnical transition requires three steps: (i) increasing undertakings and momentum on niche innovation. (ii) weakening of existing systems which creates opportunities for the niche innovation, and (iii) strengthening exogenous pressure. This three step process is illustrated by an example provided by the authors. In the energy transition that Germany is currently experiencing, the first factor, increasing momentum of niche innovation, is seen when increasing the penetration of renewable energy through a series of policies and financial incentives. The factor, weakening of existing system, is visible through the tensions against nuclear power plants led by the antinuclear movement and negative local perceptions around the industry. And the last process, strengthening exogenous pressure, is seen in the use of the Fukushima accident which was vital in triggering the decision made by the government to phase-out nuclear power. The weakening of the existing system presents a challenge to regulators because phasing-out threatens important industries that will fight to protect their interests. Phase-outs can take

[87] Frank W. Geels "Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study" (2002) 31 Research Policy 1257 at 1272.
[88] World Economic Forum *The Future of Electricity New Technologies Transforming the Grid Edge* (World Economic Forum 2017) at 5.
[89] Geels and Sovacool, above n 84, at 1243.

different forms, bans or regulations requiring emission reductions, financial incentives for decarbonisation, or removing implicit or explicit subsidies to such industries.[90]

The arguments of Sovacool and Geels have been supported and complemented by Kern and Roggea,[91] and Fouquet.[92] They also agree that previous energy transitions took a long time because they were not consciously governed, whereas today, transitions towards the creation of a low carbon system can be introduced by active actors and governments. These actors are policy makers, businesses, clean tech companies, the finance sector, civil society and NGOs. The authors also consider that international innovation dynamics can work in favour of speeding up transition.[93] One can agree with the importance of different actors in speeding up transition, which makes more sense in a globalised and interconnected world, where more information and communication channels can spread the importance of climate change concerns globally, involving more actors that promote the process. [94]

After considering the above arguments, it is possible to establish a connection between energy transition and a more active role for consumers. This research shows that the integration of decentralisation and local approaches in the centralised system supposes a transformation of the power system. Such a transformation implies that maintaining centralised features (large generators supplying consumers within the country) distributed generation, self-generation and local energy markets are integrated and can compete in a level play field with traditional and centralised actors. Energy transition implies the embracing of niche innovation and technologies that make the process feasible. These includes distributed generation technologies, smart metering infrastructure, smart grid technologies (niche innovation) and the adjustment of regulation and policies that enable decentralised options to compete on fair terms in the market and also become a feasible option of energy for off-grid areas in a context of tackling climate change and the pursuit of energy democracy and energy justice (socio-technical landscape).

[90] At 1244.
[91] Kern and Rogge, above n 44, at 16.
[92] Roger Fouquet "Historical energy transitions: speed, prices and system transformation" (2016) 22 Energy Research & Social Science 7 at 11.
[93] Kern and Rogge, above n 44, at 17.
[94] Benjamin K Sovacool and Frank W Geels "Further reflections on the temporality of energy transitions: a response to critics" (2016) 22 Energy Research & Social Science 232 at 233.

Energy transition also implies a change of behaviour by users, such as, consumers willing to participate in demand response programmes or self-generation or to participate in community energy projects. The transition will also face resistance from traditional actors (socio-technical regime) but, sooner or later, different actors across the supply chain will have to embrace such changes and adapt their business models to stay competitive in the market, e.g. distribution companies being willing to deal with increasing local load, retailers both supplying energy and embracing prosumers together with offering a competitive price for their energy. Distribution companies or retailers might also need to offer services to prosumers or sell the technology which empowers consumers. Kotler[95] calls this the introduction of prosumer-oriented marketers. Prosumers will face the same challenges that previous transitions experienced, but, arguably, there will be a need for policy and a coherent legal framework to provide support and promote this transition. This topic will be further explored in Chapter 7.

3.2.7 Energy democracy

Within the drivers of the current energy transition, there is a growing body of literature in Europe and North America advocating for the shift to a system of energy democracy in which the market will be highly permeated by local and cooperatively owned renewable resources and the re-municipalisation of energy services. For McHarg,[96] the concept of energy democracy brings a practical way of thinking on how to increase the benefits for the community in the energy sector. The answer lies in incorporating and increasing community participation by exploring various options, ownership of the resources, new roles as producers and as distributors or managers of their own energy needs. Both justice and democracy in energy require energy policy to embrace social and environmental outcomes rather than profit.

Tomain in his article 'Democratization of Energy', argues that energy and environmental law can no longer be separated because this separation ignores the fact

[95] Kotler, above n 7, at 5*12*.
[96] McHarg, above n 54, at 302.

that environmental consequences occur throughout the energy cycle. In this context that the author introduces the term 'democratization of energy', stating that "the energy/environmental future should be defined by a new political norm: the democratization of energy".[97] The traditional energy path has outlived its useful life. A central democratic principle is needed to promote greater participation. This conjunction between democratic energy and the environment can be reflected in the four aspects of energy provision. In the case of production and delivery, the generation of renewable energy and the building of more decentralised power stations introduce energy democracy; in consumption and control, the democratic principles are reproduced through the empowerment of demand side management; and in relation to regulation and enforcement, reducing the need for central government enforcement and increasing regulation and enforcement at the local level.

As we can see, energy democracy goes together with community involvement and recognises a more active participation by social actors. These new objectives fit perfectly with a more active role for consumers who are not only consuming energy and paying for it but are able to participate actively in the benefits of the industry. This value goes together with community involvement and energy justice.

3.3 An Active Consumer and the Multiple Regulatory Perspectives at Stake

There are a variety of instruments used by the state to intervene the economy or a specific market. Among these instruments are public policy, planning, declaration of an economic activity as public interest, declaration of a public utility, economic policy, promotion of incentives, management of public assets, public enterprise or nationalisation[98] and, for the scope of this research, regulation.

The concept of regulation is treated differently and has different meanings within different legal traditions. Regulation, in a strict sense, is the set of rules provided by the

[97] Tomain "The democratization of energy" (2015) 48 Vanderbilt Journal of Transnational Law 1125 at 1132.

[98] Luis FerneyMoreno "Los modelos de regulación de electricidad en América Latina y en particular el modelo de Colombia" in Luis Ferney Moreno (ed) *Derecho de la Energía en America Latina Tomo I* (Universidad Externado de Colombia, Bogota, 2017) at 83. (Translation: Electricity regulation models in Latin America and in particular the Colombian model in *Energy Law in Latin America*).

regulator which, according to the Kelsenian pyramid, are consistent with the constitutional and legal framework. Other definitions of regulation are wider, such as the one provided by Julia Black, [99] who considers that regulation is the activity or procedure that is formulated in a way to change a particular behaviour.

A traditional concept of regulation is an instrument used by the state to intervene in the economy. Legal scholarship gives it different names. In Germany it is called 'Wirstschaftsverwaltungsrecht; the French call it 'Droit Public Economique'; in Spanish and Latin traditions it is referred to as 'Derecho Publico Economico'.[100] These names refer to the relationship between law and economics from a combined public and private perspective which in the English language translates to public economic law. In contrast, in the English tradition, there is no equivalent term; however, competition law, sectorial industrial regulation and administrative law are the key areas of law that set out how a state can use regulation to intervene in the economy.[101] The relation between law and economics has been analysed by scholars to develop a theory of regulation.

The section aims to contrast the multiple regulatory perspectives that are required to be taken into account when undertaking a legal and regulatory study of active consumers. These perspectives should recognise the reasons and interests that justify regulation, the instruments used to regulate and who is in charge of setting those rules. The research includes an analysis of the relationship between regulation and technological innovation and the concept of smart regulation. This analysis is vital to develop a clear knowledge of the purpose and implications of regulation and later apply this understanding throughout the thesis as a theoretical framework foundation to answer the core research question regarding the role of law in shaping electricity systems in liberalised countries.

3.3.1 The role of regulation

[99] Julia Black "Critical reflections on regulation" (2002) 27 Australian Journal of Legal Philosophy 1 at 2.
[100] Gaspar Ariño Ortiz *Principios de Derecho Público Económico Modelo de Estado, Gestión Pública, Regulación Económica* (Universidad Externado de Colombia, Bogotá, 1999) at 24. (Translation: Principles of Public Economic Law Model, public management, economic regulation)
[101] Anthony Ogus *Regulation: Legal Form and Economic Theory* (Hart Publishing, London, 1994) at 54.

The answer to the question 'What is the role of regulation?' differs according to who answers it, an economist, a legal theorist or whether one follows either a centred or decentred concept. On the one hand, centred or conventional perspectives provided by economists, such as, Viscusi, identifies regulation as "a state-imposed limitation on the discretion that may be exercised by individuals or organizations, which is supported by the threat of a sanction".[102] For Selznick,[103] regulation "is a sustained and focused control exercised by a public agency over activities that are valued by a community". The main core of such definitions is to see regulation as a set of command and control rules that are backed by sanctions, which correspond to a direct intervention in the economy by the state.

On the other hand, decentred or alternative approaches to regulation, from legal theorists, recognise regulation as not only coming from a wider range of actors beyond the state, but also through different ways aside of command and control. For instance, for Julia Black, regulation is:[104]

> the sustained and focused attempt to modify the behaviour of others according to defined standards or purposes with the intention of producing a broadly identified outcome or outcomes, which may involve mechanisms of standard-setting information, gathering and behaviour modification.

In the same vein, Barton explains regulation as[105] :

> "a process intended to alter activity or behaviour, or to carry out an ordering, often by restricting behaviour, but at times enabling or facilitating behaviour that would otherwise not be possible".

In this way, decentred definitions of regulation recognise all mechanisms that modify behaviours, regardless of the resource of such influence. In this sense, regulation is more than a prohibitive rule coming from the discretionary powers of the regulator, it

[102] W K Viscusi, John Vernon and Joseph Harrington *Economics of Regulation and Antitrust* (5th ed, Massachussetts Institute of Technology, Massachussetts, 2018) at 25.
[103] Robert Baldwin and Martin Cave *Understanding Regulation: Theory, Strategy and Practice* (Oxford University Press, Oxford, 1999) at 3.
[104] Black, above n 99, at 13.
[105] Barry Barton "The Theoretical Context of Regulation" in Barry Barton, Alastair Lucas, Lila Barrera-Hernández, and Anita Rønne (eds) *Regulating Energy and Natural Resources* (Oxford University Press, Oxford, 2006) 12 at 14.

can also involve positive incentives to perform an activity. Further examples of this statement will be given in the next section regarding regulatory instruments.

Both centred and decentred approaches to regulation recognise regulation as an activity or process attempting to address or affect a behaviour in a particular way. Depending on where the regulation originates, either the state authority or another actor, the definition will be centred or decentred. Regulation does not only relate to a set of commands but other kinds of mechanisms such as incentives, taxes or information disclosure. While recognising the importance of all forms of social control or influences which change economic behaviour, this thesis emphasises conventional regulation, recognising alternative or decentred regulation when appropriate.

3.3.2 Reason to regulate

Consideration needs to be given to the reasons that justify regulation. Through history, and more so in modern times, there have been different reasons to regulate, ranging from the existence of natural monopolies to balancing the distribution of wealth. Breyer[106] and Baldwin[107] introduce the most important historical reasons that may justify regulation.

Market failure: From an economic perspective, regulation is only justified by the presence of market failures. Therefore, when the market is not efficient and creates distortions, regulation should take place to stabilise the market and create conditions for competition. This way of thinking also considers that the role of private law in market failure allows regulatory interference in the market, demonstrating that regulation does not exacerbate such failure. However, Barton[108] asserts that this view is mistaken because it views regulation as external to markets and not as a means to construct and control the market. Traditional market failures include natural monopolies, externalities and inadequate information that we will introduce one by one.

[106] Stephen Breyer *Regulation and its Reform* (Harvard University Press, Cambridge, 1982) at 16.
[107] Baldwin and Cave, above n 103, at 15.
[108] Barton, above n 105, at 14.

Natural monopoly: When the production of a particular good or service by a single firm minimises cost, the activity is considered a natural monopoly because the absence of competition makes it more economical. However, when the single firm controls the entire market it is likely to impose monopoly pricing. This can result in a market failure which justifies regulation.[109] This rationale is the reason for regulating transmission and distribution in the power system.

Thomas,[110] when analysing the historical role of the electricity regulator in the United Kingdom (OFGEM), concludes that the original role of the regulator was to set monopoly prices and manage the transition to a fully competitive market where it would no longer be needed. The regulatory control over a natural monopoly implies not only the setting of prices but also the limiting of entry into the market, controlling its profits and imposing a service obligation on it. One example relating to prosumers is whether it is desirable to require distributors to integrate an increasing number of distributed generation connections, enabling them to use the network. This topic will be further explored in Chapter 4, regarding access to the network by prosumers.

Externalities: Externalities justify regulation when the unregulated price of a product does not reflect the true costs to society of producing it. The purpose of regulation is to eliminate the waste and protect society or third parties that bear the consequences, by compelling the internalisation of the externalities.[111] An example of it is the polluter pays principle, which is well recognised in the regulations relating to climate change and environmental issues, such as protecting the ozone layer or carbon taxes.

Inadequate information: well-functioning markets are expected to have a significant level of information available for different industry participants and consumers to access. If the market fails to produce adequate information, regulation is needed. Market failure may occur when the cost of producing the information, and the incentives to do so, are not high or fair, or when the information that is provided is not sufficient or clear enough to help the consumer make their decision. For example, if the

[109] Viscusi, Vernon and Harrington, above n 102, at 357.
[110] Steve Thomas "A perspective on the rise and fall of the energy regulator in Britain" (2016) 39 Utilities Policy 41 at 48
[111] Baldwin and Cave, above n 103, at 25.

information is too technical and/or difficult to understand or, as a result of collusion in the market, producers may hide information regarding the side effects or low durability of products or services.[112] An example related to prosumers is their access to information regarding solar panels in terms of technicalities, payback period and fees or obligations associated with generating their energy is presented clearly and comparably. This point is developed further in Chapter 5 when discussing access to relevant information of prosumers in energy markets. In this sense, regulation is needed to correct market failures by making information more accessible, accurate and affordable to consumers and encouraging the healthier operation of competitive markets. This reasoning has been subject to some criticism when the disclosure of information is considered as misleading for consumers and/or interferes with the competitive workings of the marketplace.[113]

Anti-competitive behaviour and predatory prices: When undesirable effects on the market are produced through unhealthy competition, it is considered anti-competitive behaviour. One of the most notable examples of this sort of practice is predatory pricing. Predatory pricing occurs when a firm prices below cost, hoping that competitors leave the market because they can no longer compete.[114] At some point, it would achieve such a degree of domination that it can later use the dominant position to increase their prices to recover the cost of predatory prices and increase profits at the expense of consumers. Here, the aim of regulation is to keep competition conditions and protect consumers from predatory behaviours.[115] Traditionally these issues are deal with by commercial law but authorities directly related to the electricity industry can have a say in them.

Continuity and availability of service: If the market does not provide the desired levels of continuity and availability of a service, regulation may be required to prevent such a lack. For instance, the use of schemes to subsidise off-peak supply or less profitable customers by charging extra at high peak times or charging wealthy customers attempting to assure wider levels of access of services or products, as is the case with

[112] Baldwin and Cave, above n 103, at 26.
[113] At 28.
[114] At 31.
[115] Breyer, above n 106, at 67.

electricity. Regulation, in this sense, is justified to produce socially desirable results; however, the cross-subsidisation effects may be questionable and considered unfair.[116]One example, applicable to prosumers, is whether regulation should be used to make technologies available to vulnerable consumers and enable them to produce their own energy instead of receiving electricity bill subsidies or social funds. This topic will be further explored in Chapter 5, regarding making technologies available for vulnerable consumers.

Rationalisation and coordination: When producers are small and geographically dispersed, it is hard for them to work together to produce and bargain efficiently, since it is extremely costly for individuals to negotiate private contracts and organise themselves and their industries efficiently. Regulation in such situations can not only be a means of rationalising production processes and coordinating the market but also upholding standards; for instance, the regulation of standard agreements between retailers and household consumers or between distributor operators and retailers for the use of the network. This reason might be applicable to justify regulation in the introduction of emerging and dispersed technologies, e.g. regulation of terms and conditions for the connection of distributed generation to the distribution network. These issues will be explored further in Chapter 4, regarding access to the network.

3.3.3 Regulatory instruments

There are differences between conventional regulation and alternative regulation. Conventional regulation is the set of rules that are provided by an agency, board or commission who exercise the power to regulate a specific industry; for instance, the Electricity Authority in New Zealand, the Regulatory Commission of Electricity and Gas in Colombia or the Energy Regulator in the Netherlands. Compliance with these rules is subject to monitoring and enforcement by the regulator. The regulations may set principles, procedures and requirements about what a firm should or should not do. However, the content and enforceability depends on the purpose of the instrument and

[116] Baldwin and Cave, above n 103, at 33.

the expected behaviour, which can be compulsory, incentive or indicative. In regard to Barton's[117] classification, the types of conventional regulation follow.

- *Command and control regulation or rule-based regulation*: The regulator establishes a set of detailed rules about what a firm must do or not do. The rules are clearly established so the firm knows how to behave. If the firm does not keep strictly to the rules, either the regulator or another agency will ensure compliance. However, the rules may be inadequate or not anticipate unforeseen developments or complications, given a lack of flexibility or be open to interpretation by whoever is responsible for enforcement. When this happens, new rules are set and enforced by either the same agency that established the rules or by other agencies. Nevertheless, some critics to this type of regulation argue that there is high probability that they can be affected by the 'regulatory capture' and the interests of the industry and its interest in keeping the rules may be stronger than the public interest.[118] Another critique is that it can be complex and inflexible and may bring a proliferation of rules that leads to over regulation, legalism, intrusion on managerial freedom or strangulation of competition and enterprise.

Enforcement of the rules may also be expensive. The effects of enforcement can be uncertain, or companies knowingly breach the rules to achieve a particular outcome believing that the fine levied will be covered by the profits to be made from the breach.[119] One example of command-control rules in regard to prosumers happens when regulation restricts active consumers selling energy only to specific market actors, which is the case in New Zealand and Colombia and will be part of further explanation in Chapter 5, regarding access to the market by prosumers.

- *Principles-based regulation:* The legislator or regulator sets the general principles that are expected from the specific behaviour, but most of the time those principles are not binding and are more guidelines. For instance, in New Zealand, the Electricity Authority decided to regulate demand response relationships through guiding

[117] Barton, above n 105, at 20.
[118] Barton, above n 105, at 21; Joseph Tomain "The past and future of electricity regulation" (2002) 32 Environmental Law 435 at 440.
[119] Baldwin and Cave, above n 103, at 275.

principles. This example will be further explored in Chapter 5, regarding participation of demand response in the market.

- *Light-handed regulation:* Relies on general competition law, commercial law and information disclosure. Further regulation is seen as a threat to or intrusion in the market.

- *Discretionary regulation*: The regulator has the authority to approve or reject activities/plans or to impose conditions. The legislation provides some general principles in which the regulator has a wider discretionary power to determine whether or not to approve a specific firm's activities. This is the case with the regulation of demand response in Colombia, where the legislator sets some principles which are the basis for further regulation by the electricity authority. This type of regulation will be further explored in Chapter 5, regarding participation of demand response in the market.

- *Contracts:* The government or agencies can implement policies or achieve desired objectives by using the state's wealth and spending power. The effect of these contracts is to impose a regulatory standard across all firms contracting with the government. For instance, in Colombia, the underground belongs to the state, so the exploration and exploitation of underground resources is allowed or refused by a government agency. The firm's contract with the government defines the duties and obligations of each party and the consequence of transgressions. As such, the contract regulates the behaviour of the firm. Sometimes the law already defines the main content of these provisions, for example, matters of royalties, duration, duties which the contract reflects and develops further.

- *Standard setting:* The regulator may sets the appropriate and technical level of performance of an activity. The concern around using this mechanism is that it is difficult for the regulator to do so because the information required is technically complex and liable to be contentious. The standards are set by the International Organization for Standardization (ISO) and are known as Management System Standards, and they regulate the quality of a service or product. The government or industry decides whether companies should follow the relevant principles and norms,

in which case, the company would be granted with a certificate of accomplishment if the requirement are followed.

The standards are not mandatory but achieving them shows the level of quality of the product or services.[120] For instance, in terms of installation and performance of solar panels, many countries have their own national PV-related standards which are mainly based on the standards developed by the International Electrotechnical Commission (IEC). The group of experts working on the development of those standards are part of a Photovoltaic Technical Committee (PTC), called TC 82.[121] This type of regulation is beyond the scope of this research, but it is important to recognise the significance of these standards for the industry in terms of ensuring that the technical aspects of different technologies and appliances fulfil international technical, safety, environment and trade standards.

- *Incentives:* The regulator, instead of setting strict and coercive rules, decides to establish reward schemes to encourage a specific behaviour discouraging others. The imposition of negative or positive taxes or assuring grants or subsidies can be used a positive way of promoting or encouraging a specific behaviour. This can result in investment or participation in a specific market or diversification of business. A clear example is the creation of grants or subsidies from the public purse or reducing taxes for renewable energy projects. These grants and subsidies aim to incentivise the development of a market for clean energy to reduce climate change impacts and diversify electricity resources. Among the advantages of these schemes are relatively low levels of regulatory discretion, since the firm is required to comply with the established requirement to obtain the incentive. This type of regulation is common among regulated firms, especially when subsidies are offered. However, problems can arise when the subsidy is given socially harmful sectors or those that hold economic power, such as the fossil fuel industry, thereby creating social debate and discontent.[122] Other critics challenge the effect of using incentives, like cross-subsidisation, which is the use of revenue from the sale of one product to subsidise the sale of another product.

[120] At 279.
[121] Pierre Verlinden and Wilfried van Sark "List of international standards related to PV" in Angèle Reinders and others (eds) *Photovoltaic Solar Energy: From Fundamentals to Applications* (Wiley, Sussex, 2016) 658 at 659.
[122] Baldwin and Cave, above n 103, at 82.

This subsidisation creates distortions in the market and it does not show the real price of products and services, thereby making the economic sector dependent on subsidies.[123]

3.3.4 Who regulates?

According to the definition of regulation, the question of who regulates will depend on whether considering a traditional or classical approach or a decentred one. This section will explore how both conventional regulation and decentred regulation are understood (including self-regulation, third party regulation and market based).

On one hand, following a *conventional regulation* approach, the definition of regulation implies a set of rules provided by the state which attempts to address behaviours. These include local authorities, parliament, courts and tribunals, central government departments or, the most common, regulatory agencies. Such regulators can take the form of an agency, board or commission, according to the jurisdiction, and will be in charge of regulating a specific industry. These regulatory agencies are usually comprised of relevant experts, independent from political interests, in order to separate policy advice or convention from regulation.[124]

On the other hand, *decentred regulation* refers to regulation not set by traditional governmental institutions, following the classic concept of a regulator, but rather involves other organisations that impose regulation on the collective or in the industry who accept its authority. The elements and fundaments of a decentred understanding of regulation based on Julia Black's[125] exposition are: (i) complexity of interaction between actors in society and the operation of forces creating constant tensions between stability and change in the system; (ii) fragmentation and construction of the knowledge referring to the information asymmetry between regulator and regulated industry; (iii) fragmentation of the exercise of power and control which recognises that the state no longer has the monopoly on the exercise of power and control; (iv) recognition of the

[123] Viscusi, Vernon and Harrington, above n 102, at 539.
[124] Barton, above n 105, at 16.
[125] Julia Black "Decentring Regulation: understanding the role of regulation and self-regulation in a Post Regulatory world" (2001) 54 Current Legal Problems at 106.

autonomy of social actors, where actors are able to act on their own in the absence of state intervention; (v) the existence and complexity of interactions and interdependences between social actors and the government in the process of regulation that recognise the multiple interactions involved, not only in the regulatory process but also in the implementation process; (vi) the collapse of the public and private distinction in socio political terms and rethinking the role of authority. Following those explanations for the need of a decentred approach to regulation, there are three other types of regulation: self-regulation, co-regulation and third party regulation.

Self-regulation involves different types of regulation, incentives, command and controls, and standards with particular characteristics that come from an organisation or association which belongs to a specific industry and organises themselves with a set of rules applicable to its members. Those members, in turn, accept the authority of the organisation to regulate, monitor and enforce and being subject of governmental oversight.[126] Examples of self-regulation can be seen in New Zealand where, before the creation of the Electricity Commission and the Electricity Authority, the electricity sector was self-regulated by industry organisations.

Critics of this form of regulation come from different perspectives. One argument is that self-regulation serves the self-interest of the industry rather than the public or consumers' interests. Barton[127] rightly asserts that the problem with self-regulation is the balancing of interests and state oversight when self-regulation is not enough to ensure coherency between sectorial interest and the public interest. Ogus[128] agrees with this, seeing self-regulation as a modern corporatism, where the risk of it involves the acquisition of power by groups that are not accountable to the politic body and lack democratic legitimacy. Some authors favour self-regulation, such as Baldwin and Cave,[129] who believe that self-regulation is well-informed rulemaking with a high level of commitment and has a low cost for governments. It is also effective in detecting violations, has comprehensive rules, provides flexibility under changing circumstances

[126] Baldwin and Cave, above n 103, at 137.
[127] Barton, above n 105, at 28.
[128] Anthony Ogus "Rethinking Self-regulation" in Robert Baldwin, Colin Scott, Christopher Hood (eds) *A reader on regulation* (Oxford University Press, Oxford, 1998) 373 at 376.
[129] Baldwin and Cave, above n 103, at 140.

and has a more effective complaints procedure.[130] Baldwin and Cave suggest a mixture between self-regulation and conventional regulation in terms of a pyramid strategy. [131] Then self-regulation is favoured as an initial response, and only when the desired objective is not achieved, greater state intervention may take place.

Co-regulation takes place when self-regulation has some oversight or ratification by the government.

Third party regulation comes from advocacy groups, outside the industry, who pressure the sector by establishing programmes or guidelines having regulatory characteristics. These advocacy organisations do not have any power over the activities they monitor, instead they try to modify and mobilise public opinion and influence policy makers. [132] An example of this is the Extractive Industries Transparency Initiatives. This is a global standard which applied to the extractive industries and encourages countries and companies to follow their practice standards and governance principles.

In the case of *market based instruments,* these regulations are not coercive but persuasive and are considered regulation because they attempt to promote positive behaviour. Market forces are expected to play a significant role in creating new business, incentives or opportunities to increase income but, at the same time, address the allocation of resources and production in particular sectors.[133] Through this mechanism, there is a conjunction between conventional regulation and market instruments, since there is a legal instrument (e.g. quotas applicable to renewable resources or pollution) which are the limits imposed on firms and, within that range, they can implement different ways to accomplish it through trading permits or using cleaner resources or reduce production. So instead of a state specifying the exact activity, it establishes the general objective and the firms will operate in the most convenient way to suit their own circumstances following the logic of the market.[134] For instance, the emission trading scheme which allows legal entities to buy and sell emission rights or allowances. This scheme is enforceable by financial penalties for

[130] Ogus, above n 128, at 384.
[131] Baldwin and Cave, above n 103, at 142.
[132] Barton, above n 105, at 30.
[133] Viscusi, Vernon and Harrington, above n 102, at 170.
[134] Baldwin and Cave, above n 103, at 118.

those who exceed the cap. Both caps and allowances create a market, and those who buy from the market can emit more whilst those who sell the allowances should reduce their emissions.

Both economic and decentred regulation are attractive for policy makers because they make the market appear friendly and do not require public funds.[135] In conclusion, recognising decentred perspectives makes us question not only the role of the state and the concept of law and regulation itself but also the emerging dynamics in society and how the complexity of the relation between actors challenges the conventional concept of regulation.

Throughout the following chapters, we will use the above classifications of regulation in terms of reasons, regulatory instruments and who regulates to analyse the current legal framework applicable for the emerging technologies that allow consumers to be more active participants in the industry.

So far we explored the multiple scenarios of regulation, who regulates, when and why regulation is needed as a way of changing behaviours and/or when the state intervention may be required. However, what happens when a socio-technical change disrupts the values of a specific sector and challenges the regulatory system in place? What happens when there is a mismatch between regulation and innovation creating the 'regulatory disconnection? This can be the case for emerging technologies which enable consumers to be more active actors in the electricity system, but this empowerment may not be covered by the applicable regulatory framework. In the next section, we will explore the interesting approaches to regulation regarding technology and innovation.

3.3.5 Technological innovation and regulation

Technology, as an object of study for the social sciences, has a longer history in philosophy and sociology than it has in law. However, nowadays, there is legal scholarship dealing with technological issues, particularly the role of law in influencing

[135] Barton, above n 105, at 22.

the form that socio-technical complexities take.[136] Such legal scholarship has focused attention mainly on sectors, such as the internet, biotechnology or nanotechnology, which have revolutionised the communication, health care and agriculture industries. Such technologies have a high potential for solving human and societal problems. However, the technologies are also considered high-risk, involving a permanent dilemma between freedom in research and development whilst too much freedom could lead to calamities and lack of control.[137]

Brownsword[138] has identified two kinds of technological innovation: sustaining innovation and disruptive innovation. Sustaining innovation refers to innovation that improves the performance of established products consistent with mainstream values. Applying this concept to electricity, for instance, it would be a technology that improves the management and efficiency of the transmission and distribution lines. By contrast, disruptive technologies refer to technologies that perform poorly when first introduced but bring a very different set of values and new forms of social interaction though, eventually, such technologies may become mainstream. This concept fits to our thesis topic because distributed generation technologies, smart grids, advanced metering infrastructure, are technologies that enable consumers to produce, manage and store energy, bringing new values and complexity to the system (niche innovation). This disruption changes the way the electricity system works, the structure of electricity markets and the position of traditional players and, therefore, the regulation (socio-technical regime). The result of such innovation is the transformation of the energy system, breaking paradigms and creating systems that are more dynamic.[139] Brownsword[140] suggests that the eventual result of such disruption is that established firms may fail and new market entrants would take over. However, he fails to mention that this process involves time and a constant clash between traditional and emergent

[136] Lyria Bennett "How to think about law, regulation and technology: problems with 'technology' as a regulatory target" (2014) 5 Law, Innovation and Technology 1 at 2.
[137] Gregory Mandel "Regulating emerging technologies" (2009) 1 Law, Innovation & Technology 75 at 80.
[138] Roger Brownsword, Eloise Scotford and Karen Yeung *The Oxford Handbook of Law, Regulation and Technology* (Oxford University Press, Oxford, 2017) at 132.
[139] Donald Zillman and others "Introduction: How Technological and Legal Innovation are Transforming Energy Law" in Donald Zillman, Lee Godden, LeRoy Paddock and Martha Roggenkamp *Innovation in Energy Law and Technology* (Oxford University Press, Oxford, 2018) 2 at 5.
[140] Brownsword, Scotford and Yeung, above n 138, at 100.

actors, particularly when traditional actors are not able to adapt and respond coherently to the emerging conditions.

Disruptive technologies are often accompanied with uncertainty regarding their long-term impacts. Now the challenge for the regulator is to balance particular interest like protection of the public interest against potential risks and not to obstruct the development of new technologies. So, firstly, how do we deal with regulatory disconnection? What role does the law have in dealing with the potential risk or multiple consequences of such innovations? Or what role does the law have in stimulating and advancing technological change? In the next three sections, we will address those questions.

3.3.5.1 Regulatory gaps and regulatory disconnection

Disruptive technologies may exacerbate regulatory gaps, creating a regulatory lacuna which challenges the adaptation of the correct regulatory environment.[141] The gap between innovation and the applicable regulation may result in problems which may lead to regulatory failure. This gap is called 'regulatory disconnection' as opposed to regulatory connection which is expected from regulation.

Regulatory connection implies mechanisms that are in place for the adaptation of regulation as circumstances change because technology will always be changing and presenting new regulatory challenges.[142] In contrast, regulatory disconnection, also known in the United States as 'pacing problem', happens when innovation in the market develops faster than the respective regulation.[143] This discrepancy may widen the gap between the current regulatory environment which is based on the previous technology landscape and the developing innovations. This gap can manifest itself in regulatory obsolescence, gaps, ambiguity in the application of existing regulation, and inclusiveness or regulatory failure.[144] Regulatory failure includes regulatory outcomes such as 'futility' or irrelevance of the existing situation, 'jeopardy' where the

[141] At 127.
[142] Bennett, above n 136, at 7.
[143] Gary E. Marchant and others *The Growing Gap between Emerging Technologies and Legal-Ethical Oversight. The Pacing Problem* (Springer, The Netherlands, 2011)
[144] anna butenko "Sharing energy: dealing with regulatory disconnect in Dutch energy law " (2016) 7 SSRN 701 at 708.

regulations applied lead to a chain of undesirable side-effects, and 'perversity' where the regulatory intervention achieves outcomes opposite to those intended.[145]

In order to know whether there are regulatory gaps in dealing with law technology and society, Leenes[146] suggests a useful model composed of three stages: (1) Analysing the technology in terms of what are its relevant characteristics and which interests are being promoted by it. (2) Analysis of the issues that technology is addressing. The analysis can involve the consideration of potential risks or already manifesting problems and what the current law does to address these problems. (3) Identifying whether or not there is a regulatory gap in which we might consider intervening through regulation. Such identification leads to the question of who regulates, and why, when, what and who is regulated. This approach is very useful in identifying whether the currrent electricity framework in each jurisidction addreses emerging technologies or whether there is a regulatory gap. The application of this model to the topic will be made in Chapter 7 once the applicable regulation of relevant emerging technologies in the three chosen countries has been analysed.

So how to maintain the connection between technology and regulation? Ideally, the regulation needs to bind with the technology and evolve with it. The relevant literature has pointed out different regulatory approaches: (1) A traditional approach based on command-control regulation calling for entirely new regulatory regimes or amending existing law to respond to such risks. This approach implies that the role of the regulatory authority is vital together with a dynamic interpretation in the courts. Nevertheless, Brownsword [147] argues that this attempt may not always be realistic nor useful because its results can be expensive, uncertain, unpractical and may lack political support. (2) Changes are left to the free market or through softer ways of regulation such as self-regulation. Brownsword [148] considers this more flexible approach can be strengthened through a co-regulation strategy. (3) Another strategy is to create incentives for diverse stakeholders to work together on a new governance system or

[145] At 710.
[146] Ronald Leenes "Regulating New Technologies in Times of Change" in Leonie Reins (ed) *Regulating New Technologies in Uncertain Times* (Springer, The Hague, 2019) 3 at 6

[147] Roger Brownsword and Han Somsen "Law, Innovation and Technology: Before We Fast Forward—A Forum for Debate" (2009) 1 Law, Innovation and Technology 1 at 40.
[148] At 64.

adjusting the timing of regulatory efforts and the importance of the precautionary principle.[149] The latter is the case in risk-based regulation and experimental or temporary legislation which will be explored in the next section.[150] In my view, regardless of the chosen regulatory strategy, the need for flexibility, and at the same time predictability and consistency, is always on the table when dealing with new and evolving technologies.

For instance, Butenko,[151] when analysing the legal barriers for prosumers in the Dutch legislation, applied the theory of regulatory disconnection. She explores to what extent prosumers can share energy under the current Dutch legal framework. In doing so, she identifies the current Dutch policy that apparently promotes prosumption and also identified some legal obstacles, such as barriers in accessing local energy markets or access to the wholesale market and distortion in the net metering. For the author, these barriers reveal that in the Dutch situation there is regulatory disconnection. This thesis also attempts to identify whether there is regulatory disconnection between emerging technologies, enabling an active role for consumers, and the current legal framework. This analysis will be part of further study in chapters 4, 5 and 6 when discussing legal challenges. The different approaches to regulatory disconnection will be discussed in Chapter 7 when discussing the law in shaping the electricity system for a more active role of consumers.

3.3.5.2 Potential risk of technologies

Another legal challenge is promoting the benefits of emerging technologies whilst overseeing and addressing their potential risks.[152] Thus, regarding this first question, the role of regulation in relation to innovation is to ensure compliance with fundamental rights, maximise the positive effects and minimise the negative ones.[153]As stated previously, a significant aspect of the role of law in dealing with technological

[149] Mandel, above n 137, at 78.
[150] Butenko, above n 144, at 710.
[151] At 712.
[152] Mandel, above n 137, at 80.
[153] Anna Butenko and Pierre Larouche "Regulation for innovativeness or regulation of innovation?" (2015) 7 Law, Innovation and Technology 52 at 61.

innovation refers to minimising or addressing potential risks. It is important, therefore, to introduce the scope of risk-based regulation when dealing with innovation.

As we learnt from the previous section, traditional regulatory academic works focused on responding to market failures. However, more recent scholars, such as Julia Black, in contrast, theorize regulation to manage risk. This shift in focus and outcome has increased the popularity of the term 'regulatory governance' instead of 'regulation'. This new attitude promotes a more decentralised approach to regulation where the state and multiple actors undertake managing risk. The approach recognises the multiple interests, actors and values in the regulatory process beyond market failure, introducing the idea of 'risk governance'.[154]

From this perspective, when dealing with innovation, thought needs to be given to how to minimise the risk of harm and, at the same time, protect important values in an evolving socio-technical landscape. Further analysis goes on to consider how a particular technology should be regulated.[155] In the case of our study, technologies that enable a more active role for consumers can be considered as disruptive technologies because they challenge the paradigm and mainstream values of the energy system while presenting a new set of beneficial possibilities and dynamics together with some risks. As mentioned previously, some of the risks are congestion of the network, incorrect functioning of devices that may jeopardise the security of the system, and data management and privacy issues regarding the flow of information that is now possible to gather thanks to advanced metering infrastructure and smart meters. These risks should be addressed by different industry participants who can help to reduce the risks. In Chapter 6 we will discuss this issue.

With regard to risk-based regulation, Nesta, an innovation foundation based in the United Kingdom, has developed a new regulatory approach called 'anticipatory regulation'. Such an approach intends to deal with the challenges that come with emerging technologies, such as autonomous vehicles, drones or artificial intelligence,

[154] Brownsword, Scotford and Yeung, above n 138, at 132.
[155] Bennett, above n 136, at 12.

where there is still uncertainty as to what is the best way to regulate. Nesta,[156] in this new regulatory approach, anticipatory regulation, identifies six regulatory principles which attempt to enable innovation while protecting the public against harm and promoting better markets. Such principles are: inclusive and collaborative regulation, future facing, proactive, iterative, outcomes based and experimental. This last principle, I consider very important in dealing with innovation, which requires facilitating diverse responses by companies to test innovation and different regulatory intervention and build knowledge around possible impacts. This involves space for experimentation and the role of local experimentation which can inform a gradual process of national and international standardisation and regulation.

3.3.5.3 Regulation advancing technological change

Regarding the question of what the role of law is in stimulating technological change, law and regulation are often policy tools aimed at speeding the rate of technology innovation and increasing the speed of its uptake. Sovacool,[157] when considering the time that energy transition may take, starts a very interesting debate about governing transitions and the role of policy in speeding them up. He argues that although, usually, energy transition takes a long time to be completed, there are some cases where such transitions happened more quickly. Generally, transitions take a long time because of the need to pass through three phases: (i) experimentation and learning, (ii) scaling-up at the industrial level, and (iii) the diffusion of a successful design from the innovation core to rim and periphery markets. This happened in the transition from wood to coal, from coal to oil and is now happening from oil to low-carbon technologies.

Sovacool[158] provides some historical examples of faster transitions. The Netherlands made a rapid transition away from oil and coal to natural gas thanks to not only a significant discovery of a giant natural gas field in Groningen but also the active role the government took in promoting the transition through subsidies to new business. In Brazil, a transition from petroleum to ethanol for running cars took only six years thanks

[156] Harry Armstrong, Chris Gorst and Jen Rae "Renewing regulation: 'Anticipatory regulation' in age of disruption" (March 2019) Nesta <media.nesta.org.uk>at 19.
[157] Sovacool, above n 41, at 205.

[158] At 206.

to pro-alcohol programmes. Accordingly, Sovacool came to the conclusion that although previous historical transitions may have taken a great deal of time, we can learn from these transitions. As a consequence, the current or future energy transitions can be expedited because they can be planned and coordinated. The timeline for such changes can occur quickly or slowly depending on the need and can also be influenced by endogenous factors within a country. For instance, encouragement by political will and stakeholder involvement, or exogenous factors such as military conflict or a global crisis. In conclusion, transitions are subjective and do not automatically require a long process. Although Sovacool, in this article, argues that policy is a vital tool to boost transition, he overlooks the role of law and regulation as a concrete political instrument to create incentives or barriers for specific sectors and therefore stimulating transition.

Another approach is discussed in an article by Sovacool together with Geels[159] exploring international examples of transition to decarbonisation of the economy. In this article, the authors explored other examples where government policy and regulatory pressure have stimulated technological advancement and the phasing out of polluting technologies. For instance, in the United Kingdom the Clean Air Act 1956 allowed cities to create smokeless zones where coal use was banned completely. The Act started a transition to smokeless solid fuels and gas. Another example given is the 2009 European Commission Decision to phase out incandescent light bulbs, shifting to fluorescents and LEDs. Therefore, the authors demonstrate that, for instance, regulation aimed at phasing-out existing systems create spaces for innovation and removes barriers for their diffusion.[160]

From the material discussed, it is possible to conclude that there are different conventional regulatory and legal instruments that can be used to stimulate innovation and speed of uptake. Such instruments can be the banning of specific industries, financial incentives for the ones to be promoted, the possibility for experimentation and learning, opening opportunities for new entrants, setting binding targets, the removal of subsidies for traditional technologies and the imposition of taxes, among others. For example, Sovacool and Geels[161] suggest that innovation policies are more feasible

[159] FW Geels and BK Sovacool above n 84, at 1244.
[160] At 1240.
[161] At 1241.

politically and economically than economy-wide taxes. The former creates benefits while the latter imposes costs on industries. Innovation policies are research and development subsidies, feed-in tariff, demonstration projects and subsidies.

As a consequence, regulation, as a tool to address or affect a behaviour in a particular way, can be used in stimulating and speeding up the uptake of innovation and new technologies because it can influence actively those decisions by either establishing incentive mechanisms for the innovators or, instead, creating burdens for traditional players.

3.3.6 Smart regulation

The purpose of smart regulation is to manage the current call for sustainable development which is being challenged by climate change, and economic and social crisis, such as migration or population growth. The purpose of smart regulation refers to regulation which is end-user oriented, measurable and attempts to reduce administrative burdens for the industry and citizens.[162]Rønne,[163] when conceptualising smart regulation, identified two dimensions, a formal or process-oriented dimension and a substantive one. The process-oriented dimension pays more attention to the regulatory process, aiming to achieve better regulation and improve its quality. In contrast, the substantive dimension recognises new technologies, innovation, digitalisation and information technology and attempts to implement intelligent tools and technology to manage certain sectors such as energy, transportation or city planning.

In the energy sector, such a substantive approach means that new values and technologies are being implemented which are followed by the creation of systems that are able to accommodate more dispersed renewable energy production, end-user technology and more dynamic actors. Consequently, the energy system has to undertake major structural changes and implement more information technology into

[162] Anita Rønne "Smart Cities and Smart Regulation: Accelerating Innovative Renewable Technology in Energy System to Mitigate Climate Change" in Donald Zillman and others *Innovation in Energy Law and Technology* (Oxford University Press, Oxford, 2018) 56 at 60.

[163] At 62.

the grid to become smart. The final objective is a smart energy system that involves not only smart grids but also interoperability among the variety of actors and energy infrastructures like electricity, heating and gas.[164]

The concept of smart regulation, especially the substantive dimension, becomes important for this thesis because it attempts to recognise the benefits that new technologies bring to the electricity sector. Such technologies, especially smart energy systems, attempt to produce more interoperability and dynamism among actors. In this sense, this thesis also addresses relevant topics for smart regulation in the electricity sector.

3.4 Key points

This chapter has explored multiple sociological, political and regulatory concepts that are vital to provide a context and deeper understanding of the many reasons behind the existence of prosumers. This understanding helps us to locate the topic of active consumers within the big picture of social science and law. Also, it constitutes the theoretical framework that will be used throughout this thesis.

The prosumer's scholarship helps us to understand the opportunities for individuals and markets in terms of autonomy, knowledge and competition. However, prosumers as new actors can face opposition from traditional interest groups and the likely 'exploitation' by the 'prosumer capitalist'. Also, prosumers, thanks to new technologies and online platforms, become a part of the sharing economy. This interesting relationship legally implies uncertainty about which regulatory framework applies to consumers who are engaging as suppliers of services traditionally provided by industries. This is the case of online platforms that enable peer-to-peer transactions between energy prosumer and consumers.

Another interesting finding is how the use of the theoretical construction of socio-technical transition can be correctly applied to the topic of this research and the significance of its implications. Niche innovations (distributed and smart grid

[164] Rønne, above n 162, at 60.

technologies) are an alternative to the traditional electricity system and tailor-made regulation (socio-technical regime). Current concerns and values (tackling climate change, enhancing community involvement, energy democracy, energy justice, alternative tools for ensuring energy security and energy efficiency) are demanding new perspectives in the energy sector (socio-technical landscape). Therefore, an energy transition can happen oriented towards the integration of distributed or decentralised solutions in the traditionally centralised electricity system. Law and regulation play an important role in advancing technological change and making it happen.

These niche innovations therefore are considered disruptive technologies that challenge the paradigm and mainstream values of the traditional power system while presenting a new set of possibilities, dynamics and some potential risks that can be addressed through regulation. They also challenge the existing regulatory system, creating regulatory gaps and regulatory disconnection. As we found in Chapter 2, a more active role of the consumer, which is enabled by new technologies, faces a diversity of legal barriers such as: limited access to the network and the market, uncertainty about whether consumer rights apply to energy prosumers and particular challenges around communities engaging in energy projects. The next three chapters will look at closely such challenges.

Chapter 4: Access to the Network: The Regulation of the Distribution Activity

More active participation of consumers in the electricity sector means both an increasing connection of distributed generation devices (DG) to the distribution network and the need for deployment of smart grid technologies, such as smart meters, which enable the interaction between the consumer, the network and the market. These growing deployments challenge the capacity of the distribution network to manage increasing injections of energy, leading to significant concern over local congestion management,[1] increasing peak loads, reversed power flows and intermittency. As a consequence, the proper function and management of the distribution network is essential to ensure not only access to the network for such new participants, especially consumers wanting to inject their energy surplus into the network, but also to enhance the ability of the electricity system to deal with new concerns at the distribution level.

First, an understanding of the current role and functions of the distributor is essential because the distribution network is supposed to both transport electricity to retail customers and to be a neutral facilitator for retail consumers, ancillary services and balancing purposes. The question, in this regard, is how should distribution companies interact with distributed generation and deal with the increasing injections of energy?

Second, analysing the connection procedure of distributed generation to distribution lines is essential for the widespread development of the DG market in terms of the regulatory procedures. This involves answering two main questions, to what extent does the distributor hold discretion to decide whether to connect a DG device? And what are the terms and conditions of the connection procedures between DG and distributor?

Third, exploring the pricing scheme for distribution companies is vital since commercial considerations will underpin a distributor's decision to enable the connection of DG and the recruiting of multiple services that new technologies would

[1] Congestion management is the set of measures to solve a situation in which network capacity is insufficient.

offer to keep balance in the local network. In this regard, the financial or economic analysis of the methodologies used to calculate the cost of distribution activity is beyond the scope of this legal research. Instead, the legal issues to be examined are related to establishing who establishes the cost control for the use of the distribution network, what components are taken into account for such determinations and, most importantly, whether those components recognise or promote investment in new technologies and innovation for the more efficient management of the network and proper integration of the DG. Another legal issue is whether the DG should contribute to the overall cost of the network and to what extent. The different approaches to these three main issues (functions of the distributor, connection of DG and distribution pricing) illustrate the legal relationship between distribution line companies and DG. They will help to provide a conclusion in terms of whether there is regulatory disconnection within each jurisdiction.

This Chapter will contrast the main characteristics of the traditional transportation system and the emerging issues that are challenging the role of the network operators, especially distributors. It explores the three main issues regarding distribution regulation: the role of the distribution companies, the regulation of connection of DG and the remuneration from the distribution network. In doing so, the research contrasts what is expected from the distribution management in the face of the increasing participation of decentralised generation and the current regulatory treatment that New Zealand, Colombia and the Netherlands, in the context of the European Union, have given to these issues. Each section concludes with an identification of the regulatory challenges and concerns in dealing with and adapting the regulatory framework to emerging approaches of the role of the distribution system.

In order to clarify the terminology used in this section, any reference here to ‘network’ or ‘lines’ refer to the distribution network. References to other networks, such as the transmission grid which is the high-voltage long-distance grid, will be made clear at the time.

4.1 Traditional and Emerging Issues of the Transportation System: Transmission and Distribution

As was described broadly in Chapter 1, the transportation in the traditional-centralized power system is divided between transmission and distribution. The transmission grid typically carries large volumes of power over long distances. This grid has few connected customers, mainly large generator plants, though it has hundreds of points at which power is withdrawn, either by large consumers or at substations to supply distribution systems. In the case of distribution, after taking power from the transmission network, the electricity is delivered to a large number of consumption points.[2]

The main characteristics of this traditional-centralized system of transporting energy are:

1. Balancing the grid. There is a need to keep balance in the grid. Balance means that any feed into the grid needs to be matched by a similar output since electricity conventionally could not be stored.[3] Traditionally, the transmission system operator is responsible for balancing demand and supply.

2. Far-located generation. Historically, a generator was often located far from the loads or consumption points, creating the need for the transportation of electricity through the transmission and distribution network. [4]

3. Different treatment for transmission and distribution users. The users of the transmission and distribution networks are significantly different and have access to different features. Transmission customers are large producers and consumers. Their consumption is closely metered at each moment of the day, being able to respond to the conditions of the market. Users connected to the distribution network are small scale producers and consumers. [5]

[2] Darryl Biggar and Mohammad Reza Hesamzadeh *The Economics of Electricity Markets* (John Wiley & Sons Ltd, Sussex, 2014) at 85.
[3] Martha Roggenkamp and HK Kruimer *EU Climate Regulation and Energy Network Management* in E Woerdman, MM Roggenkamp and M Holwerda (eds) *Essential EU Climate Law* (Edward Elgar, Cheltenham, 2015) 235 at 249.
[4] Biggar and Hesamzadeh, above n 2, at 89.
[5] At 90.

4. Monopolistic activities. Both transmission and distribution networks are natural monopolies because the competition is neither sustainable nor desirable. [6]

4.1.1 Emerging issues for the transportation system

There are some emerging features applicable to the transportation system, especially for the distribution network that challenges the above traditional characteristics while creating new paradigms. Given the increasing introduction of dispersed or decentralised renewable resources, such as wind or solar, the design of the network is changing. While generation was traditionally fed into the transmission grid, distributed generation implies an increasing feed into the distribution network. This new reality creates challenges for the network operators such as access, balancing and pricing.[7] Some of the emerging concepts challenging the traditional management of the distribution network are: power system flexibility and role of the distribution network.

Power system flexibility

According to the IEA,[8] the increasing participation of large, medium and small scale renewable energy generation, characterised by being dispersed and variable, draws attention to the need for flexibility in the power system. Flexibility is the ability to reliably and cost-effectively manage the variability and uncertainty of supply and demand across all relevant timescales. In the short term, these flexibility needs are driven by technical power system characteristics which are essential for system stability. Longer-term flexibility needs are related to the availability of appropriate capacity and resources. The flexibility of resources of power comes not only from technically available options, such as the infrastructure needed, but also the technical rules and economic incentives. Those incentives include the regulatory, policy and market framework and the roles and responsibilities of the various entities providing flexibility; in other words, who is in charge of providing it.

[6] At 95.
[7] Roggenkamp and Kruimer, above n 3, at 246.
[8] IEA Tracking Clean Energy Progress: Energy Technology Perspectives 2017 (International Energy Agency, Paris, 2017) at 30.

The role of the networks, then, is to be able to connect variable renewable projects of different scales, allowing for greater flexibility and diversification to become a reality. This greater flexibility allows balance in the system by using alternative solutions such as demand response programmes and energy storage by the network operator. For instance, network operators may use additional instruments to manage short-term problems in the network, optimise the cost of maintaining the desired quality of the service, reduce network losses and reduce or postpone future investment.[9] Questions need to be asked about how to encourage network operators to connect more diverse renewable energy projects and use alternative mechanisms as a way of not only balancing the system but also delaying the need for expansion of the network.

Role of the distribution network

Nowadays, due to the increasing use of distributed generation, imbalances between the energy produced and consumed are not only happening in the transmission grid but also in the distribution network, where an increasing injection of energy is occurring. Therefore, it is essential to implement smart grids which will help the system operator keep the system in balance by applying local congestion management to the distribution system and engaging distributor operators to help balance the network. In doing this, the network operator will seek compensation from both central generation and new distribution and retail services. In this model, customers will be able to select the technologies of their choice, connect them to the network and transact with other distributed and centralised resources.[10]

Parag and Sovacool[11] foresee the network as a platform for providing different services to the system, supplying power and providing balance in a way that allows new market models, such as a peer-to-peer-model (where prosumers compete with utility companies over clients), prosumer to grid (prosumers providing services to the grid; for instance, agents may sell the production or non-consumption in large amounts to small

[9] Ignacio Perez-Arriaga *From Distribution Networks to Smart Distribution Systems: Rethinking the Regulation of European Electricity DSOs* (European University Institute, Florence, 2013) at 18.
[10] World Economic Forum *The Future of Electricity New Technologies Transforming the Grid Edge* (World Economic Forum, Geneve, 2017) at 16.
[11] Yael Parag and Benjamin K Sovacool "Electricity market design for the prosumer era" (2016) 1 Nature Energy 1 at 4.

consumers to avoid peak loads) or organised prosumer groups (community organisation which serves the interest and energy needs of the community itself in an isolated or connected manner). For instance, traditionally, large consumers have been used to support the national grid, helping to ensure balance in the transmission system operation.[12] In the future, there are new opportunities not only for these large consumers but also for small ones to help in solving more local problems and interacting more with the distributor operator. In this new context, the implementation of smart meters and smart grid technology is necessary, allowing a two-way flow of communication and electricity between the participants within the electricity system. Such communication is an interactive and coordinated way, matching the energy needs and the capabilities of the electricity system in the most efficient way.

4.1.2 Emerging functions of the distribution operator

The traditional tasks of the distribution operator (DO) are the operation and maintenance of the distribution lines, network investment and supply connection services to industry participants, taking into account congestion and voltage control. However, in the emerging power system, the DO should be a neutral market facilitator, not only for retail markets but also for balancing purposes and ancillary services.[13] Currently, and more so in the future, there will be more competition, and as long as the number of agents and the complexity of the services increase, the question that arises is what tasks should the DO perform and what other tasks should be performed by other market players?

Around the world, there are currently discussions about the new role of the DO in dealing with more dispersed generation plants and increasing generation of variable renewable energy, which is the case for generation by prosumers. Perez Arriaga[14] argues that the emerging functions of DO are local balancing, integration of local generation, planning, data handling and management of the network as a platform.

[12] Dirk Kuiken and others "Energy flexibility from large prosumers to support distribution system Operation—A technical and legal case study on the Amsterdam ArenA Stadium" (2018) 11 Energies 122 at 130.
[13] Perez-Arriaga, above n 9, at 16.
[14] At 28.

Local balancing: Traditionally, the transmission operator performs the task of balancing the system and long-term planning. Due to the increasing potential of DG, energy storage and demand response from users connected to the distribution network, the role of the distributor now involves being able to manage specific loads and helping balance the system locally. Such balancing should be coordinated with the transmission operator. This coordination includes exchanging information and transparent protocols.[15]

Integration: The integration of local generation, energy storage, energy efficiency and new uses of electricity within the distribution network is known in the literature as an 'integrated grid'.[16] This integrated grid enables the enhancement of reliability and affordability of the services provided by reducing the risk of instability when combining central and local generation and distributed storage, contracting more ancillary services (frequency response, non-spinning reserve and participation in demand response) provided by local resources to the network.[17]

Planning: Based on the recommendations of the IEA[18] relating to power system transformation, systems must include the adaptation of the system to new ways of generating and delivering electricity. Those considerations should be included in the transmission and distribution planning. Such adaptation means rethinking the role of distribution network operators and keeping pace with technology evolution.[19] Generally, there is a joint responsibility between transmission and distribution operators to ensure the long-term ability of the system to meet reasonable demands for the transportation of electricity, for operating, maintaining and developing their systems. The tasks of the different networks for long-term planning is relevant, and such tasks should be clearly defined to enable an efficient system operation and cooperation.[20]

[15] At 30.
[16] Clark W Gellings "Value of an Integrated Grid" in Fereidoon P. Sioshansi *Future of Utilities, Utilities of the Future* (Academic Press, San Francisco, 2016) at 25.
[17] At 24.
[18] IEA, above n 8, at 22.
[19] World Economic Forum, above n 10, at 32.
[20] Perez-Arriaga, above n 9, at 34.

Data handling: All the new business, technology and digitalisation rely on consumer data, which is the reason why access to data should be regulated. For instance, to what extent should consumer data be made available to agents after individuals have permitted the use of their data?[21] In the same sense, this higher degree of digitalisation and interconnection creates significant concerns regarding cybersecurity. Whether it is the distribution operator or whoever else is in charge of data handling it is beyond the scope of this research. Nonetheless, it is important to note the concern.

Management of the network as a platform: Owens[22] supports enabling networks as not only asset owners and operating and maintaining the distribution network but also as providers of market platforms that sends signals to incentivise the efficient integration of distributed resources. The distribution market model brings more competition and little centralised control.[23] For instance, in New York, the Public Service Commission adopted the model of a distribution system platform in which the distributed energy resources (DER) providers are viewed as customers and partners rather than competitors to the traditional network service. This platform will have the responsibility of offering services such as information, interconnection or dispatch services at a set-price under the terms allowed by the Commission. The platform will pay the DER providers for its services.[24] On this point, regulation is needed to enable system operators to shift from network operators to platform providers and incorporate this new function in the overall system design.

Another connected topic is the *disaggregation of functions* of the DO. Traditional DO tasks include planning, operating and maintaining the distribution network, which, are considered natural monopolies due to their cost structure. However, these tasks can be disaggregated into a set of services. The telecommunication system had a similar experience where the traditional business approach to the network came from managing assets while, nowadays, they manage a portfolio of services. The services that can be provided by distribution include energy transport, access services, market facilitation

[21] At 31.
[22] Richard Owens "How the AEMC is responding to a consumer driven transformation of the electricity market" (October 2016) < www.aemc.gov.au>.
[23] At 1.
[24] Gellings, above n 16, at 30.

services and system operator services.[25] The question is which services should the distributor operator provide and which can be provided by third parties? One regulatory approach that may answer this question is determining when competitive market actors, especially in liberalised economies, best perform new tasks. The DO role remains to facilitate local markets and to enable a smart integration of competitive services that make use of the distribution network in their business process.

On this point, the regulatory challenge is to clearly define roles, boundaries and responsibilities, especially when procuring for system services. These rules, for instance, can state that the DO only buys flexibility offered from DER or aggregators for the sake of system management and does not act as a commercial player.[26] These regulations could be either conventional regulations coming from the regulatory authority or they can be negotiated solutions coming from the actors involved. This latter approach is known in the scholarship as 'negotiated stakeholder involvement',[27] which means the contractual arrangements that empower stakeholders to defend and pursue their interests following a market-driven perspective. In my view, regardless of which approach is chosen, stakeholders must be part of the decision-making through one of two options: involvement in the design of regulation or through negotiated settlements with regulation as a default option. The importance of such involvement is that it can help to form the regulation taking into account the benefits and concerns for different stakeholders. Participation in the regulatory process could be through means such as providing information, by presenting enquiries or by commenting on draft of regulations.

Managing the roll-out of smart meters: The ownership and management of metering equipment is an essential issue for customers, suppliers and the network operation. For customers this is in terms of cost-saving and easy supplier switching; for the supplier it means remote and accurate consumption reading, and for network operators it implies reducing technical and non-technical losses and the costs for metering reading. As such, ownership and management are essential in determining responsibilities for the roll-out

[25] Perez-Arriaga, above n 9, at 28.
[26] At 45.
[27] Nele Friedrichsen, Christine Brandstätt and Gert Brunekreeft "The need for more flexibility in the regulation of smart grids – stakeholder involvement" (2013) International Economic Policy 261 at 266.

of advanced meters. Traditionally, the network operator owns and manages meters, which are bundled as a component of network management and distribution services. The benefit of metering activities being treated as a regulated monopoly is the economies of scale, which result in lower costs when just a single operator is allowed to do both. Nevertheless, because of the uncertainty about the best technological solutions, competition may be a better mechanism for allocating resources.[28]

Perez-Arriaga considers that the ownership of meters by the retailer may create barriers to competition by raising market entries and switching costs. **[29]** In this case, there is a need for specific clauses allowing retailers to hedge against the risk that consumers decide to change suppliers soon after the equipment is installed. Nevertheless, the author fails to mention that there are successful examples of smart meter roll-outs by retail companies, such as New Zealand which is explored in the next section. Concerning consumer ownership, a mandatory roll-out may not be cost-effective when the costs exceed the potential benefit for some customers, which means there is no incentive to meet such costs. This becomes an obstacle for the roll-out. [30]

For him,[31] the rolling-out of smart meters is more likely to be successful when the DO is in charge of it. Nevertheless, when the distributor operator is the owner of the meter, this does not automatically result in economies of scale as many small DOs are not large enough to achieve the rolling-out of smart meters. If this is the case, it may be better if commercial agents undertake the reading. When market players can better perform the traditional tasks of the DO, it may be better to allow them to do so. Nevertheless, if market actors develop slowly relative to policy goals, smart-meter roll-out (at least during the initial phase) should be promoted via DO or other regulated entities. The next section discussing the regulation applicable to DOs in each jurisdiction will include who is responsible for the roll-out of smart meters in each chosen jurisdiction to understand what is expected from each approach.

[28] Perez-Arriaga, above n 9, at 40.
[29] At 29.
[30] At 28.
[31] At 31.

The above list of functions called 'emerging functions of the DO' will be compared in the next section to help identify whether or not the current functions undertaken by the DO in the three chosen jurisdictions take into account those emerging functions.

4.2 Current Functions of the Distributor in Colombia, the Netherlands and New Zealand

The distribution operator when facing an increasing participation of decentralised resources and generation of energy by prosumer will have to evaluate the emerging roles described above. In this section, the research will explore the current functions performing by the distributor in Colombia, New Zealand and the Netherlands in the context of the European Union. In doing so, this section will explore whether these functions incorporate the emerging functions that the DO should begin addressing in dealing with more prosumers and decentralised energy and services.

4.2.1 Colombia

The distributor operator (DO) is in charge of operation, investments, maintenance and planning of the distribution system. In respect of planning, the regulation establishes that the DO should consider several principles such as adaptability (incorporating technology which makes for a more efficient, better quality and less costly service), economic efficiency (minimising cost) and coordination with the transmission system.[32] Such principles should be incorporated into the planning and execution of the Expansion Network Plan,[33] which should also be consistent with the Expansion of Generation and Transmission Plan elaborated on a national level by the UPME (Energy Planning National Authority). The DO is also in charge of assuring the quality of the service and its efficiency.[34]Besides, the DO shall ensure the connection of all industry participants (generator, consumer and other conveyance companies and distributed generators) which shall follow the technical, regulatory requirements, pay the respective contribution and keep up with the principle of efficiency.[35]

[32] Resolution CREG 70 of 1998 (Colombia),art 1(2.1)
[33] Resolution CREG 70 of 1998 (Colombia), art 1 (3.2.2)
[34] Resolution 084 of 2002 (Colombia), which establishes the quality parameters for the service.

[35] Law 143 of 1994 (Colombia), art 30.

A recent resolution, Resolution 131 of 2020, which is currently in the consultation process, it establish that the distribution companies are in charge of the implementation of AMI in terms of installation, administration, operation, maintenance and repositioning.[36] This resolution also establish requirements around cybersecurity, and use and protection of data while defining the procedures for third party access to the data, following legislation and standards on data protection in which the distributor is also involved.[37] The current rolling out of AMI target is 75% of grid-connected users by 2030.[38]

Hence, in Colombia, the regulation of the DO does not yet recognise the emerging functions of the distribution operator in terms of helping balance the local system or serving as a market facilitator. Instead, the DO maintains the leading role of conveying energy with a level of quality. However, there is a recent resolution that recognizes the leading role of DO in dealing with the rolling out of smart meters and data handling. The role of planning the distribution system based on the principles of adaptability and coordination with the transmission operator is a good start in initiating a conversation between both system operators on the best way to deal with the new challenges in distribution. Thus, concerning the role of distribution operator there is a certain degree of regulatory disconnection between the regulatory framework and the emerging realities that deserve to be addressed.

4.2.2 The Netherlands and the European Union

In European Union legislation the DO is called the Distribution System Operator (DSO) who is the natural or legal person responsible for operating, ensuring the maintenance of and, developing the distribution system in a given area and, where applicable, the interconnections with other systems. According to Directive 2009/72/EC, the primary purpose of the DSO is ensuring the long-term ability of the system to meet reasonable

[36] Resolution CREG 131 of 2020 (Colombia), art 11.
[37] Resolution CREG 131 of 2020 (Colombia), art 13.
[38] Resolution MME 40483 of 2019 (Colombia), art 4.

demands for the distribution of electricity.[39] The Directive 2019/944 on common rules for the internal market has recently updated these functions.

In this sense, the Directive 2019/944 reaffirms that the DSO is responsible for ensuring the long-term ability of the system to meet the demand for operating, maintaining and developing a secure, reliable and efficient distribution system. Those function by providing non-discriminatory access to the network and information to the possible entrants about access and use of the system.[40] In this regard, the Directive 2019/944 adds that they should ensure due regard is given to the environment and energy efficiency.[41] The DSO may also be required to give priority access for installation using renewable resources or cogeneration if the Member State requires it. This point deserves more attention and will be returned to later.

Moreover, the Directive 2019/944 emphasises that the DSO is required to act as a market facilitator, providing the products and services considered necessary for the efficient, reliable and secure operation of the distribution system. This provision ensures the participation off all qualified market participants, including renewable resources, demand response, energy storage, aggregators and the establishment of technical requirements for their participation according to their technical and market characteristics.[42] In this way, for the first time, a European Directive recognises the role of DSO as a market facilitator which highlights the non-discriminatory treatment that DSO should provide, not only to the actors that interact through it but also to the services that those actors provide. Therefore, the Directive recognises the new businesses and emerging actors in the market and the active role of DSO as a facilitator for correct market integration.

Likewise, the Directive suggests that DSO may cooperate with the transmission system, delivering balancing services as a consequence of agreements between the two parties.[43] Such provision contrasts with the Directive 2009/72 in which balancing was

[39] Directive 2009/72/EC (EU), art 2 (6).
[40] Directive 2009/72/EC (EU), art 25.

[41] Directive 2019/944/EP (EU), art 31.
[42] Directive 2019/944/EP (EU), art 31 (8).
[43] Directive 2019/944/EP (EU), art 31(8).

not considered a duty of the DSO but only for the transmission operator.[44] In this way, based on a contractual agreement between the DSO and the Transmission System Operator (TSO), the Directive recognises another emerging function of the DSO when dealing with an increased injection of energy by distributed generators. These increasing injections can cause imbalances in the local network, and therefore the need for a more active role for the DSO in dealing with these more frequent local imbalances.

In addition, an important new possibility was established in the Directive 2019/944. Member States shall provide the regulatory framework to allow the provision of incentives the DSO to procure flexible services in order to improve efficiency in the operation of the system.[45] Such a regulatory framework should ensure that the DSO is able to procure those services from distributed generation, demand response, energy storage and energy efficiency measures. If these services are cost-effective they will alleviate the need to upgrade the system capacity. DSO shall procure such services in a non-discriminatory and transparent manner and through market-based procedures unless the regulatory authority determines that the procurement of such services is not economically efficient or will lead to severe market distortions. Finally, the DSO shall be adequately remunerated for the procurement of such services. All of this will be put in place in the network development plan that the DSO has to publish at least every two years and submit to the regulatory authority. This development plan should provide medium and long-term flexibility services needed and requires consultation with all the relevant system users for the development of that plan. In my view, this new provision is significant because it openly highlights not only the important role of decentralised resources to manage the network efficiently but also the active role of DSO in contracting those alternative services, instead of relying on a more conventional and expensive solution such as the expansion of the network infrastructure.

As shown, the Directive 2019/944 is a vigorous example of how regulation can be connected to emerging system needs such as balancing, coordination, flexibility and becoming a market facilitator. Those new functions recognise the advantages that demand response, energy storage and a more distributed generation can create in the

[44] Directive 2009/72/EC (EU), art 25.
[45] Directive 2019/944/EP (EU), art 32.

system. We will need more time to see how this Directive is incorporated in the domestic law of the Member States. However, we can argue that this more comprehensive regulation, which recognises the new realities for the network, is an example of how legally it is possible to incorporate such needs.

In the case of the Netherlands, the DSO functions still replicate those from the Directive 2009/72 regarding only traditional roles such as the operation of the system, construction and maintenance of the network, providing information to system users and ensuring safety.[46] However, the legislation stresses the importance of the network being managed in the most efficient manner, relying mostly on economic efficiency.[47] Also, the legislation recommends that DSO should take into account measures, such as decentralised production, energy saving or demand response, to prevent the need for replacing or expanding production capacity.[48] This power to include such measures depends on the regulation of the DSOs' remuneration schemes (tariffs), the determination of which elements can be included in the efficiency assessment and what timeframes should be used for such assessments. The DSO is also in charge of the rolling-out of smart meters.[49]

Lavrijssen[50] points out that there is an ongoing debate about the extent of the functions undertaken by the DSO. She points out that the DSO is currently too constrained to innovate. In this sense, they suggest that the DSO should be allowed to have a more active role in stimulating the transition towards more sustainable and cleaner resources and promote competition, while other scholars hold that the system operators shall only fulfil their core functions and not engage themselves in the development of innovative technologies so they do not distort competition of those alternative technologies. [51]

We need time to assess how the Directive 2019/944 will be reflected in the domestic law of the Netherlands. Such implementation will clarify, for instance, the possibility

[46] Saskia Lavrijssen "The right to participation for consumers in the energy transition" (2016) 25 European Energy and Environmental Law Review 152 at 159.
[47] Electricity Act 1998 (The Netherlands), art 16(1).
[48] Electricity Act 1998 (The Netherlands), art 16(1).
[49] Dirk Kuiken and Heyd F Mas "Integrating demand side management into EU electricity distribution system operation: A Dutch example" (2019) 129 Energy Policy 153 at 155.
[50] Lavrijssen, above n 46, at 162.
[51] At 161.

of new roles for the DSO such as balancing the local system and providing flexibility. In both functions, the role of new technologies and a more active role for consumers, in offering capacity through demand response or reacting to peak times, will be essential. Consumers, when offering services to the DSO, will help them with congestion management and avoiding costs for upgrading through the provision of flexibility.

4.2.3 New Zealand

The regulation included in the Electricity Industry Act (EIA) and the Electricity Industry Participation Code (EIPC) sets the duties or functions of the distributor. The distributor operator (DO) holds the duty of continuing the supply line service.[52] Likewise, the DO is in charge of creating the ICP (installation control point) identifiers for which the distributor is responsible. The ICP identifies the connection point at which the user network is connected to the distribution network.[53]

For the proper development of its functions, the DO has to have comprehensive, written use-of-systems agreements. Such agreement is a contract between a distributor and a trader that allows the trader to trade on the distributor's local network.[54] These agreements cannot discriminate in favour of other businesses or discriminate between customers of the retailers and other retailer customers.[55] In this sense, the DO must consult on changes to tariff structures with each retailer trading in the distribution network.[56]

The Electricity Authority is working on regulating the written-use-of-system agreements to bring greater standardisation and more effective retail competition. However, its work was opposed by legal action questioning its ability to regulate such agreement. Vector, a distribution company, has held in Court some clauses that the Electricity Authority (EA) proposed to introduce in amending the EIPC. The High Court had an interesting legal question: May the Electricity Authority prescribe

[52] Electricity Industry Act 2010, s 105.
[53] EIPC, s 11.4.
[54] Electricity Industry Act 2010, s 77.
[55] Electricity Industry Act 2010, s 79.
[56] EIPC, s 12A (7).

standard terms for contracts between distributors and retailers of electricity? In particular, may it prohibit individually-negotiated terms in distribution agreements? Even though the High Court[57] has recognised that the Electricity Authority has the jurisdiction to prescribe standard terms for contracts, the limits for such authority is debatable, particularly regarding prohibiting individually-negotiated terms in distribution agreements. In the Court of Appeal, the Court considered that the EA was not permitted by the legislation to constraint freedom to contract. There was such a conclusion because one of the intended provisions was to restrict the content and subject matter of the use of system agreements to those established by the EA, and therefore the parties could not agree on another matter or in different terms.[58] Also, the Court of Appeal concluded that the Electricity Authority may not regulate quality standards in the standard terms of the use of system agreements as that is a matter to be established by the Commerce Commission.[59] However, the Court of Appeal recognised that the EA could mandate some quality standards as far as the Commerce Commission was not empowered to do so.[60] Besides, the Advisory Panel of the Electricity Price Review prized the work undertaken by the Electricity Authority on default distribution agreements to remove barriers and reduce costs for retailers.[61] The Government also strongly supports such standardisation.[62] It is worth mentioning that the Price Review Panel is an independent review into New Zealand's electricity market, which was commissioned by the Minister of Energy and Resources in April 2018 and delivered by the Panel in May 2019.[63]

Regarding the role of the DO in the roll-out of smart meters in New Zealand, the DO has not been involved. Instead, the retailer undertook the roll-out of smart meters, not because of legal duty but because conditions in the market have encouraged retailers to do so. Smart meters enable remote access and accurate reading over consumption and, as a consequence, smart meters are an essential asset for retailers to deploy. The roll-out of smart meters is currently at no extra, up-front cost to consumers unless additional

[57] *Vector Ltd v Electricity Authority* [2017] NZHC 1774.
[58] *Vector Ltd v Electricity Authority* [2018] NZCA 543 [53] [57].
[59] *Vector Ltd v Electricity Authority* [2019] NZCA 49 [27]
[60] *Vector Ltd v Electricity Authority* [2019] NZCA 49 [16] [26].
[61] New Zealand Government "Electricity Price Review" (May 2019) <www.mbie.govt.nz> at 35
[62] Minister of Energy and Resources "Electricity Price Review: Government Response to Final Report" (3 October 2019) < www.mbie.govt.nz> [83-84].
[63] Electricity Authority "The Electricity Price Review (EPR)" (October 2019) <www.ea.govt.nz>

work is required. The cost of the device is incorporated into the metering component of the electricity bill.[64] Nevertheless, in the latest Electricity Price Review,[65] it was recommended that the Electricity Authority requires retailers and metering companies to give distributors metering data on reasonable terms. Such a recommendation was made because that data can help the distributor to expand its network more efficiently to find and fix faults and outages more quickly and plan maintenance easier. In general, access to the metering data will help them to improve service quality and lower service costs. The recommendation not only relies on parties agreeing on terms but a more active role for regulators (such as the Electricity Authority and Commerce Commission) to help those agreements come through or setting default agreements. This recommendation from the Price Review Panel is appropriate because the data from smart meters is a valuable asset that should be accessible to different industry agents. Such access matters not only for competition but because the data can service building and managing the whole system more efficiently and based on the particularities of the demand side. Regarding this particular recommendation about the access to metering data by distribution companies, the Government responded that the Electricity Authority is currently consulting on a protocol for information exchange as part of the regulated default agreement between retailers and distributors. The Minister promised to urge the EA to expedite this work.[66]

The above functions suggest that the role of the DO is still traditional, and there is no mention of helping balance the system or providing flexibility services. It is worth keeping in mind that both functions are essential when we intend the DO use more decentralised services, such as demand response, distributed generation or energy storage, to manage the network. Nevertheless, the Electricity Authority is working on a project to discuss these new roles.

The Electricity Authority is exploring different regulatory scenarios based on the report 'Equal Access Project'[67] and the creation of the Innovation and Participation Advisory Group (IPAG).The current project undertaken by the IPAG, delegated by the Electricity

[64] Electricity Authority "Smart meters – information for households" (2013) <www.switchutilities.co.nz>.
[65] New Zealand Government, above n 61, at 52.
[66] Minister of Energy and Resources, above n 62 [113].
[67] IPAG Secretariat "Advice on creating equal access to electricity networks (draft for discussion)" (December 2018) <www.ea.govt.nz>

Authority, attempts to address issues around whether parties wanting to use electricity networks are treated equally and can compete on a level playing field in the market. The IPAG advises on matters relating to evolving technology and business models and competition and consumer choice. This special advisory group was formed after the publication of a Consultation Paper that received several responses expressing concern around access to the network.[68] In general, there was a lack of confidence in the ability of the existing arrangements to promote competition. This lack included the ability of the current arrangements to promote integration and allow access to new technologies which require access to the distribution network, such as batteries. Other concerns included the distributor inefficiently investing in new technology such as batteries and acting as a monopoly; lack of confidence in market participants' ability to access opportunities for supporting the delivery of the network services on fair and equal terms. Another concern was the distrust around sharing consumer data with the distributor because there is a fear that they could use it to provide themselves with an advantage in contestable markets, where distributors require unreasonable technical standards for equipment to constrain competition and the distributor setting pricing arrangements to favour the uptake of particular technologies in which they have a commercial interest.[69] It is evident from these concerns that there is a lack of confidence in the distribution operator's performance.

The report also recognises that although investment in distributed energy resources is happening, the full value of the investment is not being realised yet. If the DO is not taking full advantage of DG as a solution for network issues, it is important to encourage the creation of a market for distributed energy resources services with some technical participation rules. The IPAG also concludes that buyers and sellers of distributed energy resources need contractual arrangements and, in some cases, long term contracts.[70]To achieve this, the IPAG recommends a first stage where the distributor will be in charge of developing processes to address such issues. The distributor had until the end of 2020 to accommodate the impact of distributed energy resources and, depending on their response, other regulations and incentives will be

[68] Electricity Authority *Enabling mass participation: How can we promote innovation and participation? Consultation paper (*Electricity Authority, Wellington, 2017*)* at 8.
[69] Electricity Authority *Enabling mass participation. Response and next steps Decision* (Electricity Authority, Wellington, 2017) at 7.
[70] IPAG, above n 67, at 4.

enacted later.[71] There is a set of objectives to free up investment in distributed energy resources where, in the first instance, the distributor will self-regulate and manage their own approach towards these objectives. During this stage, the Electricity Authority and Commerce Commission monitor their progress and accountability. Although the insights and work of the IPAG are valuable because it recognises current industry concerns and alternative solutions to those problems, the IPAG is an Advisory Group, and its role remains in making recommendations to the Electricity Authority who make the final decision whether to make the changes. Whether the changes are a priority for the regulatory agenda of the Electricity Authority depends mainly on the views of the industry, and the traditional and consolidated big players are pushing for other topics to be regulated first. Since emerging and small players have less ability to bargain in respect of their regulatory interests with the Electricity Authority, those changes may take some time to happen.

4.2.4 The role of the distribution network and regulatory disconnection

As explained previously, grid balance is a function that, traditionally, the transmission operator has to deal with. However, with the rise of distributed generation connected to the distribution network, it is now more likely for an imbalance to happen among off-takes and intakes in the distribution network. As can be seen from the above analysis of DO functions, there is no express mention of the function of balancing the system either in Colombia, the Netherlands or New Zealand. However, the Directive 2019/944 in the European Union establishes an example by establishing the balancing function with the distributor, in case the transmission and distributor operators decide it is more effective and efficient to do so.

The role of the distributor as the market facilitator for decentralised service providers is still not widely recognised as a function of the distributor in Colombia and New Zealand. Let us remember that decentralised services are energy storage, distributed generation and demand response, and the role of such services (which can also be delivered by a prosumer) is to provide flexibility to the network and alternatives to increasing infrastructure or delay expansion of the network.

[71] At 5.

In New Zealand the current regulation is being revised by the Electricity Authority and the DO is the first respondent to address such services itself firstly and, depending on the results of this exercise, a different regulatory response by the Electricity Authority will be introduced. In the Netherlands, there is a regulatory provision that implies that the distributor should take into account such measures to manage the network. However, the DO mainly relies on the financial incentives that may be present for the remuneration of the activities of the DO. The best regulatory approach found is seen in the Directive 2019/944 of the European Union in which the distributor operators are encouraged as a market facilitator.

Perez-Arriaga considers that when the DO is in charge of the roll-out of smart meters that will improve the chances of the roll-out being successful. [72] However, this thesis can affirm that such success depends on the market circumstances of each country. For instance, in New Zealand the retailer has been in charge of the roll-out of smart meters, not because of legal duty but because conditions in the market have encouraged them to do so, with 83% of all New Zealand residential connections now having a smart meter.[73] In the Netherlands, on the other hand, the DO has a legal duty and is in charge of rolling out smart meters, and such a task has exceeded the expectations of having a roll-out target higher than the 80% expected by 2020.In Colombia, there is a recent resolution in consultation process that establish DO is in charge of rolling-out of smart meters and advanced metering infrastructure. The current target for the roll-out of AMI in Colombia is 75% of grid-connected users by 2030, which is currently being undertaken by some retailers in different cities of the country.

Given the information discussed above, in my view, there is a degree of regulatory disconnection between the current role of the distributor and what is expected from them in dealing with the increasing participation of dispersed renewable energy and the recognition of new services that can be provided through demand response, distributed generation and energy storage by prosumers and by other decentralised market agents. The Directive 2019/944 does provide an example of how to address such regulatory

[72] Perez- Arriaga, above n 9, at 43.
[73] Electricity Authority "What are Smart Meters" (2018) <www.ea.govt.nz>

disconnection and recognises new regulatory realities. In Chapter 7 we will discuss further implication of such regulatory disconnection and ways to overcome it.

4.3 Connection of distributed generation

The connection of distributed generation (DG) to the distribution line is essential for the widespread development of the distributed generation market and prosumers. These rules are relevant not only regarding the technical procedure for the connection but also because DO has to decide whether to connect a distributed generation device. Such faculty make us wonder to what extent the regulatory authority in each jurisdiction regulates such discretion to connect a DG. It is vital, therefore, to study the current terms and conditions applied to such connections and the challenges that may result in each chosen country.

4.3.1 Colombia

The regulation for connection of DG in Colombia has different procedures and requirements depending on the capacity of the DG device, whether it is large (more than 100 kW) or small (less than 100 kW).[74] A critical characteristic of the Colombian regulation is that it sets connection limits regarding network availability. In this sense, the regulation by the CREG establishes two connection and injection limits:[75] (i) that only 20% of the capacity of the local network can come from distributed generation, (ii) the amount of energy that can be injected per hour cannot be greater than 50% of the daily demand for energy. Both limits are known as 'technical standards' that are checked before proceeding with the connection request. The purpose of this provision is to balance two interests: on the one hand, the correct integration of energy from DG and on the other, the safety and correct management of the network. In addressing both concerns and needs, the regulation promotes a gradual connection and injection of power by the DG which attempts to give time and expertise to the DO in managing such injections and planning for likely increases in connection in the near future. In this sense, it avoids sudden increases in the connection and injection that may affect the

[74] Decree 348 of 2017 (Colombia), art 5.
[75] Resolution CREG 001 of 2018 (Colombia), art 6.

function and correct management of the network.[76] These regulatory limits can be changed later by the CREG if the conditions in the network and market justify more participation by the DG.

Having checked the network availability (technical standards), the requester continues with the connection procedure. Firstly, the regulation states that the requester for connection should be able to easily find and understand updated information on the website of the DO, e.g. information relating to the voltages, network availability and technical conditions are required for the connection of DG;[77] however, this provision has not yet been effective. It is difficult to get clear information online, and the website of the different distribution companies are out of date and do not provide accessible and up to date information about the connection procedure.

The procedure will be different depending on the size of the DG. For a DG with a capacity less than 100 kW, the procedure is simplified; in contrast, for larger devices, the procedure will be very similar to the connection of generators to the transmission grid. DG devices below 100 kW are generators that can power AC units, especially air conditioning systems for restaurants or offices. These generators usually run on diesel engines, but it is becoming more common for companies to install a significant number of solar panels to generate this amount of electricity.[78] The simplified procedure applicable for devices no greater than 100 kW begins with completing an online form which, in my research exploring a variety of DO websites, has shown it is still challenging to find it. So we can state that the information is not readily available online yet.

Once the connection form is completed, the DO has to specify in detail the conditions and date of the connection. If the application is refused, the DO has to explain the technical reasons for that decision. If approved, the DO has two days to verify that the user declared technical conditions are correct. The first technical visit does not involve extra costs for the applicant unless, after a second technical visit, the requirements are

[76] Resolution CREG 001 of 2018 (Colombia), art 12.
[77] Resolution CREG 001 of 2018 (Colombia), art 6.
[78] Rise "Generator voltage output: Various types of generators in terms of output power" (30 April 2019) <www.economictimes.indiatimes.com>

not fulfilled. Once checked and approved, the DO has three days to connect the DG to the network unless this would affect other users, in which case the connection may take longer. [79]

If the terms and conditions agreed between the DO and DG are not fulfilled, the connection applicant can make a claim against the DO to the Industry and Commerce Superintendent (SIC). This provision is interesting because the DG does not have to claim a breach of the contract under the electricity authority CREG, but instead to an authority whose primary function is the protection of consumer rights and the promotion of competition in different economic sectors, not just electricity. [80]

This differs from the connection procedure for DG devices greater than 100 kW, which applies to generators usually used for business and large industries.[81] Instead of an online application, the applicant has to undertake a connection study similar to the one requested for traditional large generators connected to the transmission network, which is regulated in Resolution 070 of 1998. The network operator has seven days to respond to the viability of the connection request. If approved, the DO has to offer a connection point and propose entering into a connection contract. In refusing, the decision should be technically justified. The DO has to test and verify that the technical conditions are met. Any concern or problems have to be addressed before connection. The SIC is also responsible if there is a breach of the connection contract. [82]

In conclusion, for larger and smaller DG, the procedure for negotiating a connection contract, therefore, is regulated, although the terms and conditions are left to the parties to negotiate. In practice, the distributor establishes the conditions through standard contracts in the case of small DG (< 100 kW). Also, in practice for small DG, the distribution companies are, most of the time, the retail companies, so the connection procedure will be undertaken by the retailer who will put forward the petition to the distribution side of the company. Concerning the timing of the connection, the regulation establishes specific terms for the performance of each step; however, in

[79] Resolution CREG 001 of 2018 (Colombia), art 12.
[80] Resolution CREG 001 of 2018 (Colombia), art 12.
[81] Resolution CREG 001 of 2018 (Colombia), art 13.
[82] Resolution CREG 001 of 2018 (Colombia), art 13.

practice, such terms are more flexible and can take longer. Some relevant regulatory aspects that characterise the Colombian arrangements is the establishment of the connection and injection restrictions over DG regarding participation in local networks, and as a consequence, constraining the discretionary power of the DO over deciding how many connections they allow in their network. Other characteristics of the Colombian regulation in the matter are different connection procedures based on the capacity of the device, in which 100 kW devices have a simplified procedure; mandatory connection studies by the applicant for larger DG and in case of breach of the contract the relevant authority is the one who has the primary responsibility for protecting consumer rights and ensuring competition.

4.3.2 The Netherlands and the European Union

Access to the network is based on non-discriminatory treatment in terms of conditions and tariffs.[83] However, when the Directive 2009/72 came into force, the principle of non-discrimination was moderated for access by renewable energy generators. This Directive aimed to increase the share of renewable energy (RE) in the market through special legal treatment such as exceptional remuneration schemes and preferential access to the grid rules. The latter consisted of 'priority access' or 'guaranteed access'. Such preferential treatment applies for access to networks, so both transmission and distribution are included.

Priority access means an assurance given to renewable energy generators that they will be able to transport and sell their energy whenever the resource becomes available.[84] Different from *guaranteed access*, which becomes essential when renewable energy is integrated into the spot market, meaning that the electricity sold or supported has access to the grid.[85] Both privileges attempt to avoid curtailment of renewable energy by all means.[86] Therefore, in the case of a curtailment decision (which plants will be restricted first), the Distribution System Operator (DSO) has to differentiate between

[83] Directive 2009/72/EC (EU), art 25 and Directive 2019/944/EP (EU), art 31.

[84] Directive 2009/28/EC (EU), Recital 60.
[85] Directive 2009/28/EC (EU), Recital 60.
[86] Hannah Kruimer *The non-discrimination obligation of energy network operators: European rules and regulatory practice* (15, Intersentia, Cambridge, 2013) at 103.

conventional and renewable energy plants if there is congestion. The curtailment order states: [87]

1. Conventional power plants (those using, e.g., lignite, coal, natural gas) are the first to be curtailed in the case of congestion.
2. Next in line are the CHP plants making use of those same conventional energy resources.
3. Renewable energy installations using storable 'non-variable' energy resources (e.g. biomass and water).
4. CHP plants running on renewable energy resources (usually biomass). If still necessary, in the final instance, renewable energy installations using non-storable 'variable' energy resources (e.g. wind and sun) can be curtailed

Not all Member States implemented the priority and guarantee access, and the Netherlands is one of those. The Netherlands enacted a Decree of Congestion Management[88] which includes priority access for renewables, but it never entered into force. For Kruimer,[89] the reason behind this omission was advice from the Council of State referring to the problematic allocation of costs associated with congestion management if guaranteed priority access was given to renewables, violating the principle of non-discrimination. Therefore, the Government decided not to apply the Decree.

However, the priority and guarantee access for distributed renewable energy generation are being evaded in practice, and the way this is done is closely related to the connection rules. Firstly, however, we need to clarify these concepts. What is the difference in EU regulation between access and connection? The term 'connection' is used, in particular, in a technical context and relates to the physical connection of the generation device to the system. 'Access' covers the right to use the network and 'connection' merely corresponds to the physical connection to the network.[90] According to Boehme,[91]

[87] Thomas Deruytter and Wouter Geldhof "Legal Issues Concerning the Decentralised Energy Production Investment Climate: Subsidies, Tariffs and Priority Access and Dispatch" in Bram Delvaux, Michael Hunt and Kim Talus (eds) *EU Energy Law and Policy Issues* (4, Intersentia, Cambridge, 2014) at 185.
[88] Decree Congestion Management Electricity 2012 (The Netherlands).
[89] Hannah Kruimer, above n 86, at 108 .
[90] Julius Sabatauskas and others European Court [2008] *C*ase C-239/07[40].
[91] Thomas Boehme, Gareth Harrison and Robin Wallace "Assessment of distribution network limits for non-firm connection of renewable generation" (2010) 4 IET Renewable Power Generation 64 at 67.

distributed system operators (DSO) could be tempted to refuse a connection based on the justification of reliability and safety of the network. The reliability and safety condition is meant to justify actions by the DSO in the case of physical congestion when it is necessary to curtail renewable energy production. In practice, the parties signed a 'non-firm connection agreement' in which the DSO imposes access constraints restricting the connection agreement.

Nevertheless, in the Directive 2018/2001, there is no mention either of priority nor guaranteed access or priority dispatching. The reason behind that omission was, according to the intentions of the European Commission,[92] to expose RE to normal market conditions. Basically, the overall share of renewable energy is increasing, and the price of developing RE projects is falling and, as a consequence, the Commission had in mind to let renewables participate fully in the market without privileges laid down by the law.[93] Another reason for omitting such preferential access rules is that they limited the possibilities for network operators to intervene if there was congestion, which can result in non-efficient outcomes.[94] The actual implications of such changes to priority rules are hard to estimate now. The removal of such privileges can create the fear of curtailment for renewable energy projects and the fear that the curtailment order will turn upside down, affecting prosumers negatively.[95] However, on this point, it is also important to remember that, although the Directive 2018/2001 does not mention these privileges, the Directive 2019/944 does when referring to the DSO functions.[96] Although this Directive recognises the role of the DSO in dealing with RE when a Member State decides to incorporate such principles, it is not clear whether it will only protect acquired rights or whether new RE plants can ask for such treatment or even if Member States can apply those instruments in the domestic law. Such lack of coordination or clarity between the new provisions makes us wonder whether prosumers that generate energy thanks to renewable energy technologies, such as rooftop solar panels, will have such preferential access.

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[92] European Commission *Impact Assessment part 3/5 accompanying the proposals for a recast E-Directive, E-Regulation, ACER Regulation and the Proposal for a Regulation of the European Parliament and of the Council on risk preparedness in the electricity sector* (Commission Staff Working Document, Brussels, 2016) at 23.

[93] At 24.

[94] At 27.

[95] BEE "*Maintaining priority access and dispatch for renewable energy*" (2016) German Renewable Energy Federation <www.bee-ev.de> at 2.

[96] Directive 2019/944 (EU), art 31 (4)

Another important aspect is the simplification of the connection procedure for small DG. In the Directive 2018/2001, a renewable self-consumer with a capacity of 10.8 kW or less should only notify the DSO about their intention to connect.[97] Such devices are enough to provide essential comfort and security to a house or a small office, e.g. power up six lights, a fan and a refrigerator.[98] If the connection is approved or if there is no decision by the DSO, the device will be connected to the network. This provision incorporates a very simplified procedure, although the domestic legislation may want to incorporate more steps. Although such a simplified procedure is beneficial for small DG, it can be a burden for the DSO. Therefore, the Member State and the different DSO will need to undertake financial and technical studies of how to increase the capacity of the networks together with acquiring new technologies to enable to deal more efficiently with the congestion management.

In the Netherlands, the Electricity Act provides the general framework on how the DSO and system users should interact and the Network Code regulates the specific conditions and requirements for the Connection and Transport Agreement (CTA). The right to connect is not absolute, and the DSO may refuse in cases where there is insufficient capacity in the network.[99] In this case, the DSO has to justify the reasons on objective, technical or economic criteria.[100] In the case of denial, the DSO should take measures to avoid future refusals when possible. If the congestion is structural (not enough capacity) the DSO has to ensure that the capacity issue is resolved. In practice, it means that the DSO will ensure capacity up to peak demand, plus some overcapacity to avoid future capacity issues.[101] This is happening with increasing participation of PV, where demand for capacity is rising rapidly, then the DSO allocates available capacity which is referred to as 'capacity allocation' as a way of congestion management.[102] This approach implies that legally, the DSO has to update the capacity of the network according to the incoming demands to ensure that there is enough capacity for new

[97] Directive 2018/2001 (EU), art 17.
[98] Rise, above n 78.
[99] Electricity Act 1998 (The Netherlands), art 24.
[100] Electricity Act 1998 (The Netherlands), art. 32(2).
[101] Kuiken and Mas, above n 49, at 157.
[102] At 159.

connections and injections and the DSO is trying to fulfil this role through congestion management.

4.3.3 New Zealand

Part 6 of the Electricity Industry Participation Code regulates the connection of distributed generation. Such procedures can be divided into three phases: a pre-contractual phase, requirements for approval for connection and terms of the relationship which can be regulated or contractual.

1. Pre-contractual phase

To be able to connect a DG to the distribution line, the interested party must obtained an approval from the DO. For this first step, it is fundamental that DO makes publicly available information about the connection procedure.[103] For instance, WEL Networks is one of the 29 distribution companies in New Zealand. When checking its website, it has easy to understand information available for those interested in connecting, for instance, solar panels to the network.[104] From now on, we will follow the example of WEL Networks to illustrate how the rules in Part 6 of the EIPC are implemented by the distribution companies. In dealing with such requests, the DO has to act based on the non-discriminatory principle.

2. Requiring an approval for connection

In general, the process will be different depending on whether the project has a capacity of 10 kW or less (regulated in Part 1 of Schedule 6.1) or greater than 10kW (regulated in Part 2 of Schedule 6.1). From this point we can notice that the three chosen jurisdictions all have a simpler connection procedure for small installations. However, the difference between small and larger installations in each jurisdiction is different. We will go back to such common features later on at the end of the next section.

For DG of 10 kW or less: Generation devices from 1 kW to 10 kW are suitable for homes and small offices. For instance, a 5 kW generator can power up to four lights, an

[103] EIPC, s 6.3.

[104] Information regarding connection of distributed generation to WEL Networks is available at this link: <www.wel.co.nz>

electric motor and a refrigerator.[105] The applicant must apply to the DO through the publicly available application. The applicant has to pay the application fee and complete the form specifying information about the DG project. In the case of WEL Networks, the application fee is 100 NZD + GST.[106] The information requested includes the capacity, fuel type (solar, wind), location, technical specification, such as the inverter that is going to be used, and voltage.[107] For instance, in relation to the quality of the inverter, in May 2019 the Electricity Authority decided to include among the requirements a specific inverter power quality mode as eligibility criteria for access to the application process.[108] An advanced power quality mode refers to inverter capabilities that change the inverter's electrical output in response to the electrical conditions measured at the inverter's terminals. These modes are designed to support local power quality and may be enabled or disabled. The significance of this change is important after recalling the power disruption in Australia that was made worse by out of date standards for inverters together with non-compliance.[109] Such failures compromise the security and reliability of the network and the system as a whole.

Later, the DO has to indicate whether the application is approved or denied. If refused, the decision should be justified.[110] After the approval notification, the parties are required to negotiate the contract in which the applicant must test and inspect their own facility to ensure compliance with the DO's requirements and give a written test report to the distributor with evidence for compliance.[111] The distributor may send qualified personnel to the site to observe the testing and inspection.[112] If the parties do not reach an agreement within 30 days (negotiation time), the relationship will continue under the regulated terms.[113] If the parties enter into a connection contract, the distributor must allow connection as soon as practicable and according to the contractual terms.[114]

[105] Rise, above n 78.
[106] WEL Networks "Application for a single distributed generation connection of less than 10 kW" (2017) <www.wel.co.nz>
[107] EIPC, Schedule 6.1, s 2.
[108] Electricity Authority *Enhancing hosting capability into Part 6 of the Code. Decisions paper* (Electricity Authority, Wellington, 2019) at 10.
[109] Steve Rothernham "Power supply disruption reveals solar inverter risks" (5 Dec 2019) Energy News <www.energynews.co.nz>
[110] EIPC, Schedule 6.1, s 3.
[111] EIPC, Schedule 6.1, s 6.
[112] EIPC, Schedule 6.1, s 7.
[113] EIPC, Schedule 6.2.
[114] EIPC, Schedule 6.1, s 8.

The expression ‘as soon as practicable’ gives a wide range of time and options to the distributor to conclude the connection.

According to the WEL Networks website, when connection approval is granted, WEL Networks installs a smart meter at the DG site, which attempts to modernise the service and improve efficiency and reliability. For instance, the installation of this meter is not required in the regulation, but it is a remarkable development that the DOs are choosing to do it. In practice, together with notifying and waiting for the approval of the DO, the applicant should also inform the retailer company, who is responsible for changing the meter configuration to measure the imported and exported electricity.

For connections of DG more than 10 kW: Because such devices have the potential to have more impact on the distribution network, the process is more detailed and with more stages. For instance, when applying to WEL Networks, applicants with devices between 10 kW and less than 100 kW pay an application fee of 500 NZD with a timeframe for assessment taking around 45 business days; for 100 kW and less than 1 MW the cost is 1000 NZD with a timeline of 60 business days. For devices with more than 1 MW, the application cost is 5,000 NZD with a timeframe of 80 business days.[115] As a consequence, in this procedure, not only is the application more expensive, but the procedure and outcome takes more time.

The connection of DG more than 10 kW starts with the intention of the DG to connect, using the application form that has been made publicly available by the DO. The applicant shall provide information about the device, capacity, technical standards, maximum power injected, proposed periods and amounts of electricity injection and offtakes from it if known. The information regarding energy intakes and offtakes is essential to avoid system congestion and mostly applies to larger projects. In the analysis of the application, the DO considers to what extent the DG project capacity or technicalities may affect the network or may breach standards of safety, voltage, power and quality. Information should be provided on measures or conditions to address such issues: estimations of time constraints that may delay connection, whether it is necessary to undertake further studies about the impact of DG into the system, who

[115] WEL Networks “Distributed Generation” (2017)<www.wel.co.nz>

should undertake such studies, and the cost and information as to the extent of planned or unplanned outages may affect the operation of DG.[116] The distributor must state whether it is approved or declined. If the connection is declined, DO must be justified the reasons. Afterwards, the parties start a period of negotiation. If they reach an agreement, the connection contract will rule the relationship, and the distributor must allow the real connection as soon as practicable. Otherwise, the regulated terms will be applicable, and the negotiation term expires.

3. Terms of the relationship: Regulated or contractual

The terms of the relationship can either be regulated or contractual terms. *Regulated terms:* If the parties do not reach an agreement to enter into a connection contract or the period to do so has already expired (30 days), or the parties agree to be bound, the relationship will be ruled by the regulated terms set out in Schedule 6.2 of Part 6 of the EIPC. In the case of WEL Networks, a majority of the distributed generation connections follow the regulated terms from the EIPC.[117] The regulated terms establish general obligations on the parties and they include provisions regarding dispute resolution,[118] pricing disputes[119] and liability.[120]

Contractual terms: The distributor and distributed generator decide to enter into a contract for the connection of the distributed generation where the contract governs the rights and obligations, and the regulated terms do not apply. At any time, the parties can enter into a connection contract that will apply instead of the regulated contract.[121] Such provision raises the question as to what happens in the case of uniform standard contracts, which affect the interests of small generators or householders. Can they expect the application of the 'regulated terms'?

It can be concluded that in terms of the connection of DG, although the DO can decide when to make the connection possible, the DO cannot reject the connection, other than for technical matters and after justifying the dismissal. For larger DGs, the quantity of

[116] EIPC, Schedule 6.1, s 12.
[117] WEL Networks, above n 108.
[118] EIPC, Schedule 6.3.
[119] EIPC, Schedule 6.4.
[120] EIPC, Schedule 6.2, s 21.
[121] EIPC, Schedule 6.6

energy that is expected to be injected must not create system congestion, although for small DGs this is not an issue. Important questions are raised in this explanation regarding the role of the Electricity Authority in monitoring connection contracts when the parties decide not to follow the regulated terms and how they can protect the DG if contractual terms are imposed. The expression 'as soon as practicable' is too broad and may give too much discretion to the distributor.

4.3.4 Regulation of connection of distributed generation and regulatory disconnection

Connection of DG is essential for the widespread development of the prosumer market. Although in Colombia, the Netherlands and New Zealand the DG connection process is regulated in detail and the denial of connection should be technically justified, the contractual terms are left to the parties to negotiate with a regulated contract as a default (New Zealand) or some minimum content required (Colombia and the Netherlands). The only difference is in Colombia, the regulator narrows the discretional power of the DO by establishing capacity limits to DG participation in the network. These regulatory limits can be changed if the conditions justify more participation of DG in the market. Based on the above explanation of the connection of DG in each jurisdiction, there are different issues that are important to discuss and address including size, timing, connection studies, public information and injection of energy.

First of all, in terms of the size of the DG to be connected, the research has identified that, depending on the size of the distributed generator, there are different regulatory treatments. Some jurisdictions want to encourage small DG units and other DG units large enough to export power to the network. The promotion of small DG units is demonstrated in New Zealand and the European Union which have special provisions to ease the interconnection for DG applications below 10 kW and 10.8 kW respectively. This distinction is made because these jurisdictions consider that small and non-exporting DG devices are more beneficial to the system and its consumers. By comparison, Colombia has established simplified procedures which encourage devices big enough to export energy to the system but not too big to burden the transportation system, which is the case for devices producing less than 100 kW. In each jurisdiction, depending on what is considered a small or large DG, simplified procedures are

applicable as they allow shorter study and connection times, lower connection fees and fewer requirements. For instance, the new energy package in Europe which specifies that DG using renewable resources with a capacity of 10.8 kW or less should only notify the DSO about their intention to connect. This significantly simplifies the procedures for connection for small devices used mainly in households. However, a simplified procedure requires more efficient and coordinated work by the DSO, who should be more oriented towards both easing procedures for small generators who want to participate in the network and being able to manage the increasing load. On this point, it is also interesting to note that although each chosen jurisdiction has different procedures depending on the size of the device, in Colombia the range is too wide when compared to the other jurisdictions. In Colombia, less than 100 kW is considered small, whereas in other jurisdictions small is considered to be less than 10 kW. I consider that it would be more appropriate to also establish a more simplified procedure for smaller devices (less than 10 kW) allowing for a smarter procedure to apply to small generation by households and small business.

Another aspect is timing. How long does the request for connection take on average? Is this timing enforceable? What is the level of discretion the distributor has to execute the connection? Another vital question is whether the regulation requires the distributor operator to prioritise the connection of renewable projects to the network as is the case for the European Union Member States, although the Netherlands did not incorporate such a provision. For instance, in Colombia, the regulator sets the maximum term that the negotiation and connecting procedure can take. If they fail to keep the terms, the network operator can be forced to comply, which may result in a complaint by the distributed generator to the Industry and Commerce Superintendence. In New Zealand the timing of each procedure is set, but it is not clear how it can be enforced, and it is less clear for the actual connection where the term used is ‘as soon as practicable’ giving a broad scope in terms of time and options for the distributor to conclude how long it will take. This flexibility over time may go against the need for certainty by the DG.

Another issue is whether the request for connection requires connection studies and whether the financial burden of carrying such studies is taken by the DO, the DG or the regulator. Shifting the financial burden of interconnection studies confirms their necessity and ensures they address safety concerns while considering transaction costs

and reasonable requirements. In New Zealand and Colombia, DG is encouraged by wholly exempting specific DG devices from connection studies. In Colombia, there is no need for a connection study when the device has a capacity of less than 100 kW. A visit can be arranged, and the distribution company bears the cost of it unless the declared condition of the device differs from that expected. In New Zealand, if the DG is greater than 10 kW, the distributor can require reasonable studies that can be undertaken either by an agent of the DG or by the DO. These studies should be paid for by the DG. In the case of DG projects less than 10 kW, there is no need for further studies; however, if the distributor wants testing and inspection of the distributed generation location, the applicant should pay for such visits.

Another concern is the availability of public information regarding the connection procedure. In New Zealand and Colombia, the terms and conditions for access to DG have to be made publicly available, easily accessed and understood, to enable participation in distributed generation. Typically such conditions are published on the website of the retail company. Although the regulation requires that public information is available online, in Colombia, this is still not happening, and it is difficult to access the information or have clarity about the procedure to undertake. This is different from New Zealand, where distribution companies have available and easily accessible information for applicants.

A final concern is regarding restrictions over the injection of energy. Connection of DG does not necessarily mean that the DG can export energy at any time. In the case of Colombia, the regulation gives clear instructions to the DO concerning the amount of energy that can be injected by the DG per hour, which cannot be greater than 50% of the daily demand of energy. In the Netherlands, the signing of 'non-firm connection agreements' can curtail renewable energy production by imposing access constraints on the DG, restricting their use of the network. This phenomenon was explained by John Hancock[122] as "Yes, but … connection agreements" in which DG can connect to the network but cannot export, or can only export a specific amount of energy or only export when it is beneficial to the system, or when the system says so, as is the case in

[122] Energy News "Aussie energy expert talks DER with Hancock" (6 December 2019) <www.energynews.co.nz>

Australia and New Zealand. [123] On this point, it is essential to clarify that the DO sometimes can impose such restrictions because it is part of its congestion management role, which attempts to ensure the reliability and security of the network. However, in a future of increasing participation of DG in the network, it is a fundamental to the role of the DO in advancing the infrastructure and capacity of the network to deal with those increasing loads.

In general, based on the material discussed, we can state that in respect of the procedure for connection of distributed generation to the distribution network, there is no regulatory disconnection in any of the chosen countries. This statement is based on the fact that there are specific rules that apply to the connection of distributed generators, and the procedure and obligations would be different depending on the size of the project. In this way, the regulator in the different jurisdictions distinguish that a more simplified procedure is needed for smaller installations. Therefore, the regulator is attempting to make it more accessible for the interested parties. Besides, the regulation also recognises the unique characteristics of small local generation while protecting the integrity of the network when requesting more studies and requirements for larger devices which can jeopardise the security and capacity of the network if they are not well managed. In this regard, it is worth mentioning the provision in the Netherlands that requires that if the connection is denied, the distributor also has to address the issue, so that in the next request of connection, denial will not happen again. This provision means the distributor is called to update the capacity of the network and prepare itself for increasing penetration of DG in the long run.

There is room for improvement regarding the effectiveness of provisions, mainly regarding the timing of the procedure, access to information and the differences between connection and access to the network. This latter issue means that connecting the DG device does not necessarily mean that energy can be injected, but instead, this decision is made by the distributor. Such decisions are sometimes regulated (Colombia through the technical standards) or can also rely on the ability of the DO to undertake congestion management skills (New Zealand and the Netherlands).

[123] At 1.

4.4 The Cost of distribution activities

The distribution activity is considered a natural monopoly, and therefore one traditional purpose of regulation is to exercise cost control over the activity. Network cost control is vital to consider since finances will underpin the reasons why distributors chose to promote the connection of distributed generation and the recruitment of the multiple services that demand response or energy storage can offer to balance the network. These services can also be provided by prosumers. The financial or economic analysis of the tariff or methodologies used is beyond the scope of this legal research. Instead, the legal issues to be examined are related to establishing who determines the distribution pricing, what its components are and, most importantly, whether those components recognise or promote investment in new technologies and innovation for more efficient management of the network and proper integration of DG.

Perez Arriaga has written extensively about the role of distribution networks and the operators when facing new technologies and its role leading to a smart distribution system. The next paragraphs will consider his studies of engineering and economics of the distribution system. He argues that traditionally the distributor system operator is negatively impacted by high penetration of DG, penetration that consists of more than 20–25% of the capacity of the network. The possibility of high penetration could mean that an alternative regulatory arrangement is needed to compensate for the negative impact on DOs. [124] Besides, although new network uses are creating uncertainty about distribution system costs, they are also creating more opportunities to solve traditional distributional problems, such as congestion, expansion, balance or distant location of generation. [125]

Current approaches to distribution remuneration, in a context of distributed energy resources and prosumers, are causing increased financial risks, extra costs and a lower quality of service for network users.[126] Regulators around the world are regulating this issue in different ways: For example, defining the investment that the DO is allowed to

[124] Perez-Arriaga, above n 9, at 28.
[125] JD Joode and others "Increasing penetration of renewable and distributed electricity generation and the need for different network regulation" (2009) 37 Energy Policy 2907 at 2911.
[126] MIT *Utility of the Future An MIT Energy Initiative Response to an Industry in Transition* (MIT, Massachusetts, 2016) at 33.

make; specifying the services or outcomes expected. For instance, energy efficiency, peak saving or data sharing, instead of picking specific technologies. The regulation here can include objectives related to the commercial quality of the service, voltage quality, energy loss reduction and continuity of electrical supply.[127] This is known as outcome-based regulation. [128]

Another instrument is a model designed in the United Kingdom known as the RIIO model (Revenue = Incentives + Innovation + Outputs): This regulatory model aims to incorporate investment incentives by relying on an outcome-based total expenditures approach, bypassing the problem of estimating, negotiating or benchmarking CAPEX (capital expenditure) and OPEX (operating expense). This model attempts to ensure a cost-effective combination of conventional investment and novel operational expenditure to meet the demand for network services at desired quality levels. Thus, removing incentives for utilities to invest only in additional network infrastructures and encouraging, instead, investment in non-wire alternatives such as network digitalisation, energy storage, distributed generation and demand response.[129]

In RIIO, the Office of Gas and Electricity Markets (OFGEM) which is the regulatory authority in the UK, defines six output categories, consumer satisfaction, reliability and availability, safety, conditions for connection, environmental impact and social obligation. So each DSO has to come up with an eight-year business plan specifying TOTEX (total expenditures) and services to be delivered.**[130]** Another example is the Brooklyn-Queens Demand Management project in New York, where distributed energy resources are being used to support project load growth, instead of building a new network infrastructure. In this case, the utility company replaced capital investment in new infrastructure with operating expenses to achieve the same goal through solar, batteries and energy efficiency. This programme enables the deferring of 1.2 billion US dollars in upgrades of electrical substations in Brooklyn, leading to an estimated net benefit of almost 9.2 million US dollars to customers.[131]

[127] MIT, above n 126, at 31.
[128] Perez-Arriaga, above n 9, at 42.
[129] At 29.
[130] OFGEM "Network regulation – the 'RIIO' model" (2018) <www.ofgem.gov.uk>
[131] World Economic Forum, above n 10, at 15.

In general, it seems that an incentive regulatory approach and outcome-based regulation may be helpful to promote the adoption of innovative solutions or new technologies to the network. In the next section, we will explore the components that are taken into account with regard to cost control for the use of the distribution network. Also, we will analyse who decides those components and whether those components recognise or promote investment in new technologies and innovation for more efficient management of the network and proper integration of DG. The purpose of doing this analysis is to identify which instruments of the listed above are being used by the chosen countries to incentivise distributors to accommodate more distributed generation energy and services into the network.

In addition, this section will explore whether prosumers or distributed generators should contribute to the overall cost of the distribution system for the use of the network. This topic is important in terms of the different uses that a traditional consumer makes of the network, compared to the prosumer who, for instance, installs a solar panel and consumes more energy from self-generation than the energy takes from the network. A case in New Zealand will be the focus of study which raises an interesting question as to whether the DG should contribute to the overall cost of the system, even though their use of the network is not the same as a traditional consumer. We will explore how this question is answered in the chosen jurisdictions with particular attention to New Zealand.

4.4.1 Colombia

The regulatory authority — CREG — defines the methodology to control cost of the use of the distribution network and approves the tariff for use of the network. In Colombia, the regulatory authority establishes the tariff methodology applicable to the users of the 32 distribution areas.[132] Resolution 082 of 2002 establishes the general principles and methodology for the distribution charges, which is price control over the charges to consumers. The charge for the use of the network is collected by the retailer as an element of the electricity bill. This charge covers optimal management conditions taking into account reference to efficient companies; investment costs, including

[132] Decree 1073 of 2015 (Colombia), art 2.2.3.2.2.1.

opportunity costs for the capital, administration costs, operation and maintenance for maximum efficiency of the unit; and loss of energy and efficiency of the distribution area which is comparable and depends on the characteristics of the area.[133] The Ministry's regulation[134] states that CREG has to include, among the elements for remuneration, the distribution activity hourly rate and different tariffs that incentivise a more efficient economic use of the infrastructure and the reduction of costs. The CREG also has to design a mechanism within the tariff structure that allows consumers to respond to time price signals, which can only apply to consumers who have the smart meters.[135]

Hence, in Colombia, although the structure of the tariff is conventional, the Ministry of Energy established that the electricity regulator, when formulating the methodology for each distribution area, should incentivise the setting of an hourly rate use of the network for more efficient use of it and to encourage consumers to respond to price signals. As a consequence, it is the role of the regulator to establish how the distributor can meet those requirements in the specific area and, in doing so, the regulator can make use of either conventional regulation like the definition of a methodology for each component or through incentives or an outcome-based regulatory approach.

4.4.1.1 Contribution of the DG to the overall cost of distribution

According to Resolution CREG 030 of 2018, the distributed generators shall contribute to both transmission and distribution charges and should pay for the restrictions and any loss of energy suffered in the system. The latest component should only be paid when the DG exports energy to the network.[136] In this sense, DG still contributes to the cost of the system and some extra costs, when feed electricity into the network.

4.4.2 The Netherlands and the European Union

[133] Law 143 of 1994 (Colombia), art 39 and art 45.
[134] Decree 2492 of 2014 (Colombia), art. 1.
[135] Decree 2492 of 2014 (Colombia), art. 1.
[136] Resolution CREG 030 of 2018 (Colombia), art 18.

In respect of the revenues and costs control of the distribution network, the 2009/72/EC Directive states that national regulatory authorities have to regulate distribution system operators (DSO) and fix or approve conditions for connection and access to the network.[137] The costs control includes the network charges or the methods used to calculate them, ensuring the tariff is transparent and non-discriminatory. Any cross-subsidies between transmission, distribution and supply shall be avoided. Furthermore, Directive 2012/27/EC on energy efficiency also includes other relevant criteria for energy network regulation and network tariffs, including that the tariff should reflect on cost-savings achieved from demands response programmes and DG. The tariff shall include savings from lowering the cost of delivery or for network investment and more optimal operation of the network. National regulation should provide incentives for network operators to make available such services in the context of deployment of smart grids.[138]

In the Netherlands, the network tariffs are assessed on the most efficient quality of transportation and the efficiency of business management.[139] The methodologies used by the DSOs to define connection and transportation fees are regulated by the National Regulatory Authority (NRA) through the Tariff Code.[140]

4.4.2.1 Contribution of the DG to the overall cost of distribution

Regarding the question of whether prosumers or distributed generators shall pay for the use of the network, Directive 2019/944, for the first time, makes a special mention of active customers being subject to cost-reflective, transparent and non-discriminatory network charges. As an essential factor in calculating network charges, there should be separate accounts for the power fed into the network and consumed from the network.[141] Active customers should also contribute to the overall cost-sharing of the system in an adequate and balanced way and be financially responsible for the imbalances caused in the grid so they are considered responsible parties in maintaining

[137] Directive 2009/72/EC (EU), art 25.
[138] Perez-Arriaga, above n 9, at 33.
[139] Electricity Act 1998 (The Netherlands), arts. 41 and 41(a).
[140] Electricity Act 1998 (The Netherlands), arts. 32(1) and 37(6)(7).
[141] Directive 2019/944/EU (EU), art 15 (e).

balance.[142] This provision is vital because, for the first time in the European legislation, it provides clarity about the rights and duties of active customers in using the network and contributing financially and proportionally to the system. This topic was previously highly debated and now active customers are considered responsible for balance purposes, which aims to support the DSO in managing congestion of the network. However, questions arise whether and how households as active customers will perform the balancing role and under what conditions.

4.4.3 New Zealand

Given distribution networks are a natural monopoly, the Commerce Commission is in charge of enforcing the Fair Trading Act 1986 and of regulating the price and quality of the service.[143] In general, the Commerce Commission regulates markets where there is little or no competition using three types of regulation: (i) information disclosure regulation, (ii) arbitrate regulation (parties are required to negotiate price and quality), and (iii) price-quality regulation.[144] The price-quality regulation can be of two types: (1) default/customised price-quality regulation, in which the paths are set for all regulated suppliers; and (2) individual price-quality regulation, in which the Commerce Commission sets a price-quality path for an individual regulated company.[145]

In the case of electricity lines services, specific regulation is found in Subpart 9 of the Commerce Act. All distributors are subject to information disclosure and price-quality regulations. There are 17 electricity distributors subject to the price-quality regulation out of the 29 distribution companies present in New Zealand. In the case of consumer-owned companies, they are not subject to price-quality regulation but are only subject to information disclosure.[146] Although the largest distribution company is Vector, which is listed in the stock exchange, most of the distribution companies are consumer-owned companies,[147] or community trusts and, therefore, the price-quality regulation does not apply unless there is a customer petition to apply it.[148] Information disclosure

[142] Directive 2019/944/EU (EU), art 15 (e).
[143] Commerce Act 1986, pt 4.
[144] Commerce Act 1986, s 52 B.
[145] Commerce Act 1986, s 52 B.
[146] Commerce Act 1986, s 54 G (2).
[147] Electricity Authority *Electricity in New Zealand* (Electricity Authority, Wellington, 2018) at 15.
[148] Commerce Act 1986, 54 H.

regulation does apply to consumer trustees to enable transparency and public control. As such, there is self-regulation for community trusts with little regulatory intervention which creates debate around the need for more control over the management and investment decisions that distributors make. However, the Advisory Panel of the Electricity Price Review suggested to the Government that the Commerce Commission should have more power to regulate distributors, mostly in cases where the result would be more beneficial for consumers. [149] This recommendation implies amendments to the Commerce Act. The Government response to this recommendation was that additional power for the Commerce Commission to regulate more distributors is not a high priority and the proposed changes address potential future risk rather than current needs. However, the Government encourages the Minister of Commerce and Consumer Affairs to jointly report on options to improve the regulation of electricity distributors.[150]

The Commerce Commission sets default price-quality paths via **electricity distribution input methodologies.[151]** The input methodologies are the rules, requirements and processes that the Commerce Commission use to set price-quality paths and set information disclosure requirements. These methodologies involve default and customised price-quality, how to calculate OPEX and CAPEX, incentives, cost allocation, assets valuation, depreciation, treatment of taxation, costs of capital and availability of information. This methodology is reviewed at least every seven years. According to the Commerce Act 1986, through these methods, the Commerce Commission must promote incentives and must also avoid creating disincentives for suppliers of electricity line services to invest in energy efficiency and demand-side management and to reduce energy losses.[152] The current input methodologies for electricity distribution businesses are the Electricity Distribution Services Input Methodologies Determination 2012, as amended on 3 April 2018. Based on these methodologies, the Commerce Commission on November 2019 set the 2020-2025

[149] New Zealand Government, above n 61, at 53.
[150] Minister of Energy and Resources, above n 62 [114-116].
[151] Commerce Act 1986, part 4, supt 3.
[152] Commerce Act 1986, s 54Q.

default-price quality path for the 17 electricity distributors who applied for the period April 2020 to 31 March 2025.[153]

One of the issues that this latest path regulates is the recovery of the costs of investments on new practices and technologies in the network, up to 0.1 per cent of revenue or a minimum NZD150,000 across the five years.[154] This decision of the Commerce Commission was seen by the line companies association (Electricity Network Association) as a "miserly" innovation allowance which discouraged them from fulfilling the technical and operational improvements that both the Commerce Commission and Electricity Authority expect from them.[155] This decision may place a financial burden on the distribution companies and prevent them from making structural reforms to their business in the long-term by investing in smart technologies. It seems that the distribution companies require a methodology that encourages them to implement new technologies such as distributed generation, smart meters or even energy storage on the network. This disposition should be amended or reconsidered and taken into account when, in five years, the path is evaluated, and a new price methodology is established. On this point, it is crucial to balance, on the one hand, encouraging innovation through financial incentives and, on the other hand, the cost that results for consumers who are the ones covering extra costs. Stevenson and others [156] consider that the Commerce Commission could facilitate more innovation by requiring distributors to consider distribution alternatives when looking at requirements for new capacity.

At the same time, the Electricity Authority has stated that distribution companies should change the way they are pricing the services they provided and take more account of the service that emerging technologies, such as solar panels or electric vehicles, can bring to the management of the network. In this regard, traditionally, the distributor has

[153] Commerce Commission New Zealand "2020-2025 Default Price-Quality Path" (27 November 2019) <www.comcom.govt.nz>

[154] Commerce Commission New Zealand "Electricity Distribution Services Default Price-Quality Path Determination 2020" (2019) <www.comcom.govt.nz>at 67.

[155] Energy News "Networks upset by "miserly" innovation allowance: ENA" (27 November 2019) <www.energynews.co.nz>

[156] Toby Stevenson and others "Transitioning to zero net emissions by 2050: moving to a very low-emissions electricity system in New Zealand" (27 April 2018) Sapere Research Group at 116.

operated a fixed-cost business, in which charging depends on the volume of energy and not on the economic cost of using the network. Currently, there is a technical group supported by the Electricity Authority called the 'Distribution Pricing Administrative Issues Working Group', who have been analysing and evaluating the role of distributors in improving the distribution prices and analysing the pricing methodologies that are used by each distribution company for its business. In November 2019, the working group published an anonymised assessment of how the 29 distribution companies were handling this issue. The assessment concluded there is work to do in terms of improving pricing for residential and small commercial customers; there is a different performance among the companies, some of them working towards efficient pricing while others are not. Based on the assessment, the Electricity Authority proposed to the distribution companies that they should signal the economic cost of using local electricity network services and, in this way, they need to generate enough revenue to recover the efficient cost of the distribution network. Such provision means that knowing the price of the specific network service, the consumers and prosumer can require a different service and pay for those as is charged.[157]

In my view, the work of the Electricity Authority analysing the pricing methodologies of each distribution company in terms of efficient pricing should go together with the pricing methodologies established by the Commerce Commission and the understanding of the importance of giving financial recognition to investment in innovation. The Commerce Commission now needs to align pricing methodologies with the outcomes that the Electricity Authority expects from the distribution companies, as well as reflecting such efforts.

Currently, network owners are being encouraged to avoid or defer investment in increasing infrastructure and, instead, engage in alternatives to network solutions such as demand response and batteries. For instance, distribution company directors are explaining to the Commerce Commission how much the company is investigating and applying the use of alternatives to network solutions, according to an IPAG recommendation to the Electricity Authority.[158] Finally, it is vital to mention that in the

[157] Electricity Authority "Distribution Price Review" (2019) <www.ea.govt.nz>
[158] Joshua Riddiford "Efficient distribution pricing not a 'nice to-have' - IPAG" Energy News (2019) <www.energynews.co.nz>.

Electricity Price Review,[159] the Advisory Group recommended the Government should issue a government policy statement directed to the Electricity Authority to guide the reforms to the distribution pricing. Such reforms should be a guide to promote fairness, efficiency and certainty; for instance, encouraging structured distribution pricing to drive consumers to make decisions about investing in emerging technologies or being structured in a way that reflects the distribution cost of electricity at different times.

4.4.3.1 Contribution of the DG to the overall cost of distribution

Another important issue, is whether the distributed generator should pay for the use of the distribution network. It is an important topic in terms of the different uses that a traditional consumer makes of the network, compared to the use that a prosumer does of it. A judicial case shows the challenges of defining such structures and the need for explicit provisions from the Electricity Authority in this regard.

A solar company (Solar City) filed a case in the Electricity Authority for a ruling against a distribution company (Unison Networks Limited) for the imposition of new delivery prices for customers using distributed generation.[160] Such new delivery prices meant an increase in line charges on a kW/h basis for customers with solar panels. The purpose of this new charge, says the distribution company, is to ensure that households installing solar panels still contribute a fair share to the maintenance of the local network. Solar City argued that this new charge was a breach of the pricing principles contained in Part 6 of the EIPC. The Electricity Authority first, and later the High Court, confirmed that the Ruling Panel of the Electricity Authority does not have jurisdiction in this matter because it has limited exclusive prerogative set by the legislator.[161] This new charge is considered by the solar industry as a 'solar tax', arguing that such charge may discourage customers from installing solar panels because it makes them more expensive. The solar industry viewed the High Court ruling as disappointing because they viewed the decision as allowing the "electricity sector to make up its own rules without having to defend them in a hearing".[162] In conclusion, the resolution of this

[159] New Zealand Government, above n 61, at 51.
[160] *Unison Networks Ltd v Solar City New Zealand Ltd* [2017] NZHC1343 at [4] .
[161] At [31]
[162] Gavin Evans "Panel action on Solarcity com-plaint halted" EnergyNews (20June2017)<www.energynews.co.nz>

case meant that there is no certainty about the limits or criteria that distributors can take into account in determining the price when supplying to distributed generators. The relationship retailer-distributor is not regulated by the Electricity Authority but through written use-of-systems agreements. On this point, it is essential to recall that the Electricity Authority is working on a default access agreement, or regulating written-use-of-system agreements to bring more standardisation and more effective retail competition, as was described in a previous section.

In my view, there are three main perspectives when considering this case: the first is concerning the arguments used in Court, the second one regarding the lack of jurisdiction, and the last one, concerning the issue of sharing the overall cost of the network:

In terms of the arguments used in Court, it is persuasive that the charges formulated by the first respondent (Solar City) were not the correct ones because they claimed a breach of pricing principles applicable between the distributor and distributed generation in terms of connection (Part 6 of the Code). Instead, they should have appealed for a decision on the relationship between distributors and retailers for the use of the network, which is dictated by the written use-of system agreements. Such a relationship later impacts the electricity bill that the consumer with solar panels has to pay in terms of the distribution charge. Accordingly, the new delivery prices did not breach part 6 of the Code, principally because this part applies to the relationship between distributed generators and distributors in terms of connection to the network, which is not the cause of the conflict in this particular case.[163] The cause of the conflict is the new delivering prices that are increasing the electricity bill of the distributed generator and that involves also the retailer. The problem that arises is whether the Electricity Authority has jurisdiction over conflicts between distributors, retailers and new network users who favour emerging technologies, which is the case for solar panel owners.

In relation to the lack of jurisdiction argued by the Electricity Authority and confirmed by the High Court, this decision may be challenged. Part 4 of the Electricity Industry

[163] Daniela Aguilar Abaunza "Getting ready for the future: the regulation of energy prosumers in New Zealand" [2018] New Zealand Law Journal 292 at 294.

Act contains a general jurisdiction clause[164] stating that any person can make a complaint against a distributor following a dispute resolution scheme which is further regulated in Schedule 4. Therefore, this research consider the Electricity Authority has jurisdiction to decide the legality of the new delivering prices. However, in order to avoid uncertainty as to whether they have jurisdiction, it would be better to make it clear by reforming the Electricity Industry Act. The Electricity Authority should have a broader jurisdiction, and it should have a say in the conflicts that arise among participants in the industry, being able to set clear parameters as to what is expected from the relationships between them and the way they relate with new market entries. Without this, there is the potential for a denial of justice which also goes against the promotion of competition and the control of monopolistic behaviours. This opinion is also shared by the Advisory Panel who performed the Electricity Price Review and who recommended that the Electricity Authority should have more power to regulate network access, meaning amending the Electricity Industry Act. [165] The amendments involve allowing the Electricity Authority to regulate the participation of distribution companies in markets for prosumers and related services, as is the case for distributed energy services, such as distributed generation, energy storage, electric vehicles, smart meters, demand response. The Panel says that the Electricity Authority should be able to draft regulation regarding these new technologies and circumstances, particularly when, as stated by the Advisory Panel, "distributors use their monopoly position to deter competitors from entering the market for such products and services or disadvantage those already in the market".[166]

This research also considers that this case could have been held before the Commerce Commission, who is responsible for establishing price-quality path regulation and approving distribution tariffs consistent with such a path. On this point, it is essential to recall that distribution activity is a natural monopoly and the role of regulation is to oversee and control it to ensure this monopoly does not take advantage of its position to the detriment of other industry participants. That is the reason why the prices and quality are regulated. It is also important to note that recommendation 'F' of the

[164] Electricity Industry Act 2010, s 95.
[165] New Zealand Government, above n 61, at 56.
[166] At 57.

Advisory Panel in charge of the Electricity Price Review[167] suggests that the Electricity Authority should be drafting distribution regulations in consultation with the Commerce Commission. Such coordination ensures consistency with the price-quality regulations and establishes clear boundaries between the monopoly elements that the Commission regulates and the contestable elements that the Electricity Authority supervises. The Government's response to the recommendation was that it would be important to propose a Government Policy Statement (GPS) on the distribution sector after consultation with the Electricity Authority and the Commerce Commission. Such GPS would emphasise the importance of innovation, energy efficiency, demand response and new renewable electricity generation, and the role of regulation in supporting it.[168]

Finally, regarding the sharing of the overall cost of the network, I consider that, based on the perspective of energy justice, all network users should contribute to the cost of the system in order to avoid creating perverse incentives. Such perverse incentives can be the reward of more wealthy users, who can afford to get new technologies, such as roof-top solar panels, at the expense of low-income users, who have to continue using the traditional energy supply. Such incentive implies that if wealthy users do not contribute to sharing the cost, the extra cost will potentially go to the electricity bills of residential customers, small businesses and low-income users. Energy justice considerations requires that all system users participate in the overall cost of the system in a fair and proportionate way, based on the use users make of the system. Therefore, the distribution charges must consider the type of user who is using the network. Such distinction can depend on whether the user is a household, business, with or without solar panels, with or without electric vehicles or energy storage, since each type of user gets a different service from the network and also makes a different impact on it. In this sense, more discussion is needed regarding decisions made over the pricing scheme for distribution, which should be led by the Electricity Authority with the active participation of all the sector participants including advocacy groups for consumer rights following the concept of procedural justice and engaging the different stakeholders in a non-discriminatory way in the decision-making.

[167] New Zealand Government, above n 61 at 57.
[168] Minister of Energy and Resources, above n 62 [109].

4.4.4 Challenges of price control for distribution and regulatory disconnection

The material above examined different legal issues regarding the price control over the use of the distribution network. The issues analysed were who controls price the sector, what are the components of the price control and, most importantly, whether those components recognise or promote investment in new technologies and innovation for more efficient management of the network and proper integration of distributed generation. For instance, all the chosen jurisdictions rely on traditional approaches with some components that aim to encourage either energy efficiency (the Netherlands or New Zealand) or real-time use of the network (Colombia). However, there is a big difference in who determines the method. In New Zealand, it is the Commerce Commission while in Colombia and the Netherlands it is the electricity regulatory authority using a more specialised approach. However, both authorities have the same purpose of regulating a natural monopoly through setting prices and quality paths and methodologies.

In general, traditionally the distribution operator (DO) does not profit from the presence of DG in its network, except for low DG penetration. Such low profit could mean that an alternative regulatory arrangement is needed to compensate for the negative impact on DOs when there is increasing participation of DG of more than 20% on the capacity of the network. In the comparative analysis it is evident that, for example, the Commerce Act 1986 in New Zealand establishes that one of the parameters used to define the methodology by the Commerce Commission is the promotion of incentives for suppliers of electricity line services to invest in energy efficiency and demand-side management. However, it cannot be forgotten that the current pressure is for DO to invest more in new technology following first a self-regulatory perspective. In Colombia, the regulations are established by the Ministry and regulators who are required to form, amongst the elements for the remuneration of the distribution activity, hourly rates and different tariffs that provide economic incentives for more efficient use of the infrastructure and the reduction of costs. The regulatory authority also must design mechanisms, within the tariff structure, that allow consumers to respond to time price signals which can only apply to those consumers who have smart meters. However, the CREG has not introduced any further regulation relating to this provision.

Such omission prevent the Ministry's norms from having the desired effect regarding a more efficient remuneration of the distribution activity.

Although regulators in the three jurisdictions have legal requirements to implement energy efficiency measures, it is still debatable whether these open the door for more investment in smart grid technologies that enable better management of the network and especially the proper integration of distributed energy resources. The regulatory authorities require a more energetic approach in regulating the distribution network since, as natural monopolies, they have a dominant position that determines the conditions for the use of the network and the management of it. So a significant effort by regulatory authorities is needed to regulate networks, particularly when further penetration of new technologies is required. Therefore, to some degree, there is a regulatory disconnection between the need, in reality, to invest in new technologies by the distributor and the aspects that regulators see as essential to invest in, which are still not strongly directed to promoting investment in innovation. Such regulatory disconnection is creating gaps and uncertainties for emerging network users.

When considering whether the prosumer has to contribute to the overall cost of the distribution system, there is a clear conclusion that they should, according to an energy justice perspective. Ensuring such contributions are proportionate and deciding on the criteria the prosumers should do so is still debatable, as it is in New Zealand. In the case of the European Union with the Directive 2019/944, such questions are partially answered by stating that active customers are balancing parties and should contribute to the network charges. Such charges shall be based on the use that they make of the network and by also distinguishing between the energy fed into the network and that consumed. Further regulation in each Member State is needed to establish the methodology for setting the tariff used for both feeding and consuming and which type of use makes the greater demand on the system. Such a tariff will determine whether the purpose of the methodology is to encourage one or the other type of use more.

4.5 Key points

The vital role of regulation over distribution activity in encouraging a more active role for the consumer is seen from three different aspects. The first one is that the distributor

should be engaging in new functions to accommodate the new incoming generation into the network and to promote the advantages that energy storage or demand response can offer to the more efficient management of the network. In this regard, the research found a remarkable example in the European Union, in which the latest Energy Package recognises unambiguously the emerging functions of the distributor acting as a market facilitator, balancing functions based on agreements with the transmission company and procuring flexibility through decentralisation. Such an example is isolated and does not denote the general trend. In general, in the other analysed jurisdictions, the role of the distributor is still traditional and, from a regulatory point of view, they have not yet dealt with the new realities and challenges that the distribution network is facing. Nevertheless, the regulatory authorities are currently working on updating these approaches

The second aspect is the role of the distributor in connecting distributed generation to the distribution network and, as a consequence, the first step to enabling them access to the network. The general trend is to regulate the connection procedure based on the size of the distributed generator, either small or large DGs. A distinctive point is the regulation in Colombia which imposes capacity limits on the network in which the DG is allowed to participate, while in the Netherlands or New Zealand the distributor has more discretion to decide when to do so. Another key aspect in this regard is that although the connection procedure and its requirements are vital to ensuring the access to the network is not unnecessarily burdensome, connection to the network does not necessarily mean that the use of the network is granted. The actual use of the network remains a decision of the distribution companies who can decide whether the network is capable of receiving the injection of energy, depending on congestion management skills. Nevertheless, the regulatory approach should focus on encouraging the DO to invest in advancing the infrastructure and capacity of the network to deal with the increasing loads. One recommended approach is outcomes-based regulation.

The final aspect is regarding the cost-control over the distribution activity. All the chosen jurisdictions rely on traditional practices with some presence of components that aim to encourage new features. Such new features are energy efficiency and demand-side management on the distribution side or real-time use of the network. However, it is still debatable whether these components open the door for more

investment in smart grid technologies that enable better management of the network and proper integration of distributed energy resources. Finally, in discussing whether the prosumer should contribute to the share of the overall cost of the distribution network together with the traditional consumers, the answer is yes, but the conditions or proportion remains unclear. It would be advisable that all system users contribute to the overall cost of the system in a fair, proportionate way depending on the use that they make of the network.

Chapter 5: Active Consumers: Access to Relevant Markets and Consumer Rights

When prosumers want to sell the energy surplus to the network or to some other actors, this decision requires not only a connection agreement, as discussed in the previous chapter, but also access to relevant markets to sell the energy for a fair price. Also, a prosumer may want to remain connected to the network to import energy because self-generation is not enough to meet their needs and they have to use the network as a back-up source. The opportunity to decide which option to take is vital for prosumers together with the effective integration of their goods and services to the electricity industry. Such integration also implies contributing to the costs and benefits of the system. This chapter discusses the issues involving access to markets for prosumers for a fair and clear remuneration, regarding the selling of surplus energy and participation in demand response programmes.

Small prosumers have however reduced bargaining power in the market and, as a consequence, the literature has recommended the extension of consumer rights to prosumers. [1] The latest European Union Legislation contained in the Directive 2018/2001 states that renewable self-consumers (prosumers) are entitled to maintain their rights as consumers.[2] This provision raises questions as to what it means in practice and what the rights are that have traditionally served to protect consumers that can also be extended to prosumers, especially small prosumers. As a result, the entitlement to self-generate, universal access, the right to change supplier, access to relevant information, access to the technology and access to specific and simplified procedures will now be discussed. The analysis of these issues suggests that prosumers, especially small prosumers, should have access to the services that the electricity industry and market can offer on equal terms, instead of being 'penalised' by the industry and the regulatory framework for becoming prosumers.

[1] Josh Roberts *Prosumer Rights: Options for an EU Legal Framework Post 2020* (ClientEarth, London, 2016) at 38.
[2] Directive 2018/2001 (EU), art 21 (2) (c).

Before continuing this analysis, it is crucial to provide some clarification to ensure a better comprehension of the information included in this chapter. Consumers who become prosumers can be either industrial such as co-generators, commercial, residential, communities, or medium or large customers. This chapter will principally focus on residential and small consumers, although some consideration will be given to large customers. Therefore, when reference is made to 'consumers' this refers to small customers rather than large customers. Distinguishing consumers according to size is essential because it highlights the different regulatory and market treatment of prosumers, recognising the limited bargaining power that small customers (consumers) have. This unequal position in the market should entitle them to a particular legal framework that ensures both fairer access to electricity services and in offering their services to the market.

5.1 Energy Surplus and Access to Relevant Markets

To ensure prosumers can participate actively in the industry, it is essential they can access relevant markets. Market mechanisms, together with regulatory incentives, should reward the energy and services that prosumers can offer as long as they are beneficial to the system. In this regard, the possibility of prosumers participating in the market in the selling of energy should be allowed and encouraged. The key challenge is creating a level playing field. The literature[3] argues that although most of the liberalised systems present themselves as technologically neutral, the way that the energy market is designed and the requirements to participate in it lead to the conclusion that the markets are not neutral but reward traditional players. Given this, the next section will analyse to what extent this statement is true in legal terms, by analysing the legal framework that energy markets are based on in the chosen jurisdictions. Such analysis enables an understanding of first, whether it is possible for prosumers to participate in the market, and second, whether it is desirable for them to participate or if it is too burdensome to do so.

[3] Ignacio J Perez-Arriaga, Jesse Jenkins and Carlos Batlle "A regulatory framework for an evolving electricity sector: Highlights of the MIT utility of the future study" (2017) 6 Economics of Energy & Environmental Policy 71 at 83; Darryl Biggar and Mohammad Reza Hesamzadeh *The Economics of Electricity Markets* (John Wiley & Sons Ltd, Sussex, 2014) at 85.

After analysing wholesale and retail market settings, the final section will explore international examples of emerging markets that are changing the paradigms and dynamics of energy markets. Emerging markets and new business ideas are widening the possibilities for diverse industry participants, not only for prosumers, to participate in energy transactions. On this point, it is worth recalling the concept introduced by Philip Kotler regarding the call for marketers to create prosumer oriented markets as new business opportunities to adapt their business to the emerging realities and technologies and embrace change rather than be left behind or opposed to prosumers. [4]

5.1.1 Wholesale market access

According to Biggar and Reza,[5] participants in the wholesale market are predominantly large players who can offer financial guarantees, capacity and meet the technical requirements. In Colombia, there is a legal entry barrier for generators with a capacity of less than 10 MW, which cannot participate in the spot market.[6] By comparison, generator plants greater than 20 MW must participate in spot markets and national dispatch.[7] Generator plants between 10 to 20 MW can choose whether to participate or not.[8] Large customers[9] and large prosumers[10] (large scale self-generators) cannot participate directly in the market unless they are represented by retailers or generators. Therefore, there is a legal entry barrier for large-scale self-generators that cannot participate directly in the wholesale market, and must be represented by a retailer or generator.[11]

In New Zealand, generators producing more than 10 MW are required to bid on the spot market.[12] Distributed generators can sell their energy to the clearing manager or to a retailer trading on the local network where the generation device is located.[13] Although

[4] Philip Kotler "The prosumer movement: a new challenge for marketers" (1986) 13 Advances in Consumer Research: 510 at 513
[5] Biggar and Hesamzadeh, above n 3, at 86.
[6] Resolution CREG 86 of 1996 (Colombia), art 3.
[7] Resolution CREG 55 of 1994 (Colombia), art 4.
[8] Resolution CREG 86 of 1996 (Colombia), art 3.
[9] Resolution CREG 31 of 1997 (Colombia), art 1.
[10] Resolution 024 of 2015 (Colombia), art 12.
[11] Decree 1073 of 2015 (Colombia), art 2.2.3.2.4.4.
[12] EIPC 2010, s 13.25 (1).
[13] EIPC 2010, s 14.4

it can be said selling to the clearing managers is one way of participating in the wholesale market, it is not often used by household prosumers who usually sell their surplus energy to the retailer. It is also worth stating that small generators (less than 10 MW) are not required to submit an offer to the market but can sell energy to the clearing manager.[14] In this sense, the participation of a distributed generator in the market is similar to the participation of small generators.

Another example of entry restrictions relates to requirements for market participants which mostly applies to traditional large actors. Butenko[15] identifies one restriction in the Dutch market that makes access for prosumers to the wholesale market theoretical. This statement is exemplified by the obligation towards parties trading on the wholesale market to act as 'programme responsible parties', which means parties are responsible for optimising the supply and demand portfolio to ensure balance in the electricity grid.[16] Ashe explains, large market parties can usually solve the imbalance by portfolio optimisation. In contrast, individual prosumers who do not have such a portfolio cannot effectively fulfil the role of a programme responsible party. Therefore, it is usually the suppliers who perform that role on behalf of prosumers.[17] In New Zealand, industry participants must comply with "prudential requirements" which ensures that they can meet financial obligations. The requirements are, maintaining an acceptable credit rating and providing acceptable security. These requirements are important to maintain the reliability of the financial transactions happening in the industry, but can be an entry barrier for prosumers, especially the smaller ones.

After exploring some of the legal barriers to entry for prosumers, this research can confirm the previous statement of Biggar and Reza[18] that large actors are the only ones participating in the wholesale market. In the case of large prosumers, according to the regulation in New Zealand and the Netherlands, they can in theory participate directly in the wholesale market. However, the requirements imposed on market participants

[14] EIPC 2010, s 13.25.
[15] Anna Butenko "Sharing energy: dealing with regulatory disconnect in Dutch energy law " (2016) 7 SSRN 701 at 702.
[16] Dutch Electricity Act 1998 (The Netherlands), art 1.1.
[17] Butenko, above n 15, at 702.
[18] Biggar and Hesamzadeh, above n 3, at 93.

are tailor-made for traditional and large market players, as shown in this section, which can discourage prosumers to participate in the wholesale market.

Entry barriers, in terms of size and requirements, suggest that the regulation of the market attempts to guarantee adequate financial, technical and capacity conditions for market participants. These restrictions and conditions are set up to ensure the market functions well and is able to guarantee security of supply to the national grid. For that reason, it is understandable that such requirements were established because they are meant to protect the security of the system and the security of supply. However, we can wonder about the participation of prosumers in smaller markets such as the retail market.

5.1.2 Retail market

The traditional retail market is oriented towards supplying power to end-customers which means, in most liberalised industries, competition among retailers and the right of consumers to choose a supplier. In the emerging electricity system, questions can be asked, including can the prosumer become a supplier and provide energy to other end-customers. In order to answer this question, two issues need to be considered. The first relates to the definition of a supplier and what is needed to become one i.e. entry requirements, such as obtaining a supply licence. The second relates to the duties of a retailer and if it's desirable to become one or not.

In respect of the first issue, there are different examples within the chosen jurisdictions of legal entry barriers. In the Netherlands, in order to be considered a supplier, a supply licence is needed, which is granted by the Dutch National Regulatory Authority.[19] Although, in theory, prosumers could apply for the supply licence, the administrative burden and the financial and technical requirements connected to it make it unlikely that prosumers would want to apply for it. However, an Experimentation Decree empowers the Ministry of Economic Affairs to grant individual exemptions from the application of the Electricity Act 1998 for 10 years to specific projects experimenting with prosumer initiatives. In this context, the projects can apply to be exempt from the

[19] Electricity Act 1998 (The Netherlands), art 95A.

requirement of a supply licence.[20] Such projects are related to community energy which will be further explained in Chapter 6.

In Colombia, although the retail market is open and does not require a supply licence to operate, there is a requirement to establish the retail company as a public utility company.[21] Such a requirement implies that the applicant has enough financial, technical and administrative capacity to operate as a public utility company which can be seen as a burdensome barrier for smaller players. In New Zealand, the market is open, and retail companies are required to register with the Electricity Authority and to comply with the Code,[22] which includes meeting the "prudential requirements"[23] that ensure financial obligations within the industry. The question that arises therefore is, it is attractive or desirable for a small prosumer to become a retailer in order to be able to supply energy to other end-costumers. This question leads us to the second issue regarding the duties of the retailer.

The clarification around the duties or obligations of the supplier will enable a prosumer to decide whether it is desirable to become one. The requirements and duties apply to large actors and for small actors would be burdensome and disproportionate to pursue. In the Netherlands, for example, energy suppliers have to comply with the universal service obligation, meaning that suppliers must supply any consumer who wants to participate.[24] Such a provision is a visible obstacle for prosumers who may want to only supply energy to their family, close friends or neighbours and cannot satisfy all their energy needs. A similar case in New Zealand shows that retailers must ensure the security of supply to the customer that chooses them and also there is an obligation on retailers, set out in the Code, which includes a requirement to compensate customers in the event of an official conservation campaign.[25] These functions may be seen as uneven for small prosumers whose desire is to sell surplus energy to others close to them. These responsibilities on the supplier are understandable and are needed for big players but can be disproportionate if the same rules are applied to prosumers because they can

[20] Experimentation Decree 2012 (The Netherlands), art 15 and art 16.
[21] Resolution CREG 156 de 2011 (Colombia), art 5 and art 6.
[22] Electricity Industry Act 2010, s 9.
[23] EIPC 2010, s 14A,2.
[24] Electricity Act 1998 (The Netherlands), art 95(b)(1)
[25] EIPC, s 9.24.

discourage them from engaging as prosumers. As a consequence, given the specific characteristics and the capacity of prosumers, they cannot realistically compete in the retail market, due to their limited organisational, financial and technical ability, in a way that enables them to provide energy and ensure the security of supply.

So the question that remains is, if prosumers are not legally allowed to sell to other end-customers, who can they sell their energy surplus to? In the case of Colombia, the Netherlands "with some exemptions", and New Zealand, prosumers can only sell their energy to retailers who may act on their behalf to sell their energy elsewhere. Given the fact that prosumers in the chosen jurisdictions cannot supply energy to consumers, the competition in the retail market provides the possibility for prosumers to sell the energy surplus to the retail company and shop around for the best deal. For this reason, it is vital to extend the right to change supplier to prosumers and, as a consequence, when a prosumer is not satisfied by the financial return from the retailer, they can switch to another supplier who offers a higher tariff.[26] For instance, Peter installs solar panels with a monthly capacity of 900 kWh and only consumes 600 kWh. Peter is currently selling his energy to Retailer A, who offers 10 cents per kWh, but what if there are better offers in the retail market for the 300 kWh surplus? Retailer B offers 12 cents, and Retailer C offers 13 cents per unit. A prosumer should be able to shift to another retailer and sell the energy to them instead. However, questions remains about the procedure for doing so and how often they can change retailer. Such issues should also be considered when exploring the effectiveness of this option.

In New Zealand, one major generator-retailer company called Trustpower has developed an interesting business idea known as 'Solar Buddies'.[27] The idea consists of allowing consumers who have solar panels to sell their energy surplus to whomever they decide (buyers are called 'buddies') located in any part of the country and for any rate agreed between the parties. There are two main limitations in this arrangement. Firstly, the prosumer can only supply a maximum of 50 units (kWh) per month per buyer. Secondly, prosumer and buyers have to be customers of Trustpower. It means

[26] Martha M Roggenkamp "The Position of Citizens in Energy Production in the Netherlands: Is a New Approach Emerging?" in Lila Barrera-Hernández and others (eds) *Sharing the Costs and Benefits of Energy and Resource Activity: Legal Change and Impact on Communities* (Oxford University Press, Oxford, 2016)194 at 198.

[27] Trustpower "Get more for your extra solar power with Solar Buddies" <www.trustpower.co.nz>.

that the rest of the energy supply to the buyers will come mainly from Trustpower since 50 kWh only represents about 10% of the monthly consumption of an average household.

We can briefly illustrate the above initiative by an example. George has a rooftop solar PV system that generates 400 kWh per month. His average consumption is 300 kWh/month, and he decides to sell the surplus to his mother and two friends (Mary and Charlie) using Trustpower as an intermediary. They live in Auckland, Wellington and Rotorua, respectively. George agrees with his mother to supply 50 kWh per month at no cost and to Mary and Charlie 25 kWh/ per month for 15 cents kWh each. At the end of the month, his mom, and Mary and Charlie will be charged on their electricity bill for this transaction distinguishing it from the rest of the supply energy by Trustpower. George will receive a credit on his monthly bill of NZD7.50 for the energy he sold to Mary and Charlie and will receive a note of the energy he agreed to give for free to his mother.

If George were not enrolled with 'Solar Buddies', he would have received the standard rate for his energy from Trustpower, which is 7 cents kWh. The average retail price per unit is around 22 cents, so for George's mom, and Mary and Charlie, the units they bought from George were cheaper than the rate they paid for the rest of the bill (majority part) supplied by Trustpower. Trustpower does not take any commission from this transaction but does have four customers who buy energy from it.

In a conversation with Shane Adams, one of the individuals in charge of running the Solar Buddies programme, he highlights the success of the programme.[28] He confirmed that while allowing trade between prosumers and end-consumers, Trustpower is retaining or gaining more customers. The prosumer is not going to other retailers for a better price deal because they can get a much better price agreed with the end-consumer. When asked about problems or limitations on applying the Electricity Industry Participation Code, he claims he did not encounter any problem with the current regulations that limits the innovative idea. Other big retail companies do not offer similar options. The average 'buy-back rate' of energy surplus by retailers ranges from

[28] Shane Adams, Energy Trader at Trustpower Ltd. Phone conversation 15 April 2020.

7 to 12 cents per kWh.[29] It is significant that the prosumer has the option of not only a better economic deal but also the ability to sell to any person they choose.

However, as the New Zealand Smart Grid Forum[30] rightly points out, new entrants to the retail market are also able to capitalise on the opportunity provided by emerging technologies and business ideas while pushing traditional generators/retailers to offer better deals. One new retailer company Our Energy[31] provides software that collects local data production and matches it first with local consumption. An example follows of how this could work. Anne requires 5 kWh and, at the same time, her neighbour Peter is producing an excess of 3 kWh. The platform matches Anne's energy demand with Peter's production, and the rest comes from the national grid. In the case where there is no local generation, Our Energy will supply energy from the wholesale market since the retailer still has to ensure the security of supply. For this business model to work, it is vital to have access to the metering data of the consumer. Therefore, the first thing Our Energy does is to change the settings of the smart meter and to bring the reading of energy closer to real-time. Such particular settings differ from the general set-up of smart meters in New Zealand, which read metering data 2 days after consumption. The platform also sends signals to consumers whenever someone is producing energy so the user can consume it by a local match. The idea behind Our Energy is the creation of a local energy market, in which the retailer provides the technological platform to allow people and communities to produce and consume locally generated electricity.

In a conversation with John Campbell, CEO of Our Energy, he argued that his original business idea was to provide an online platform that connects people interested in supporting local generation.[32] However, for this to be possible in the New Zealand legal framework, he had to establish his business as a retail company in order to be able to provide such services, since there is no other option within the current legal framework that allows it to connect buyers and sellers. He would have preferred to act instead as a 'community aggregator', which is a business model that engages more with the demand

[29] Mercury "Solar- FAQS" <www.mercury.co.nz>
[30] New Zealand Smart Grid Forum *Relative Progress of Smart Grid Development in New Zealand* (New Zealand Smart Grid Forum, 2016) at 52.
[31] For more information, <www.ourenergy.co.nz/>
[32] John Campbell, CEO of Our Energy. Skype conversation, 27 March 2020.

side. When asked about the regulatory barriers that his business has faced so far, he highlighted the difficulties of accessing metering data and the financial constraints. Regarding the financial constraints, Campbell said that a retailer business needs to provide financial credentials to be able to buy electricity ahead of time in the wholesale market to be able to ensure the supply of energy to his customers. However, his original business idea was to provide other services to consumers rather than becoming a retailer. This fact highlights another legal obstacle which is that consumers cannot enter into multiple trading relationships on a single connection point.[33] It means only one retailer per connection point, instead of allowing the buying of energy from one trader selling to another or engaging in different and multiple relationships simultaneously with different suppliers.

Concerning the possibility of multiple trading relationships, it is relevant to mention a current project led by the Electricity Authority to investigate the possible outcomes of allowing multiple relationships at a single point of connection to happen. This project is called 'Additional consumer choice of electricity services' (ACCES), previously known as 'Multiple Trading Relationships'.[34] It implies, for instance, sharing the consumption data with multiple traders, relationships among them and either coordination or clear purposes for each transaction. If the project has a positive outcome for multiple trading, and if the Electricity Authority remains interested in pursuing so, it will allow businesses like Our Energy to provide locally matched energy and to let other traditional retailers supply the rest of the energy consumption needs. In my view, multiple trading relationships can improve consumer choice and make the market more competitive by not having to contract all the transactions with the same retailer but with those offering the best deal in different segments of the market. However, it can also be complex for consumers to manage all the emerging transactions. Nevertheless, this difficulty can be easily overcome by the correct use of technology and advertising.

The material discussed above shows that the legal entry barriers for becoming a supplier and the duties imposed on it are not consistent with the changing world. The legal barriers to entry are restricting prosumers from supplying energy directly to others and

[33] EIPC 2010, s 9.21(1)
[34] Electricity Authority "Additional consumer choice of electricity services (ACCES) " <www.ea.govt.nz>

forcing some innovative businesses to present themselves as something they are not, as with Our Energy. It makes more sense to be open to the idea of new market participants being able to empower consumers to act and benefit from the market. The case of Trustpower's Solar Buddies initiative is an example of an enterprise which can develop their business idea within the legal framework. Compared to Our Energy which is an example of a business who has encountered legal barriers in the process of developing their business. A comparison of the two cases works as a reminder of the real drivers behind each business. Trustpower's purpose is to supply more energy by retaining and gaining more consumers. This is different from Our Energy's main focus, which is not the supply of energy but instead, bringing local producers and consumers together facilitating the transaction, and earning a commission out of it. In the latter scenario, the concept of Sharing Economy can be applied, in which there is an online platform that allows consumers to supply goods or services to other consumers. With the concept of Sharing Economy, the critical legal question remains as to whether those platforms should be legally treated in the same way as traditional industries.

The lessons from the implementation of multiple trading relationships could also be helpful in Colombia or the Netherlands,[35] where the restriction of only contracting with a single supplier also remains. However, in Colombia, it would first be vital to promote more competition in the retail sector, as although the retail market is legally liberalised, the market, in reality, is not competitive and consumers can only deal with the incumbent retailer. Hence, it is critical to promote greater competition in the retail market so that through eliminating restrictions on using a single supplier, the provision can be effective and useful in practice.

5.1.3 New markets

Emerging markets and business ideas are challenging the wholesale and retail market. The new products, actors and locations are challenging the structure of energy markets, and therefore, they demand the creation of channels to integrate the advantages of new actors interacting in the electricity system. It is worth stating that these new markets' spaces create a more complex structure in regard to offering services and the actors

[35] Butenko, above n 15, at 711.

involved. Some of the new markets discussed by Parag and Sovacool[36] when analysing the design of the market for a prosumer era are: peer-to-peer models, local markets and prosumer to grid models.

Peer-to-Peer model (P2P): Inspired by sharing economy concepts, this model aims to remove the supplier as an intermediary and instead use third-party platforms where prosumers can trade with each other.[37] The P2P has been used traditionally for large transactions between large generators and large customers through bilateral agreements using the transmission grid, whose application can now also be extended to transactions using the distribution network. For such service, Parag and Sovacool, when analysing the design of the market for a prosumer era, point out that the distribution company will receive a management fee plus a tariff for the distribution function, depending on the distance between the provider and consumer. This market also allows other kinds of transactions, e.g. one agent generating electricity and another one storing it. Nowadays, P2P has gained attention thanks to block-chain platforms that affirm they can provide information about where the energy is taken and injected to, promising more stable grids and networks.[38]

There are different international examples of P2P online platforms that enable transactions between prosumers and consumers. One example is the Netherlands-based Vandebron, which has launched a platform that enables households to buy green electricity directly from a local business. Vandebron is an energy marketplace started in 2013 which enables households or businesses to choose whom they want to buy energy from. The platform shows the different energy resources and the price per month. The customers can choose which small business they want to buy from and support, instead of buying from large energy companies. Currently, Vandebron has more than 100 resources of energy distributed throughout the Netherlands and more than 100,000 connected households.[39] In this business model, Vandebron acts as an

[36] Yael Parag and Benjamin K Sovacool "Electricity market design for the prosumer era" (2016) 1 Nature Energy 1 at 3.
[37] Donal Brown, Stephen Hall and Mark E Davis "Prosumers in the post subsidy era: an exploration of new prosumer business models in the UK" (2019) 135 Energy Policy 110984 at 110986.
[38] GTM "Peer-to-peer energy trading still looks like a distant prospect" <www.greentechmedia.com>
[39] Vandebron "Good energy Vandebron" <www.vandebron.nl/about>.

energy retailer and is the intermediary for the energy transaction because the Netherlands legislation requires so.

Another example is Piclo in the United Kingdom. The company "Open utility" launched a P2P marketplace for local renewable energy known as Piclo. This web-based service connects local renewable generators directly with customers and helps them to shift from the traditional utility company to help and support local community projects.[40] The first trial of Piclo was launched on 1st October 2015. For the first time, business consumers, such as the Eden Project, could buy its electricity directly from the source. This project is partly funded by the Department of Energy and Climate Change and is supported by other industry experts.[41] The web marketplace also offers distribution system operator flexibility services call Piclo Flex and is looking into innovative peer-to-peer grid charging models. Also, South Korea, according to Juyong, has allowed prosumers to engage in trading through P2P between neighbours in a micro-grid as a way of invigorating the electricity market, since 2016. [42] In Colombia, there is currently a P2P pilot project in which the developers are using blockchain technology to enable transactions between 14 households located in different areas of the city of Medellin. In some households located in low income areas solar panels were installed. Their energy surplus will be sold to other households located in high income areas. The project is being developed by the platform providers "Transactive Energy Colombia" in association with the distribution company, EPM.[43]

Local markets: The local energy market is an emerging concept related to the decentralisation of energy generation. In such a context, 'local' refers to the smallest geographic denominator of a market, in which the production and consumption take place close to each other. The locality can refer to a town, village, neighbourhood or street. This concept recalls the term 'localism' explained in Chapter 3. A local prosumer refers to those who produce energy and consume and trade it locally. The advantages for local markets are the market integration of distributed energy generation, allowing

[40] Open Utility "A glimpse into the future of Britain's energy economy" (2016) <www.piclo.energy>.
[41] Piclo "Flexibility & Visibility: investment and opportunity in a flexible marketplace" <www.piclo.energy> at 8.
[42] Juyong Lee and Youngsang Cho "Estimation of the usage fee for peer-to-peer electricity trading platform: The case of South Korea" (2020) 136 Energy Policy 111050 at 111052.
[43] Santiago Ortega "Transactive Energy: knowledge sharing with Colombia and the UK" (4 October 2019) UCL Institute for Sustainable Resources < https://www.ucl.ac.uk/>

participation and profit to empower consumers, reduce network costs and being able to introduce innovation through new business models and by entrepreneurs. [44] Again, the initiative of Piclo in the United Kingdom is an example of local markets meeting demand needs with closer or local renewable generators. Currently, in there, local energy is considered one of the transformative themes discussed as non-traditional business models outlined by OFGEM.[45] In New Zealand, the business model of Our Energy, explained above, can also fit into this category by aiming to match local generation and consumption in real-time. Local markets are linked to peer-to-peer transactions but differ because local markets only refer to local transactions. In contrast, with P2P, the transaction can happen between actors located far from each other.

Prosumer to grid models: In this model, prosumers are connected to a micro-grid with the option of connecting to the main grid. If connected, there is an incentive to generate more energy than needed and sell it back to the main grid. In the case of an off-grid project or 'island mode', the excess generation can be used in case of energy storage capacity. An example of this is NOBEL (Neighbourhood Oriented Brokerage Electricity and Monitoring System) funded by the European Union in Sweden.[46] Examples of this model will be studied more in detail in Chapter 6, regarding community energy.

The three chosen jurisdictions are all exploring the problems associated with integrating the above new markets. Having analysed the participation of prosumers in the retail and wholesale market and the emerging alternative marketplaces that create more opportunities for prosumers to have active and direct participation, we can conclude by stating that there is a level of regulatory disconnection between the possibility of prosumers supplying energy to other consumers and the legal entry barriers that restrict such transactions or that are tailored-made to traditional large actors. The only option for small prosumers currently is selling the energy surplus to the retailer. New business ideas and retailers have tried to find a way within the legal framework or lobbying for changes to it, to enable prosumers to sell their energy to a broader range of actors.

[44] Butenko, above n 15, at 715.
[45] Open Utility, above n 41, at 79.
[46] SICS "RISE" <www.sics.se/>.

While it can be acknowledged that, within the current legal framework, businesses have found ways to enable prosumers to sell energy to other consumers, it is crucial to open the retail market further and allow new entrants to join. That is the case of online platforms allowing local matching, without the need for them to operate as a traditional supplier. Instead, the regulatory authority can regulate the service they provide, for what it is and offers. In this regard, the Multiple Trading Scheme is an interesting project that can further invigorate the New Zealand retail market, and both the Netherlands and Colombia can learn from such experience.

5.2 Remuneration of Prosumers for their Energy Surplus

What remain to be discussed is the price of that energy and how much the prosumer should get paid for it. This section will also discuss who decides on the value of the energy. Is it the market, a market participant or the regulator?

Roberts[47] rightly argues that remuneration should be fair and based on the energy and services that the prosumer provides to the system. One example of such statement was included in the European Directive 2018/2001 which states that self-generators have the right to receive remuneration for the self-generated electricity which is fed into the networks reflecting its market value.[48] There are several models to remunerate prosumers: net-metering, feed-in tariff, net billing, auctions and fixed-price.

5.2.1 Net-metering

Net-metering is a scheme that offers strong incentives to consumers to become prosumers. In general, it refers to balancing the amount of energy that is delivered to the network with the total energy consumption. In principle, the balance between what is self-generated and what is consumed means that electricity produced by prosumers will receive the same retail price for each kilowatt-hour of power consumed. It is worth remembering that retail prices usually are much higher than wholesale prices because retail prices include the cost of the different chain activities, i.e. generation,

[47] Roberts, above n 1, at 32.
[48] Directive 2018/2001 (EU), art 21(2).

transmission, distribution, metering, retail costs and profits.[49] As Iliopoulos[50] explains, net-metering implies a higher price to be recognised by the retailer and compensation that is higher than the real value of what is offered by the prosumer.

Let us take an example. In January Nicole's solar panel had an installed capacity of 600 kWh, and her energy demand for the month was 900 kWh. It means that she withdraws 300 kWh from the network. In February, Nicole had the same capacity (600 kWh), but she was not at home most nights, so her energy consumption was only 400 kWh. The energy surplus (200kWh) was fed into the network. The electricity bill is bi-monthly, so at the end of these two months, what she took from the grid (300kWH) and what was injected into the grid (200kWh) was balanced out, and Nicole only has to pay for 100kWh. However, the price of energy in January, when the energy was withdrawn, was different from February when she fed energy into the grid. Such a difference in price and timing results in some positive and negative effects that will be explored in the next paragraphs.

Net-metering requires the installation of a bidirectional meter which measures the flow of electricity to and from the customer. It applies only to grid-connected systems. The meter runs forwards or backwards depending on consumption or generation. For example, when the prosumer generates more electricity than is consumed, the meter runs backwards and, at the end of the billing period, if the injected power is more than that consumed, the utility compensates for it at the end of the period. This is the basic idea behind net-metering; nonetheless, the complexity and extra advantages or limitations vary between jurisdictions. In general, net-metering policies vary in terms of (i) the size, (ii) the rollover period, (iii) the limits on the energy load, and (iv) the level of compensation for the excess energy supplied to the network.

Restrictions to net-metering based on size could imply different features depending on each country. For example, in the United States, the size limitations among the states

[49] Melissa Powers "Small is (still) beautiful: designing U.S energy policies to increase localized renewable energy generation" (2012) 30 Wisconsin International Law Journal 595 at 599.

[50] Theodoros G Iliopoulos "Regulating Smart Distributed Generation Electricity Systems in the European Union" in Leonie Reins (ed) *Regulating New Technologies in Uncertain Times* (Springer, Berlin, 2019)153 at 160.

range between 10 kW and 80 MW.[51] In the Brussels region of Belgium, only prosumers supplying up to 5kW are eligible for net-metering.[52] In Colombia, only small generators using alternative renewable resources with a capacity of less than 1MW can benefit from net- metering. Such size restrictions question whether a large prosumers can be benefited by special remuneration schemes. It also make us think about which type of prosumers the legislation and policy want to encourage.

Differences in the rolling credit timeframe also need questioning, that is, how long can a customer keep rolling their excess credit onto their next account? According to Barraco,[53] the answer to this question suggests there is an obligation on the energy company to maintain a balance sheet allowing the customer the benefit of carrying forward the credit indefinitely. This time frame can be an hour, a day, a month or a year. A more extended period means lower consumer bills. In this sense, net-metering works as a kind of virtual energy storage and, depending on the length of that period, can either discourage or promote self-generation and even affect the income of the distribution and retail companies. With regard to affecting distribution companies, there are studies cited by the European Parliament[54] that demonstrate that more extended netting periods cause a decrease in the distribution company's incomes and larger cross-subsidies. Such consequences are expected because generally in net-metering programmes there is no distinction between peak and non-peak periods affecting distribution company finances. Other side effects of net-metering will be explained in further paragraphs.

In respect of the limit on the energy load that a utility company has to offset, in the Netherlands, small consumers can offset their total production against their total consumption annually, with a cap of 5,000 kWh. [55]

[51] Heather Payne "A tale of two solar installations: how electricity regulations impact distributed generation" (2016) 38 U. Haw. L.Rev 135 at 140.

[52] Andreas Poullikkas "A review of net metering mechanism for electricity renewable energy sources" (2013) 4 International Journal of Energy and Environment 975 at 979.

[53] John V Barraco "Distributed energy and net metering: adopting rules to promote a bright future" (2014) 29 Journal of Land Use & Environmental Law 365 at 370.

[54] European Parliament *Electricity Prosumers* (European Parliament, Brussels, 2016) at 29.

[55] Martha Roggenkamp "Energy Law in the Netherlands" in *Energy Law in Europe: National, EU and International Regulation* (Oxford University Press, Oxford, 2016) 725 at 739

In respect of the compensation for the excess of energy supplied, there are three different scenarios:

1. Self-generation and consumption are the same. In this case, the electricity bill is zero.
2. Self-generation is less than consumption, which implies taking energy from the network. In this case, the units of self-generation are discounted from that consumed. For instance, the installed capacity of Nicole's generation was 500 kWh and her energy demand was 800 kWh. Hence, Nicole has to pay for the difference (300 kWh) at the retail price.
3. Self-generation is more than consumption, which implies injecting the energy surplus into the network, e.g. Nicole's generation has a capacity of 800 kWh, but she only consumes 400 kWh. Nicole decides to feed that energy into the grid. But at what price? Contrary to Iliopoulos'[56] views that net-metering policies imply that the credit offered is equal to the retail rate, net-metering policies around the world provide different solutions. Such solutions range from creating a positive balance for the next bill, or only applying the spot price and others who apply the retail price. For instance, some countries compensate at a much lower rate, valuing the electricity based on the costs that the utility would have incurred had the electricity been delivered to the customer.[57] Other systems apply when time-of-use tariffs exist, and the calculation is more complex because the off-peak generation is credited against the off-peak consumption and likewise for peak times.[58] Alternatively, for instance, in the Flanders Region of Belgium, there is no financial compensation when the energy exported is more than that imported.[59] In the Netherlands, prosumers receive a fixed price for their energy which will vary depending on the retailer. This price is generally lower than the retail price.[60] Colombia applies the spot price as will be explored later. All previous scenarios contrast markedly to some states of the United States, such as California, Colorado and Delaware, in which the utility pays the retail price for the surplus.[61] Although the last scenario suggest a good revenue

[56] Iliopoulos, above n 51, at 163.

[57] Barraco, above n 54, at 372.
[58] Payne, above n 52, at 142.
[59] Poullikkas, above n 53 at 976.
[60] Butenko, above n 15, at 770.
[61] Payne, above n 52, at 141.

> for the prosumer, it is burdensome for the retail company because it has to pay the retail price for the energy that can be bought much cheaper in the wholesale market. The extra price that the retailer pays to prosumers would be later recovered from other customers through more expensive electricity bills.

As is to be expected, net-metering has faced some criticism. Powers[62] argues that net-metering is not sustainable in the long term since it ignores the time-price of electricity (the prosumer pays and receives the same price regardless of system conditions). For this reason, it is vital that net-metering exposes the prosumer to real-time prices from the wholesale market. Doorman and de Vries[63] points out that net-metering avoids network charges because there is an implicit subsidy which can lead to grid distortion. They argue net-metering is a subsidy given to those who can invest in such devices and therefore, becoming a financial burden for the system and for those who do not have space or lack financial resources to get a generation device. Rasking[64] also agrees with the negative impacts of this scheme by stating that the higher cost of electricity resulting from the widespread use of subsidies like net-metering, increases the electricity bill for a large portion of consumers who do not have the option of installing solar panels, e.g. low-income consumers. In the United States, for example, the debate is about whether net-metering policies subsidise private solar owners by forcing non-solar ratepayers to pay fixed grid costs that otherwise are attributable to them. On the other hand, manufacturers and sellers of solar PV argue that cutting back net-metering policies will strangle their ability to compete with local utilities in supplying power to consumers.[65]

Such criticisms were taken into account in the European Directive 2019/944,which requires Member States that have existing schemes that do not account separately the electricity fed into and consumed from the grid (which is the case of net-metering), shall not grant new rights after 31st of December 2023.[66] Such provision recognises the

[62] Powers, above n 50, at 600.
[63] Gerard Doorman and Laurens de Vries "An Electricity Market Design Based on Consumer Demand for Capacity" in *Design the electricity market of the future* (European University Institute, Florence, 2017) at 49
[64] David Rasking "Getting distributed generation right: a response to 'does disruptive competition mean a death spiral for electric utilities?'" (2014) 35 Energy Law Journal 263 at 266.
[65] Harvey L Reiter and William Greene "The case for reforming net-metering compensation: why regulators and courts should reject the public policy and antitrust arguments for preserving the status quo" (2016) 37 Energy Law Journal 373 at 379.
[66] Directive 2019/944 (EU), art 15 (4).

market distortions that net-metering creates and suggests the separate account of the energy that goes in and out of the network. In my view, the setting of a date ending the granting of net-metering rights recognises that, although this incentive mechanism is used to boost participation of prosumers in the market, it is also a burden for the system. In the long term, net-metering creates distortions and extra costs for traditional consumers, who cannot afford to buy generation devices and instead have to continue paying increasing electricity bills.

It is useful here to explore in more detail the net-metering schemes in the Netherlands and Colombia. In New Zealand, there is no net-metering and instead, the regulation of New Zealand uses a different scheme in which the retailer decides how much to pay for the energy, as will be explained later in the section discussing fixed prices.

5.2.1.1 The Netherlands' net-metering

In the net-metering scheme in the Netherlands, household consumers can offset their total production with their total consumption annually, with a cap of 5,000 kWh.[67] Such provision sets a limit on the energy load that can be balanced out annually. As Butenko explains, the prosumer receives a fixed price for the energy surplus, which varies depending on the retailer. This price is mostly lower than the retail price.[68]Another characteristic of the net-metering in the Netherlands is that prosumers are only allowed to have a contract with a single supplier who acts as a single buyer at a fixed price. The supplier is obliged to accept the energy offered by the prosumer. These suppliers are responsible for metering and balancing up to 5,000 kWh of the electricity produced and consumed.[69]

The main advantage of this scheme is that it is still considered an attractive and stable incentive for promoting local production.[70] However, given it is an annual net-metering scheme, it creates price distortions because it does not reflect the time-price difference

[67] Electricity Act 1998 (The Netherlands), article 31 C.
[68] Butenko, above n 15, at 710.
[69] Martha Roggenkamp and others "EU Energy Law" in *Energy Law in Europe: National, EU and International Regulation* (Oxford University Press, Oxford, 2016) 187 at 194.
[70] Lea Diestelmeier and Dirk Kuiken "Legal framework for prosumers in the Netherlands" (2018) 12 European Energy Law Report XII at 40, at 72.

from when the energy is consumed or injected to the network. Such a problem can be overcome through the proper use of smart meters, frequent measurements and communication systems that can make net-metering or any remuneration scheme more efficient. The remuneration scheme would also have to follow the provisions of the Directive 2019/944 and start calculating energy in and out of the grid separately.

5.2.1.2 Colombian net-metering

According to law 1715 of 2014 and further regulation included in the Resolution CREG 30 of 2018, net-metering in Colombia is called 'energy credit' and is the remuneration scheme applicable to small generators (less than 1 MW) using alternative renewable resources.

When trading the energy surplus, the retailer acts on behalf of the small scale self-generator.[71] The small self-generator can sell it to either the retailer for regulated users or to other generators or traders to supply non-regulated users and to the retailer bundled to the network operator who is obliged to buy the energy.[72] Regardless of the purchaser, the remuneration is the same, in the form of energy credits and these credits are recognised within a billing cycle. The retailer is responsible for updating the standard supply contract with added provisions on purchasing energy surplus introducing reciprocal obligations.[73]

Compensation for the excess energy depends on the size of the small self-generator. For prosumers whose generation is equal or less than 100 kW, taking more energy from the network than it exports, the price would only recognises the profit margin for the retailer.[74] If the export of energy is higher than the imported, the price of the energy is the same as the spot price.[75]

[71] Resolution CREG 30 of 2018 (Colombia), art 14.
[72] Resolution CREG 30 of 2018(Colombia), art 15.
[73] Resolution CREG 30 of 2018(Colombia), art 15.
[74] The component of the profit margin is also regulated by CREG though the Resolution 119 of 2017: tariff methodology to establish electricity supplying cost to the users of the national system, where the components of the electricity bill are regulated.
[75] Resolution CREG 30 of 2018 (Colombia), art 17.

For prosumers whose generation is greater than 100 kW, each extra kWh imported from the network includes both a profit margin and also the sum of production, transmission, distribution costs, and purchase of energy and system loss. When the export is higher, the prosumer gets paid the spot price. The different energy cost for small scale generators, such as households, seems fair, giving a more favourable price than the price charged to a large self-generator. The large generator still has to contribute to the actual price of the delivery of the electricity and system losses, unlike small self-generators which only pay for the profit margin for the retailers.

In general, net-metering seems like a vital policy for encouraging prosumers, especially for small prosumers. However, it creates some market distortions and some major burdens for low-income households who do not have the money to install local generation devices. As a consequence, traditional consumers, who remain in the traditional-centralised system, have to pay increasing electricity bills. The European Directive 2019/944 is an excellent example of the limitations of net-metering and the need for it to be changed. It is therefore essential to implement more accurate use of network tariffs, smart meters and a separate measurement of the energy fed into and taken from the network.

The Netherlands and Colombia could benefit from taking into account the above European perspective, although some lessons can also be learned from both countries. On the one hand, the establishment of a cap of 5,000 kWh in the Netherlands to offset annually through net-metering, can serve as a limit up to which the system is willing to cope with extra costs. Such a limit, while allowing prosumers to be given special rates which are enough to promote self-generation, also consider the additional burdens on the system. Future regulation can take into account these caps and, based on the results, the cap can be set higher or lower, depending on what is beneficial, not only for the system but for the cost of electricity for other consumers. In consideration of energy justice perspectives, a special treatment that gives an advantage to some individuals or groups, which result in extra costs for other electricity consumers, is not desirable. In Colombia, lessons can be learned from the different legal treatment applied depending on the size of the project. Such consideration focuses on what prosumers have to contribute to the system when taking energy from the network, not what they get paid for their energy surplus. In this sense, a favorable regulatory framework applies to small

prosumers, who only pay a profit margin for the retailer, while larger prosumers have to pay for all the supply chain activities and energy losses per kWh consumed.

5.2.2 Feed-in Tariff (FIT)

The feed-in tariff policy attempts to address problems related to the high upfront cost of distributed generation technologies by providing a guarantee of return on the investment and ensuring connection to the network. This is quite different from net-metering, where there is no certainty of repaying the full cost of the investment. FIT does provide clarity and stability concerning revenue over the years and, in the end, it will be able to recover full costs and receive some profits.[76] In FIT, the retailer offers a long term contract to the prosumer of between 10 to 25 years (time needed to recover the investment), offering a higher price for the energy that is exported to the grid than the retail price. At the same time, prosumers will pay the retail price for the power that they consume from the network.[77]

Germany is the country where the FIT scheme is more commonly employed. The scheme pays full retail rates or even more and guarantees priority access to the network. Also, in some states of Australia, such as Victoria, FIT is the norm where the premium price can be three times higher than the retail price.[78] According to the European Parliament, [79] the main problem associated with FIT is that it increases the electricity bill for other consumers by cross-subsidies and distorts the energy market. For instance, some critics of the Energiewende Programme in Germany, which includes FIT for households and large renewable generators, suggest that such schemes have more than doubled the electricity bill and destabilised the grid.[80] Barton and Campion,[81] considering an energy justice perspective, correctly argue that FIT is strongly regressive if the extra costs are paid for by households instead of industries. Therefore, where a country selects FIT as a scheme to remunerate and incentivise prosumers to generate

[76] Powers, above n 50, at 600.
[77] European Parliament, above n 55, at 30.
[78] Poullikkas, above n 53, at 977.
[79] European Parliament, above n 55, at 31.
[80] Rasking, above n 65, at 267.
[81] Barry Barton and Jennifer Campion "Energy Justice and the Design of Climate Change Legislation: Avoiding Regressive Measures" in I. Del Guayo and others (eds) Energy Justice and Energy Law: Distributive, procedural, restorative and social justice in Energy Law. (Oxford University Press, Oxford, 2020).

and sell their energy to the market. The scheme has to be configured in a way that the increase in energy costs for others does not affect small consumers such as households, small businesses and, vulnerable consumers.

5.2.3 Net billing

For this model a smart meter is needed to measure the current flows in each direction (electricity withdrawn and electricity injected into the grid) and tabulate them separately. Separate accounts of both flows are needed since each flow will have a different pricing mechanism. At the end of the billing period, the energy used from the network will be charged at a retail price, and the energy injected may receive a remuneration which can be the wholesale market, FIT or fixed price (lower than the retail price).[82]

Net billing is used in Argentina, where prosumers receive an injection rate for each kilowatt-hour delivered to the distribution network. The price of the injection rate will be established by regulation according to the seasonal price corresponding to the type of user, whether they are a household, business or industry.[83] In the electricity bill, the volume of the energy demanded is distinct from the energy injected into the network, and the prices adjusted accordingly to each kilowatt-hour.[84] As a consequence, the prosumer has to pay the net calculation between the monetary value of the energy demanded and the energy injected before taxes.

The European Commission recommends net billing since it offers incentives for self-consumption and a fair distribution of network costs.[85] Thus, the price of the energy corresponds to the actual price of each activity (injecting or exporting energy at particular time).[86] It is critical to argue that for this scheme to work, the correct implementation and setting up of smart meters is vital, so the price of the consumed

[82] Roberts, above n 1, at 37.
[83] Law 27,424 (Argentina), arts 11A and 13.
[84] Law 27,424 (Argentina), art 11C.
[85] European Commission *Best Practices on Renewable Energy Self-consumption* (European Commission, Brussels, 2015) at 8.
[86] Directive 2019/944 (EU), art 15 (4).

and injected energy also reflects time-market prices and encourages self-consumption during peak hours.

5.2.4 Auctions and tenders

In the traditional electricity system, auctions are a method of allocating FIT or power purchase agreements in large renewable energy projects or capacity payments to encourage the construction of more generation plants. Although auctions cannot be directly applicable for small scale projects in terms of size and financial and technical requirements, the introduction of an aggregator can address such barriers.[87] The aggregator can pool both the electricity generated by prosumers or the demand reduction and act as a single entity when participating in auctions or tenders. Aggregators have a significant role to play as an intermediary between customer groups and the market by creating a level playing field for customers. Colombia missed the opportunity to extend the auction mechanism oriented to promote long-term contracts for non-conventional renewable energy and apply them to self-generation and local generation. The terms of the auction failed to incorporate self-generators as possible participants in the auctions since only wholesale market participants, such as generators and traders, can participate in it. [88] Self-generators cannot therefore participate directly in the wholesale market but only being represented by traders or generators. However, this was not the case in the auction held in October 2019, where results showed the priority given to centralised generation projects

5.2.5 Fixed price

In a liberalised traditional electricity sector, in case there is no regulation regarding special remuneration schemes for the energy surplus of prosumers such as net-metering, feed-in tariff nor net billing, the retailer (in the case of small prosumers) can establish the price and conditions. This is the case in New Zealand where small prosumers are only allowed to sell the energy surplus to the retailers trading on the local network where the prosumer installation is located.[89] Nevertheless, there is no duty to purchase

[87] European Commission, above n 86, at 7.
[88] Resolution MME 40590 of 2019 (Colombia), art 30.
[89] EIPC 2010, s 14.4.

such electricity or control how much will be paid. Usually, the price paid for the energy surplus is called the 'buy-back rate', which is set by the retailer and is often much less than the retail rate of electricity.[90] These lower prices may be explained by the additional costs that retailers incur, such as transmission, distribution, billing, administration charges and metering together with the profit for the retailer, which are added to the wholesale cost of electricity. The rates vary from retailer to retailer and finding the best price available is the job of the prosumer. The right to shift the retailer becomes essential when it comes to finding the best deal. This scheme may not create the necessary incentives for customers to self-generate because there is no certainty over the outcome in terms of return rates and conditions. While the retail price of kWh in New Zealand is around 22 cents, the fixed price or buy-back rate paid by retailers to prosumers ranges between 7 and 12 cents, depending on the retailer. [91] This is a huge disparity that discourages consumers to become prosumers.

Overall, it is reasonable to conclude three crucial factors when establishing a remuneration model for prosumers. The first point to consider is whether the scheme will ensure the prosumer can recover the investment made when buying the generation device in the medium or long term and maybe allow some profit. This is vital because it is an economic incentive for consumers to become prosumers. A second aspect is market distortions that the system can stand and overcome when promoting prosumers and for how long such special treatment should be in place. This decision can be made by the regulator and by the government guiding those actors. A third part is when choosing a scheme that results in extra costs for the system. The extra costs should not burden other households by charging those more to incentivise those who have the financial capabilities to purchase a generation device. Also, vulnerable customers need special protection. Such extra costs create inequalities for other consumers, which are not coherent with concepts of energy justice and should be avoided.

5.3 Participation of Demand Response in the Market and a remuneration Scheme

[90] Energywise EECA *Power from the people: a guide to micro-generation* (EECA Energywise, Wellington, 2010) at 19.
[91] Mercury, above at 30.

Demand response (DR) is the reduction in demand in response to a price signal from the grid or network.[92] Either higher prices or economic rewards are used to influence consumer behaviour and incentivise the reduction of consumption at particular times, either as an emergency method to respond to an energy supply crisis or to improve energy consumption habits.

Theoretically, DR can occur in both the wholesale and retail markets. Legally, the possibility of it happening in both markets is recognised, for instance, in Europe in the Energy Efficiency Directive which requires the Member States to ensure demand response can happen in both markets. [93]The Directive also promotes access to and participation in demand response in balancing, reserve and other system service markets.[94] However, as will be shown, DR is more common in the wholesale market directed to larger customers who traditionally are able to respond to price signals.

5.3.1 Wholesale market

Demand response in the wholesale market has two main objectives: to be available for economic reasons or in an emergency. In Emergency Demand Response, customers agree to be on call to reduce electricity demand when the system requires it, mostly when the system is under stress; for example, during the summer when it is hot, and everyone is using air conditioning or in winter when it is very cold and everyone has the heater on. Traditionally, the way of managing the highest peak is by turning on more power plants to meet the high demand. In this case, emergency DR is a cheaper substitute reducing the demand at peak times.[95] Two methods of remuneration are available. First, customers are paid monthly to be available and, in return, customers must participate when the market needs them to reduce consumption. Second, customers receive a monetary incentive for their participation, allowing disconnection of specific devices. For example, a DR programme might use sensors on large residential appliances such as heaters or air conditioners controlled over the internet to reduce use during a specific period.

[92] Sharon B Jacobs "The Energy Prosumer" (2017) 43 Ecology Law Quarterly 519 at 525.
[93] Directive 2012/27 (EU), article 15(8).
[94] Directive 2012/27 (EU), article 15(8).
[95] Joel Eisen "Who regulates the smart grid? FERC's authority over demand response compensation in wholesale electricity markets" (2013) 4 San Diego Journal of Climate & Energy Law 69 at 74.

In New Zealand, Transpower, the transmission company, uses demand response programmes to reduce the need to invest in transmission upgrading. In 2015 this programme was used during peak times where participants were asked to reduce their demand and, in exchange, received payment. Currently, Transpower is carrying out an active demand-response trial programme. This programme requires consumers to register their interest in participating. They sign into a mobile app and receive advance notice of an upcoming event which requires reduced demand. There is no obligation to accept an event offer, and consumers only receive a payment for the actual reduction. This programme is specially directed to industries involved in agriculture, food processing, commerce, education or healthcare.[96]In the case of Colombia, Resolution CREG 011 of 2015 establishes the regulation applicable for demand response in situations of 'critical conditions'. This expression means when the spot price is higher than the scarcity price, which mostly reflects the scarcity of hydropower resources. This regulation applies to users who willingly choose to participate in demand response programmes. The retailer represents their loads in the wholesale market.

On the other hand, in Economic Demand Response, customers agree to reduce their consumption and are compensated based on the decrease in their electricity load. Price signals allow consumers to modify their demand when the wholesale market price is too high. Their consumption would shift from peak time, which is more expensive, to some other time during the day when the consumption of energy is cheaper. On this point, it is key to understand the importance of dynamic pricing in sending strong incentives to customers to move demand.

For instance, in New Zealand, there is a programme called 'Interruptible load', where industrial and commercial end-users receive payment for reducing consumption by the distributor. Some distributors rely on this mechanism to regulate their system peaks.[97] The regulatory response from the Electricity Authority to these programmes was at first passive. Later, after an express request from Transpower to the Electricity Authority

[96] Transpower "Demand Response Programs" (May 2017) Transpower.co.nz <www.transpower.co.nz>.

[97] IEA *Energy Policies of IEA Countries - New Zealand 2017 Review* (International Energy Agency, Paris, 2017) at 25.

asking for guidance for dealing with demand response programmes, the Electricity Authority decided to set out some principles. This is known as a principle-based regulation approach. Such principles should apply to demand response initiatives but are not binding. These principles were first set up in 2015 and later updated in 2018. There are four principles: (i) best-possible incentives, which require that the incentives for demand response reflect the marginal benefit to the electricity system; (ii) openness, which implies opening the market to demand response wherever practical; (iii) choice, which refers to the recognition that the consumer should be free to contract with third parties on their behalf without too many restrictions; and (iv) transparency about access to quality information for deciding whether or when to offer DR. These principles suggest that demand response should not be pushed at all costs into the energy market, but instead encourages electricity companies to find financial or technical ways to open the way for consumers to contract directly with aggregators without the approval of the retailer.

Taking a similar approach, the European Directive 2019/944 on common rules for the internal market provides an example of the elements the regulator has to regulate in terms of demand response and aggregator responsibilities. Firstly, outlining the duty on the regulator to encourage and promote demand response for final customers on a non-discriminatory basis. [98] Beyond this general provision, the Directive secondly dictates the different aspects that regulators have to take into account when creating a legal framework for demand response and aggregators. These elements include the right for each aggregator to enter the market without consent from other market participants, clear assignment of roles and responsibilities, and rules and procedures for data exchange between market participants and market mechanisms for the participation of demand response.[99] The regulatory authority, in establishing these elements, should take into account the transmission system operator and distribution system operators in close cooperation with aggregators and final customers. Besides, suppliers cannot penalise customers for having contracts with aggregators. The aggregator also needs to be financially responsible for any resulting imbalances in the system.[100]

[98] Directive 2019/944 (EU), art 17.
[99] Directive 2019/944 (EU), art 17.
[100] Directive 2019/944 (EU), art 17(4).

An interesting final European provision is that the customer participating in demand response programmes shall pay a financial compensation to other market participants. [101] The aim of the compensation is to cover the resulting costs incurred by the supplier during the activation of demand response. Although the provision says that such compensation should not create a barrier to market entry by participants engaged in aggregation or a barrier to flexibility, the question that arises is why the provision established the duty to pay compensation by the final customer instead of the aggregator. This in fact can be seen as a regulation imposing the duty to compensate traditional market players by emerging actors justified by the creation of imbalances. Time is needed to understand the factual implications of this provision and how it will affect the final customer's decision to engage in demand response. Also, this provision does not clarify whether it is only applicable to large final customers or whether small final customers or households also must pay compensation. It is important, therefore, to undertake a proportionality test between the need to compensate for imbalances created in the system and the promotion of the consumers to participate in demand response programmes.

The European and New Zealand perceptions of how demand response should be regulated have common aspects and a difference. The common aspect for both countries' regulation is the aim for encouraging more actors to participate in demand response and contract with aggregators. The difference is the cost incurred by suppliers when activating demand response. It seems that the New Zealand approach, when referring to the introduction of demand response is, 'wherever possible', referring to the ability of industry participants to use demand response without pushing the market or creating large burdens on other market players (e.g. imbalances on the grid). This is different from the European perspective, in which the option that participants of demand response (final customers and aggregators) pay financial compensation to other market participants (e.g. retailers) seems to foresee the creation of large burdens on the systems, which have to be compensated for those who create them. In New Zealand it seems that it is not desirable to have these extra costs and burdens, whereas in the European Union any imbalances are compensated by the parties involved. For both economic and emergency demand response in the wholesale market, the industry

[101] Directive 2019/944 (EU), art 17(4).

participant who mainly represents these reductions is called the 'aggregator', which deserves special consideration in the next section.

5.3.2 The role of the aggregator

The aggregator is the industry participant who represents combined reductions of consumption in the market. In New Zealand, the 'load aggregator' is a person who contracts with one or more consumers to change their consumption voluntarily. [102] Then, the aggregator can offer the combined increase or reduction as interruptible load or as collective demand, either in the wholesale electricity market or under any other bilateral agreement or contract. Such an approach differs from Colombia, where there is no role for an aggregator. However, the regulations establish that anyone who represents demand load reduction of a user or group of users in the wholesale market is the retailer or supplier.[103]

Firms such as EnerNOC, now known as EnelX,[104] Comverge and Viridity,[105] work as intermediaries for the wholesale market and their portfolio consists of demand response under contracts with business and commercial customers to curtail electricity use. They usually operate in countries such as the United States, New Zealand or Canada. Traditionally, business and commercial customers are more familiar with DR and feel more comfortable with the business idea behind it. However, recently, such aggregation companies are starting to open the door to the retail sector and small consumers offering products tailored to households.[106]

These demand response firms have hardware and software to manage price signals and demand reductions. Usually, the company offers the means for the consumer to finance and install the system and a technological solution designed to manage and control the response to price signals. For instance, the firm installs a programmable thermostat to reduce demand from specific devices at a given price signal. The technology might also

[102] Electricity Industry Act 2010, s 5.
[103] Resolution CREG 011 of 2015 (Colombia), art 5,

[104] For more information: www.enelx.com/en
[105] For more information: www.viridityenergy.com
[106] Eisen, above n 96, at 74.

allow consumers to retain some control over the devices. Such a possibility is a big factor in terms of empowering consumers in the electricity sector.

The challenges for aggregation are mostly in terms of the responsibilities and the relationships with other actors, where there is not conventional regulation but bilateral contracts. The relationship of the aggregator with a retail company can imply that the retailer asks the aggregator to curtail certain bulk power whenever required to so, and for that service, the aggregator would be rewarded. Such a reward can be either a fixed reward against its services or based on a dynamic pricing model.[107] The relationship between the aggregator and the final customer could now happen easily thanks to new technologies which enable the controlling of home appliances (known as home automation). However, incentives and effort are required to attract consumers for demand response, which means that the aggregator is allowed to directly control the consumers' dispatchable loads during peak hours. Some of the incentives used to attract consumers are a fixed price for the load reduction, or dynamic pricing mechanism in which the consumer is rewarded with a price based on real-time electricity markets.[108] Another important interaction is between the aggregator and the wholesale market. One of the challenges for aggregators is to be able to sustain and control demand reductions for extended periods, similar to generation plants which are required to be able to compete in the market and not just provide reductions for shorter periods. In this sense, as Eisen[109] argues, there is a need for a strong relationship with other market participants, such as the retailer and generators, including providing back-ups, to ensure energy security.

5.3.3 The Retail market

The retailer can offer different programmes, including a dynamic pricing scheme that makes consumption of electricity more expensive in peak times or enable companies to pay the customer for reducing consumption, especially at peak times. Demand response in the retail market challenges the traditional pricing scheme, which tends to offer a

[107] Muhammad Babar and others "The conception of the aggregator in demand side management for domestic consumers" (2013) 2 International Journal of Smart Grid and Clean Energy 371 at 372.
[108] At 373
[109] Eisen, above n 96, at 75.

fixed retail price per kWh, isolating end-customers from the wholesale price variations during the day.[110] In the retail market, two factors are essential to encourage demand response. These are dynamic pricing and the correct set-up of the smart meter to allow an awareness of how much energy is consumed. The awareness about the price of the energy at a specific time and the best moment to consume or do a specific task is vital for the promotion of demand response. An example of this would be deciding at what time of the day is cheaper to use the washing machine or the dryer. A regulatory example in the European Union is found in the Energy Efficiency Directive which states that network or retail tariffs 'may' support dynamic pricing for demand response measures by final customers.[111] As Roberts[112] argues, consumers should have the right to be offered a tariff by their supplier or distribution company that allows them to engage in demand response, e.g. through fixed or dynamic time-of-use, based mainly on usage and redistributed network usage charges.

However, not all retailers or local utilities offer demand response programmes, and many of those who do focus on programmes for larger commercial and industrial customers, as opposed to residential customers. Also, the retail market's compensation for demand response is irregular and is almost always lower than wholesale market compensation.[113] For instance, Contact, a generator-retailer company in New Zealand, uses a demand flexibility tool with 12 businesses which allows them "to automatically cut energy use from equipment such as pumps, fans and compressors when grid demand is high".[114] Therefore, the businesses are more flexible when using power and, for this reduction, they get paid. However, this initiative is only available to commercial and industrial customers.

5.3.4 Remuneration

When thinking about the remuneration for demand response programmes, it is important to ask how much is paid to the customer for a demand reduction. Eisen[115]

[110] At 76.
[111] Directive 2012/27/EP (EU), annex XI (3).
[112] Roberts, above n 1, at 40.
[113] Jacobs, above n 93, at 523.
[114] Energy News "Smart software helps Contact customer load-shift" (13 December 2019) <www.energynews.co.nz>
[115] Eisen, above n 96, at 74

discussed the case that occurred in the United States when, in 2011, the Federal Energy Regulatory Commission (FERC) issued Order 745 which required wholesale energy markets to compensate demand response at the same price as the electricity bid in the market. This issue, at the time, resulted in a significant controversy between the different market participants and traditional providers. At the time, the role of the FERC was only seen as fostering competition and promoting the sale of electricity at the lowest cost. However, in this case, it was seen as changing the basis of the wholesale market by promoting less consumption of electricity at peak times. The decision also challenged the traditional idea of 'consumer', with the emerging concept of prosumer that not only consumes energy but offers grid services.[116] This scheme recognised the efficiency of demand response in the market by stating that reducing demand is as efficient as producing energy.

In New Zealand, it is mainly the distributor operator who establishes the price for the DR programme, and the customer decides whether or not to participate. The Guiding Regulatory Principles established by the Electricity Authority recommend that the incentives to demand response should reflect the marginal benefit for the electricity system.[117] It means that incentives should reflect both consumers' willingness to pay for electricity and the costs of supplying it. In Colombia, it is the retailer or supplier who offers reductions to the wholesale market, and the market operator decides whether it is cheaper and efficient to buy such reductions compared to the energy bid.[118]

In general, it can be agreed that demand response offers a new product in the energy market: the reduction of consumption, which was named by Amory Lovins[119] as 'negawatts', referring to the units of energy saved. This new product (energy that is not consumed) can contribute, to various degrees, to solving the security of the supply problem and, as such, should be allowed to be included in the different energy markets on a level playing field. Its integration in the markets should recognise not only the outcomes for the energy market but the environmental benefits by avoiding the production of more energy than is necessary. The need to expand DR programmes

[116] Jacobs, above n 93, at 526.
[117] Electricity Authority *Guiding Regulatory Principles for Demand Response—2018 Update: Guidelines* (Electricity Authority, Wellington, 2018) at 15
[118] Resolution CREG 011 of 2015 (Colombia), art 10.
[119] Amory Lovins "The Negawatt Revolution" (1990) 27 Across the Board at 20.

beyond large customers and make them more accessible and attractive for businesses to introduce to households and small businesses is a must. Smart meters and the introduction of real-time pricing that connect consumers with wholesale market prices or price signals that communicate when it is better to consume will create enormous benefits in the system by efficient use of it. The market must create the correct signals and incentives that are backed-up by the regulator to promote pricing of DR that encourages a broader range of participants. An attractive incentive would be to pay the unit saved at the same price as the unit produced.

Having explained the importance of guaranteed access to relevant markets for prosumers and the need for fair remuneration for the services they provide, the next section will introduce some special provisions and legal responses required for small prosumers to be treated fairly in the market.

5.4 Consumer Rights and Small Prosumers

Josh Roberts,[120] in 2016, in his work commissioned by Greenpeace and submitted to the European Commission, recommended a dedicated prosumer rights framework to promote active participation by consumers in the energy market. One of his recommendations was to guarantee that prosumers maintain their traditional consumer rights. This recommendation was incorporated into the Renewable Energy Directive which states that 'renewable self-consumers' are entitled to maintain their rights and obligations as a final consumer.[121] From this provision, multiple questions arise. What are the implications of maintaining the rights and obligations of final consumers? Are there special rights for energy consumers that are also relevant to be extended to prosumers? Are there special rights that prosumers should be entitled to? Which obligations should also be extended to prosumers?

One can begin by saying that knowing and understanding consumer law is vital in this area as it deals with the relationship that comes from the supply and use of goods or services. One of the topics dealt with in consumer law is consumer protection. This

[120] Roberts, above n 1, at 38.
[121] Directive 2018/2001 (EU), art 21.

addresses the general principles and rules governing and protecting consumers concerning problems of supply that affect consumers.[122] The special protection that consumers need, according to Hadfield and others,[123] relates to the risks in the market where there is not enough competition. As a consequence, consumers may be misled or taken advantage of because they lack bargaining power or are not well informed. Smith,[124] instead, considers that even in competitive markets, there is no guarantee of consumer protection, and they can instead result in unfair practices. He considers that is the nature of the goods and services and the cost of obtaining and processing information that leaves consumers in a poor bargaining position. [125] Regardless of their position in competitive markets, the law recognises the insufficient bargaining power or the lack of information for consumers that can lead them to make wrong decisions, especially small consumers. Consumer law establishes a legal framework to balance the trading relationship. In the case of electricity, consumer protection law becomes relevant, particularly in liberalised countries where retail market competition is introduced. According to Barton,[126] this is because the technical issues of the industry and fraudulent practices of marketers can puzzle consumers and mislead them.

Small consumers wanting to become prosumers also have to deal with the electricity industry on unequal terms. Due to small prosumers having reduced bargaining power, their interactions may result in excessive charges or conditions affecting their desire to become a prosumer or continue being one. Three examples of disproportionate and unfair terms affecting small prosumers are: the possibility that the retailer stops supplying energy as a back-up resource to the prosumer; no representation from consumer protection bodies and complicated administrative procedures.

In considering such issues, first, there is a need to address whether the current regulatory provisions facilitate an active role for consumers without 'penalising' them

[122] Muldri Pudamo James Pasaribu and Ningrum Natasya Sirait "Triangular concept of legal pluralism in the establishment of consumer protection law" (2018) E3S Web of Conferences 52 at 5.
[123] Gillian Hadfield and others "Information-based principles for rethinking consumer protection policy" (1997) 21 Journal of Consumer Policy 131 at 141.
[124] Rhonda L Smith "When competition is not enough: consumer protection" (2000) 39 Australian Economic Papers 408 at 411.
[125] At 413.

[126] Barry Barton "Risk and promise in energy market liberalization: consumer choice in buying electricity" (1999) 64 Applied Energy at 279.

through regulatory ineffectiveness, legal uncertainty or inadequate consumer protection. In doing so, this section will consider two main questions: Who is a consumer? And what are the legal implications of being a consumer?

5.4.1 Who is a consumer?

There are two terms used frequently within the doctrine and legal framework: consumer and customer. 'Customer' is a broader term which includes households, businesses, commercial and large users. On the other hand, 'consumer' refers to small customers, such as households or small businesses, with limited consumption of energy. na.[127]

In the European Union, the concept of customer and consumer has evolved after liberalisation and has recently taken on new meanings. To begin with, according to Cseres,[128] the role of the customer developed as an instrument to achieve market integration but did not evolve autonomously. Customers were seen as passive beneficiaries of free trade and regional market integration but not active agents of it. An example of this is the definition of final customer that was introduced in the Directive 2019/944, in which a final customer of electricity could be either a household customer or non-household customer. A household customer purchases electricity for his household consumption, excluding commercial or professional activities.[129] However, recently the Directive 2019/944 and Directive 2018/2001 both widen the concept of the customer to more than purchasing energy for their use. These directives introduce, for the first time, the concepts "active customers"[130] and "renewable self-consumers",[131] respectively. Both concepts refer to a final customer who generates electricity, consumes or stores their energy, and such activities do not become any part of commercial or professional activity.[132] Such new concepts recognise the reality of a more active role for consumers without limiting it to a commercial activity. However, it recognises the option for consumers to generate their energy and manage their own energy needs.

[127] Cseres KJ "The active energy Consumer in EU law" (2018) 9 European Journal of Risk Regulation 227 at 232.
[128] At 230.
[129] Directive 2009/72/EC (EU), art 2 (9).
[130] Directive 2019/944 (EU), art 15.
[131] Directive 2018/2001 (EU), art 21.
[132] Directive 2019/944 (EU), art 2 (8).

In New Zealand, there are two relevant definitions of a consumer, one provided by the Consumer Guarantees Act 1993 (CGA) and the other by the Electricity Industry Participation Code 2010 (EIPC). The definition provided by the CGA defines a consumer as a person who acquires from a supplier, goods or services for personal use without the purpose of resupplying them.[133] The CGA treats electricity as goods, supplied to consumers by retailers.[134] This definition, when applied to electricity, means that the final customer acquires the energy for their consumption. On the other hand, in the electricity regulation contained in the EIPC, the Code distinguishes between a consumer and domestic consumer. A consumer is a person who is supplied with electricity for consumption, which implies large and domestic consumers.[135] The definition of 'domestic consumer' is someone who receives electricity for personal, domestic or household use and does not intend to resupply it.[136] As outlined in these documents, the concept of the consumer from the CGA is equivalent to the concept of domestic consumer included in the EIPC and neither recognise an active consumer.

In Colombia, there are two different types of consumer who are legally postulated as 'regulated users' and 'non-regulated users'. Regulated users (consumer)[137] are those households and small consumers of energy who, due to limited bargaining power, have to agree on a supply contract of uniform conditions with the utility company. The terms conditions and prices are regulated by the electricity regulator, CREG, who has the role of protecting consumers given their unequal position within the supply contract. The position is different for non-regulated users who are large consumers of energy who have the power to bargain with generators or suppliers in a supply contract following commercial and civil law principles and rules. The prices in these transactions are not regulated but consensual.

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[133] Consumer Guarantees Act 1993, s 2 (a). consumer means a person who—
(a) acquires from a supplier goods or services of a kind ordinarily acquired for personal, domestic, or household use or consumption; and
(b) does not acquire the goods or services, or hold himself or herself out as acquiring the goods or services, for the purpose of—
(i) resupplying them in trade; or
(ii) consuming them in the course of a process of production or manufacture; or
(iii) in the case of goods, repairing or treating in trade other goods or fixtures on land
[134] Consumer Guarantees Act 1993, s7.
[135] EIPC 2010, pt 1, Preliminary provision.
[136] EIPC 2010, pt 1, Preliminary provision.
[137] Law 143 of 1994 (Colombia), art 11 and Law 142 of 1994, art 14.33.

Having referred to the different concepts and definitions related to the consumer in the chosen countries, one can affirm that those definitions, except the new one adopted in the European Union about active customers, fit into a traditional definition of consumer. Such a traditional definition only recognised consumers as passive actors who are supplied with electricity and pay for it. Therefore, it can be concluded that these definitions do not fit with the reality of an emerging active role for consumers and, given this disconnection, consumer protection rights might not cover the active consumer. As it will be argued in the next section, such protection must be extended to active consumers, especially to households and small businesses.

5.4.2 Traditional electricity consumer rights

So what are the rights that a consumer is entitled to? The next paragraphs will analyse what these consumer rights are and how they are formulated in the three chosen jurisdictions.

In New Zealand, the general consumer regulation includes general statutes such as the Fair Trading Act 1986, the Consumer Guarantees Act 1993 and some competition rules embodied in the Commerce Act 1986 and amendments. Although the consumer protection regulation contains general provisions that apply to most economic activities, there are a couple of provisions specifically about electricity consumers. For instance, the Consumer Guarantees Act recognises consumers a guarantee of acceptable quality for the supply of electricity,[138] the right to a fair procedure for disconnection in the case of non-payment of their energy bill and the right to cancel their contract or switch supplier.[139] There is no specific authority protecting consumer rights. However, any breach of the rights and provisions contained in the Consumer Guarantees Act can be heard in the High Court, District Court or Dispute Tribunal according to the value of the claim.[140] The Electricity Authority, different from other jurisdictions, does not have a role in protecting electricity consumers.

[138] Consumer Guarantees Act 1993, s 7A.
[139] Consumer Guarantees Act 1993, s 35.
[140] Consumer Guarantees Act 1993, s 47.

However, the Advisory Panel in charge of elaborating the Electricity Price Review[141] realises there is a regulatory gap in protecting electricity consumer interests. As the Panel appreciates, the strict function of the Electricity Authority (EA) of only promoting efficiency, competition and reliability of supply in the sector leaves the consumer unprotected. In response, the panel recommends giving the EA an explicit consumer protection function, and this is to protect households and small business consumers. It requires amending the Electricity Industry Act 2010 to introduce this function, allowing the EA to modify the EIPC and further regulate its role in protecting consumers. The Government response to this recommendation was to agree and report back to Cabinet with a specific proposal to amend legislation to give the Electricity Authority a consumer protection function, especially for those in hardship.[142]

In Colombia, the process of liberalisation of the electricity industry also required a new legal framework that recognised the special and essential characteristics of the supply of electricity. Since 1994, the supply of electricity has been considered a domiciliary public service. The connotation of public service, according to Atehortua,[143] requires that, regardless of who supplies it, the activity should satisfy the general, permanent and continued primary needs of users. Therefore, the purpose of the legal framework is the improvement of the quality of life for people and guaranteeing universal access. As public service, the state intervenes via regulation and supervision to guarantee the supply of the service. One consequence of this intervention is the enactment of law 142 of 1994 which regulates domiciliary public services, such as electricity, sewage, gas, and sanitation, among other services. Law 142 of 1994 recognises the following rights for regulated users (small consumers): the right to choose their supplier;[144] to quality service;[145] to ask for information;[146] to have consumption measured;[147]to be charged based on the regulated tariff set by the electricity regulator[148] and that there is no abuse

[141] New Zealand Government "Electricity Price Review" (May 2019) <www.mbie.govt.nz> at 59.
[142] Minister of Energy and Resources "Electricity Price Review: Government Response to Final Report" (3 October 2019) < www.mbie.govt.nz> [124-125]
[143] Carlos Alberto Atehortua *El Régimen de los Servicios Públicos Domiciliarios en Colombia* (Dike, Medellín 1998) at 18 (Translation: Public Services Regime in Colombia).
[144] Law 142 of 1994 (Colombia), art 9 (2).
[145] Law 142 of 1994 (Colombia), art 9 (3).
[146] Law 142 of 1994 (Colombia), art 9 (4).
[147] Law 142 of 1994 (Colombia), art 9 (1).
[148] Law 143 of 1994 (Colombia), art 23.

of power in executing a uniform conditions contract.[149] In this sense, the electricity regulator (CREG) is required to set the tariff for regulated users and, in particular, to protect vulnerable consumers.[150] In Colombia, therefore, there are specific industry regulations relating to energy consumer rights, and the regulatory authority is the first called to protect such rights.

In the European Union, consumer rights are included in Annex I of Directive 2009/72/EC, concerning common rules for the internal market, establishing measures on consumer protection. These measures include the following rights:[151] the right of the consumer to a contract with the service provider; to withdraw from a supply contract; to receive information on prices, terms and conditions; to be offered a choice of payment methods; to benefit from simple and inexpensive procedures in respect of complaints and mechanisms for the settlement of disputes out of Court; to universal access; to access to consumption data; to the implementation of smart meters where the state has made a positive assessment for their use and special protection for vulnerable customers. Recently, these rights have been extended to active consumers. In the Directive 2018/2001, the renewable self-consumers, namely active consumers, are entitled to maintain their rights as consumers.[152] It is a clear provision extending consumer rights to prosumers, giving certainty regarding relevant aspects of the legal framework and protections that they are entitled to, which includes those contained in the Directive 2009/72 on consumer protection. Time is needed to assess how such provisions are implemented in domestic legislation of the Member States.

The way that the EU legal framework is reflected in the Dutch legislation is through the Streamlining Act, which came into force on 3rd April 2013. This Act merged the Competition Authority and the Consumer Authority into the Authority for Consumers and Markets (ACM), whose main legal framework is based on Administrative Law.[153] Since the merges, Willems and Mulder[154] argue that the regulation of the energy market

[149] Resolution CREG 108 of 1997 (Colombia), art 11.
[150] Law 143 of 1994 (Colombia), art 23 further regulated in Resolution CREG 108 of 1997.
[151] Directive 2009/72/EC (EU), Annex 1 (1).
[152] Directive 2018/2001 (EU), art 21 (c).
[153] Authority for Consumers and Markets "Establishment Act of the Authority for Consumers and Markets" (February 2013) <www.acm.nl>.
[154] Bert Willems and Machiel Mulder "Competition in retail electricity markets: an assessment of ten year Dutch experience" (2016) 11 TILEC Discussion Paper at 18.

is increasingly based on general consumer protection legislation rather than industry-specific legislation. The ACM is a multifunctional authority which combines enforcement of competition law, consumer protection and transport, telecommunication and energy regulation. In this sense, Cseres[155] affirms that the Netherlands has moved from a separate agency model to an integrated model to enhance the effectiveness, efficiency and quality of consumer-centred market supervision. The ACM, for instance, mainly ensures the right to switch supplier, protect consumers from misleading information, and to have clear and accurate billing, which not only has to measure consumption but also the composition and resource of the electricity supplied, e.g. solar, gas, wind.[156]

One can state, therefore, that in terms of the general consumer legislation applicable to energy consumers, the rights of energy consumers in liberalised economies are as follows: choice of the supplier, access to an electricity connection, accurate information on consumption, special protection for households or small or vulnerable consumers, easy resolution of complaints and disputes, access to relevant information, and to own and control data. So which of these rights are relevant for small prosumers? Moreover, do other rights need to be identified?

Josh Roberts[157] recommends that prosumers maintain their traditional consumer rights. This is, the right to an electricity connection (universal service); the right to choose and switch supplier; the making ownership available, especially for vulnerable consumers; the right of access to relevant information; access to simplified administrative procedures and access to data protection. The subsequent sections will further explore the relevance of the first five rights for small prosumers and one more, which I consider appropriate to include in the list, the right to self-generate.

Although the right to access to data protection for prosumers is extremely important in the context of smart and IT technologies when addressing cybersecurity or data appropriation, the analysis of this right is beyond the scope of this research and it is

[155] KJ Cseres "Integrate or Separate - Institutional design for the enforcement of competition law and consumer law" (2013) SSRN Electronic Journal at 20.
[156] Authority for Consumers and Markets "Provision of information in the consumer energy market"<www.ceer.eu> at 9.
[157] Roberts, above n 1, at 23.

more appropriate to cover it in specific research on data protection. Relevant issues regarding access to consumer data include: managing data and protection, which involves deciding who manages the data and whether third parties can have access to it. Also, the sharing of consumer data across the sector and who governs those relationships, are among the topics that are relevant to a new research and will help to create new regulatory perspectives.

5.4.3 The Right to self-generate electricity and decide on its use

Does an individual have a legal right to self-generate electricity for his/her use? According to the principles of both common and civil property law, a property owner has a legal right to generate his/her electricity because this falls within the owner's right to use and enjoy his property. Such a right shall be consistent with the rule of law about not interfering with the property rights of other parties and following resource management, planning and safety regulations.[158] If there is no law against it, there is no need for a law explicitly prescribing a right of self-generation. However, to ensure a clear understanding of the rights of the consumer, specific provisions can be incorporated into legislation.

In New Zealand, there is no specific provision for consumers producing electricity, but the concept of distributed generation is applicable. Alternatively Colombia, law 1715 includes a definition and different provisions relating to self-generation recognising the ability of customers to produce energy mainly for their own needs. The Netherlands has no specific provision relating to the ability to self-generate, and, in consequence, the doctrine has to apply both producer and consumer definitions. However, policies relating to net-metering or the Experimentation Decree clearly legally recognise and support self-generators. Thus, there is no legislation in New Zealand, Colombia or the Netherlands prohibiting customers producing electricity, and, on the contrary, norms are creating different legal consequences for doing so. It is essential to mention that the 2019 European Electricity Directive[159] and 2018 Renewable Energy Directive[160]

[158] Jon Wellinghoff and Steven Weissman "The right to self-generate as a grid-connected customer" 36 Energy Law Journal. 305 at 317.
[159] Directive 2019/944 (EU), art 15 about "active customers" are entitled to sell self-generated electricity.
[160] Directive 2018/2001 (EU), art 21 mention that "renewable self-consumer" are entitled to generate renewable energy, including for their own consumption.

include a clear definition of active consumers and renewable self-generators and their ability to generate and consume power.

Together with the right to self-generate, for example, within property rights, prosumers should have the right to choose what to do with the electricity produced (consume it, sell it or store it). Provisions which go against this right include a requirement that the full output of the prosumer should be fed into the grid or only permitting self-consumption, without allowing a diverse choice of options.[161] In Colombia, there is no such restrictions. According to Decree 348 of 2017, the energy surplus could be any amount left after allowing for personal consumption[162], and the regulatory framework does not impose any other restrictions. In New Zealand and the Netherlands, there is no mention or provisions restricting the consumer deciding what to do with the electricity they produce.

Overall, it is reasonable to conclude that prosumers have the right to self-generate within their right to use and enjoy their property as long as they follow resource management, planning and safety regulations and the general principle of not interfering with the property of others. All the chosen jurisdictions recognise this right in the legislation.

5.4.4 Universal access

The right to universal access refers to the ability to be supplied with electricity of a specified quality within the national territory at a reasonable and comparable price.[163] This right is vital for active consumers and especially connected consumers in regard to continuing the supply of energy when it is needed. It means a back-up service when the self-generation is insufficient to meet demand. Such a right becomes essential since, without a back-up service, prosumers will be forced to tolerate outages when the self-generation is insufficient to meet the demand.

[161] Wellinghoff and Weissman, above n 159, at 320.
[162] Decree MME 348 of 2017 (Colombia), art 2.2.3.2.4.7
[163] Wellinghoff and Weissman, above n 159, at 320.

Universal access implies, in effect, a network connection and supply contract with the supply company. The network connection has already been discussed in the previous chapter, and it is appropriate to focus here on the supply contract. In the US, for example, before the energy crisis in 1978, electricity utilities were not required to provide prosumers with back-up or standby power services when the prosumer's generation was unavailable. It was also unclear whether utilities were obliged to connect self-generators to the distribution network, and utilities could even refuse to purchase their power.[164] According to this situation, one can wonder whether, in the chosen jurisdictions, the retailers should supply energy to prosumers as a back-up resource, or if the retailer can refuse to do so.

In Colombia, according to law 142 of 1994,[165] everyone using or living in real property has the right to be supplied power by the retailer and for that, should agree on a uniform standard supply contract. The public utility cannot deny the service other than for technical and safety reasons established by the regulator.[166] This principle is also applicable to self-generators. According to resolution 084 of 1996, the retailer shall provide back-up supply to the self-generator. The price of this energy is the same as the applicable tariff for regulated users (small consumers). Non-regulated users (large consumers) who self-generate must enter a contract for a back-up supply with a retailer and the parties will freely set the price of the energy.[167]

There are no similar provisions in the Netherlands and New Zealand, although clear provisions are placing a duty on the distributor operator to connect distributed generation as discussed in Chapter 4. The lack of provision may cause problems in the future because there is no certainty about the duty of retailers to agree to sell electricity as a back-up for small self-generators. The alternative for prosumers would be to shop around and check which retailer would agree to supply energy to them, which could result in increasing transaction costs.

[164] At 322.
[165] Law 142 of 1994 (Colombia), art 134 further regulated art 16 Resolution CREG 108 of 1997.
[166] Resolution CREG 108 of 1997 (Colombia), art 17.
[167] Resolution CREG 084 of 1996 (Colombia), art 4.

5.4.5 The right to change supplier

As stated previously, one of the rights that comes with the liberalisation of the energy industry is the right to change supplier. This right is instrumental in promoting more competition amongst suppliers because, when a customer is unhappy with the service or with the price, they can change to a different supplier. For instance, in Colombia the right is included in general legislation about domiciliary public services,[168] while in New Zealand is found in general consumer protection legislation as it is included in the Consumer Guarantees Act.[169] In New Zealand, this right is particularly important and has been the subject of widespread campaigns such as 'What is my number?'[170] In this still live campaign, the Electricity Authority invites customers to easily check whether their current power company is offering them the best deal. If they do not offer a good deal, the Electricity Authority has a website and procedure, which make it easier to shop around and compare tariffs and terms and change the power company. Typically, the procedure of changing procedure is free and takes an average of three to four days.[171] Furthermore, with more people currently requiring smart meters makes possible for retailers to include plans offering different deals according to the time-price of electricity.

According to the Advisory Panel who undertook the latest Electricity Price Review, although there are better prices for those who shop around, such a right has not been fully utilised. The panel estimates that between 23 to 42 percent of all consumers have remained with the same retailer since 2002.[172] This high proportion has the biggest effects on low-income households who are paying too much for electricity by staying with the incumbent suppliers. As Barton[173] warned, existing suppliers have little incentive to reduce prices without competitive pressure. So in New Zealand, as the Advisory Panel affirms, although new retailers have entered the market since 2005, the five biggest gentailers (generator-retailer) continue to dominate the market with a 90 percent market share.[174]

[168] Law 142 of 1994 (Colombia), art 9 (2).
[169] Consumer Guarantees Act 1993, s 35.
[170] For more information consult, www.whatsmynumber.org.nz/
[171] Electricity Authority *Electricity in New Zealand* (Electricity Authority 2018) at 11.
[172] New Zealand Government, above n 142, at 31.
[173] Barton, above n 127, at 281.
[174] New Zealand Government, above n 142, at 31.

This right to change supplier continues to be important for prosumers who are not only interested in the price they have to pay for energy but also in the price or incentive they are receiving for the energy they sell to the retailer. For example, in the Netherlands, the right to change a supplier is used to obtain better deals in net-metering.[175] These examples show the importance of introducing competition in the retail market as a way of encouraging companies to be innovative and offer new options such as attractive price options.

The right to choose and change a supplier in the future may also be extended to include consumers and prosumers who want to do energy business with, including generators, aggregators, retailers or new actors. Hence, consumers having the right to choose an aggregator and generator rather than just a supplier or retailers is extremely important. For instance, the approach to new business ideas such as those of Valdebron in the Netherlands and Piclo in the United Kingdom, allow consumers to choose directly which generator and what kind of energy resource they want to buy energy from. This right can also be extended to include choosing whether to contract with a retailer or an aggregator or intermediary. As a consequence, it is essential to have a legal framework that identifies the roles and responsibilities of the aggregator, the customer and the market.[176] In this regard, the initiative of multiple trading relationships which allow the consumer to have different service providers at one point of connection should also be on the table.

5.4.6 Access to relevant information and participation in decision making

For Roberts,[177] the right to ask for information, which traditionally only refers to accurate information about consumption, now includes information relating to more efficient consumption and mechanisms for guidance on support for renewable and local resources. Besides, access to information regarding the scope of consumer rights, understanding the opportunities to participate in the market as an individual and collective are also important. For example, for prosumers, it will be key for them to be

[175] Diestelmeier and Kuiken, above n 71, at 73.
[176] Roberts, above n 1, at 37.
[177] At 39.

able to evaluate the payback period and fees or obligations associated with generating energy for customers interested in participating in demand response programmes. It is vital that customers have access to clear information to choose an independent aggregator and information to help them understand the financial implications of each decision clearly and comparably.[178] Currently, this function is carried out by retailers or distribution companies who attempt to promote products easily and attractively to engage customers. However, there is also the need for regulatory back-up to strengthen these roles.

Another critical point is the importance for the prosumer or consumer bodies to participate in the decision making process and regulatory process. It means participation ex-ante when any relevant authority makes related decisions or regulations affecting consumers and prosumers and not only for appeal purposes.[179] In order to ensure prosumers have adequate means to entitlement of their rights and participation, the consumer bodies and organisations should have clear competence for prosumer rights, particularly concerning handling complaints and energy price formation.[180] On this point, one of the socio-political criticisms of prosumers already explained in Chapter 3, can be applied to prosumers as agents that can be easily exploited by capitalism.[181] In order to avoid this, it is vital to ensure that prosumers have access to relevant information and can participate in the decision-making process. The regulatory channel for consumer bodies to participate are already legally established. For instance, in New Zealand, the Electricity Industry Act establishes the procedure for amending the EIPC, in which before amending it the Authority must publicise a draft of the proposed amendment and consult the public and interested parties on the proposed amendments.[182] In Colombia, a similar procedure is carried out when amending or enacting new regulations by the regulatory authority CREG. The CREG shall publicise the draft of the regulation, at least 30 days before issuing it, so the interested parties can comment or propose changes.[183] Therefore, in theory, consumers or groups of

[178] At 40.
[179] Saskia Lavrijssen "The right to participation for consumers in the energy transition" (2016) 25 European Energy and Environmental Law Review 152 at 155.
[180] Roberts, above n 1, at 38.
[181] George Ritzer and Nathan Jurgenson "Production, Consumption, Prosumption: The nature of capitalism in the age of the digital 'prosumer'" (2010) 10 Journal of Consumer Culture 13 at 25.
[182] Electricity Industry Act 2010, s 39.
[183] Decree 2696 of 2004 (Colombia), art 9.

consumers can participate and discuss how convenient or not the regulation is for their interest.

In practice consumers generally lack technical knowledge to comment on the regulation. In the case of Colombia, as Palomo suggests,[184] consumer participation is only a formality and does not produce the expected outcomes. Such disconnection between the regulation and the reality occurs because the CREG and the Government do not divulge enough information about participation channels, or there is no certainty about whether the CREG will have to take into account the feedback given by the citizens.[185] Another issue is there are not enough mechanisms to educate citizens about the technical and specialised issues of the industry.[186] Therefore, it is fundamental to educate consumers regarding their rights, technicalities of the sector and the participation channels.

5.4.7 Making technologies available for vulnerable consumers

This topic becomes relevant concerning low and medium-income households who can also benefit from new technologies to enable them to reduce increasing electricity bills. As stated previously, technologies like solar panels are still expensive and not everyone can afford them. Different mechanisms, such as direct subsidies, tax incentives, shared-ownership, crowd-funding and access to public or private loans, are being used to widen access to new technologies.

Tax incentives are a mechanism used for promoting investment in new technologies and specifically the ownership of devices. For example, in Colombia, this tool has been used for the promotion of non-conventional renewable energy technologies on a large and small scale. Such incentives include 50% off over the investment taken from income tax, exclusion from VAT (value added tax) and exemption from the payment of

[184] Nora Palomo García "El Procedimiento Regulatorio y la Participación Ciudadana en el Ámbito de las Competencias de la Comisión de Regulación de Energía y Gas (CREG)" in Luis Ferney Moreno *Mejora Regulatoria del sector minero-energético en Colombia* (2019, Universidad Externado de Colombia, Bogotá) at 29. (Translation: The regulatory procedure and citizen participation in the scope of the powers of the Energy and Gas Regulation Commission in *Regulatory improvement of the mining-energy sector in Colombia*).
[185] At 30.
[186] At 30.

customs and accelerated depreciation.[187] However, these tax exemptions are of not much use to poor households and may only be beneficial for importers and large and small consumers, who can pay the upfront cost of the generation device.

In the Netherlands, some amendments to the Electricity Act in April of 2015 included a tax relief of EUR.075 per kWh applicable since 1 January 2014 when renewable energy is generated by an association of owners or cooperatives and used by small consumers in the neighbourhood.[188] In New Zealand, it is difficult to find similar provisions that attempt to incentivise the adoption of such technologies and is purely market-driven. In Colombia and the Netherlands, the situation is different since they are amongst the countries who use tax reductions to reduce high technological costs and promote more investment. However, these tax incentives are not enough to promote the adoption of new technologies, especially for vulnerable or low-income consumers, although they can work better together with other mechanisms such as access to financial funds or subsidies.

California provides a good example of a jurisdiction that has used different incentives. There have been different incentive programmes to increase self-generation such as California Solar Incentive, California Self-Generation Incentive Program, Federal Tax Credits and property tax exemption.[189] The California Solar Incentive provides cash rebates to PV owners. These rebates decline as installed capacity increases until a robust solar market is created because the scheme attempts to be temporary.[190] The California Self-Generation Incentive Program does the same for wind, and other recent high-cost commercialised technologies. Federal taxes provide a personal investment tax credit of 30% of installed system capital costs and a corporate investment tax credit equal to either 10% or 30% of system costs depending on the technology. Another incentive allows a property tax exemption of 100% of the increase in property value resulting from the installation of a PV system.[191] The problems of such credits are that they are

[187] UPME *Integración de las Energías Renovables no Convencionales en Colombia* (Unidad de Planeación Minero Energética, Bogotá 2015) at 53. (Translation: *Integration of non-conventional renewable energies in Colombia*).

[188] Roggenkamp and others, above n 70, at 196.

[189] Virginia Lacy, Ryan Matley and James Newcomb "Net energy metering, zero net energy and the distributed energy resource future" (2012) Rocky Mountain Institute < www.rmi.org>

[190] At 1.

[191] Li Yumin "Incentive pass-through in the California Solar Initiative – An analysis based on third-party contracts" [2018] 121 Energy Policy 534 at 537.

only available to owner-occupiers and not to tenants. Such an issue raises questions regarding ownership and tenancy disparities and legal gaps that need to be addressed to provide social and financial benefits for those who need them the most. It is for this reason that it is crucial to take into account the solar adoption gap between economically disadvantaged communities and those in middle and high-income communities. The state of California has established several new programmes such as the New Solar on Multifamily Affordable Housing program or Green Tariff programs that provide discounts to electricity bills for low-income customers and solar community projects located in disadvantaged communities.[192]

Nowadays, there are alternative financing mechanisms, such as crowdfunding, which have become popular. Crowdfunding is an open call made through the internet to the public for financing projects such as energy projects. Several crowdfunding platforms dedicated to energy projects exist such as Abundance Generation in the UK, Windcentrale in the Netherlands, Lumo in France in 2012, Mosaic in the US in 2013, Trillion Fund and Gencommunities in the United Kingdom and Clean Reach in the United States in 2014.[193]

This topic is particularly relevant to energy poverty and the significance of making available the ownership or use of self-generator devices, such as solar panels for low income and vulnerable consumers, as a way of combating energy poverty. For instance, in the European Union, the Energy Efficiency Directive prioritises schemes for households experiencing energy poverty or those who are in social housing.[194] Also, the Directive 2018/2001 states that every Member State should undertake studies of the current gaps and ways to promote renewable self-consumption. Among the issues that these enabling frameworks need to address include the technology and finance availability to final consumers, especially low-income or vulnerable households.[195] In

[192] Boris R Lukanov, Elena M Krieger "Distributed solar and environmental justice: exploring the demographic and socio-economic trends of residential PV adoption in California" (2019) 134 Energy Policy 110935 at 110938.

[193]Catherine Banet "Enabling the Crowdfunding of Energy Projects: the regulation of small-scale Community Financing in Europe" in Lila Barrera-Hernández and others (eds) *Sharing the Costs and Benefits of Energy and Resource Activity: Legal Change and Impact on Communities* (Oxford University Press, Oxford, 2016) at 121.

[194]Directive 2012/27 (EU), art 7(7).

[195] Directive 2018/2001 (EU), art 21 (6)(a).

New Zealand, energy poverty issues are dealt with through social services, so energy poverty does not become part of the regulation of the Electricity Authority. However, according to one of the recommendations of the Electricity Price Review, the Electricity Authority should have a role in protecting consumers, especially vulnerable consumers.[196] In Colombia, the electricity regulator (CREG) is responsible for setting the tariff for regulated users and in doing so, protects particularly vulnerable consumers.[197] In Colombia, there are subsidies for lower-income households depending on zonal stratification levels. This scheme has six levels, with level 6 representing high-income people. Levels 1, 2 and 3 are subsidised by 4, 5 and 6. The importance of prosumer initiatives such as these is that they can provide an alternative to subsidies and instead help low-income households to generate their electricity.

5.4.7 The access to specific and simplified procedures

As has been noted already, there is a lack of a specific legal framework for prosumers and either there is no certainty about the rules applicable to prosumers, or the rules that apply may discourage prosumers because they result in complicated or burdensome practices producing real discrimination. For instance, according to the 2009 Directive,[198] Member States are required to take appropriate steps to ensure simplified procedures for smaller projects and decentralised devices. However, according to the 2015 Renewable Energy Progress Report, the implementation of this provision has been slow, and there is a significant disparity in administrative barriers for smaller and decentralised projects within the European Union.[199] In the same vein, the Directive 2019/944 reaffirms such concerns and, when introducing the new category of 'active customers', states that they should not be subject to disproportionately burdensome procedures and charges that are not cost-reflective.[200]

The correct promotion of small prosumers requires to establish simplified procedures which are consistent with the specific characteristics of the devices. For instance, in Colombia, the introduction of law 1715 of 2014, further regulated by the CREG, has

[196] New Zealand Government, above n 142, at 23
[197] Law 143 of 1994 (Colombia), art 23 further regulated in Resolution CREG 108 of 1997.
[198] Directive 2009/28/EC (EU), art 13.
[199] European Commission "Renewable energy progress report 2015" (16 June 2015) <www.ec.europa.eu>
[200] Directive 2019/944 (EU), art 15 (1).

provided more detailed regulation and special procedures have come into place for small self-generators in terms of connection, as we explained in Chapter 4, regarding access to networks. However, it is essential to create special conditions for prosumers to participate in the market or tenders as was explained extensively in the previous section regarding access to markets by prosumers. In the case of New Zealand, specific regulation, such as that contained in Part 6 of the EIPC regarding the connection of distributed generators, is an example of detailed and simplified procedures but even more certainty and detail is necessary for the terms of access to markets, special relationships with the retailer and back-up.

Finally, this section about the rights of small prosumers cannot conclude without also providing an example of the emerging duties. For instance, the Directive 2018/2001, when stating that the self-generator should not be subject to discriminatory procedures or any kind of charges regarding the energy that remains within their premises, establishes an interesting obligation. From 1st December of 2026, if the overall share of self-consumption installations exceed 8% of the total installed electricity capacity of a Member State, and it is demonstrated that this is causing a disproportionate burden on the long-term financial sustainability of the power system, prosumers can be subject to charges and administrative procedures.[201] Hence, this provision attempts to address some of the adverse effects that an increased installation and connection of self-generator devices may create early on. This provision is an attempt to address the concern over how more simplified procedures and requirements may affect the overall functioning of the system. Time is needed to be clear as to how helpful this provision will be in the future. Nevertheless, we must also consider that the proper functioning of the whole system also depends on how adaptable the system is to the likely increased participation of distributed generation. And it also depends on how these complexities are being dealt with mainly by the regulator and the distributor in coordination with other relevant actors of the system such as distributed generators, self-generators, aggregators, retailers and the deployment of new technologies such as smart grid technologies.

[201] Directive 2018/2001 (EU), art 21 (3).

Overall, this section can be concluded by agreeing with Roberts in recommending that the European Commission should maintain consumer rights for households and small business prosumers. Such a lesson can be learned and extended to other jurisdictions. Small prosumers do not have strong bargaining power, so require legal protection when dealing with other market actors, especially distributors and retailers. In my view, it is necessary that the chosen jurisdictions also amend their current legislation and extend the appropriate consumer rights to small prosumers. Otherwise, the regulatory disconnection and uncertainty will continue, affecting the relationship with the prosumer. It is recognised that consumer protection rights are a state intervention in the market. However, this intervention is required to ensure a balanced relationship between small prosumers and other market participants. For larger prosumers, civil and commercial legal frameworks can be more easily applicable because larger actors can negotiate the terms and conditions of transaction in more equal terms.

5.5 Key Points.

This chapter explored two main issues. The first one regarded access to relevant markets by prosumers to sell their surplus energy and their participation in demand response programmes in exchange for fair remuneration. The second issue related to the extension of consumer rights protection to small prosumers.

According to the material studied, we found that the existing markets (wholesale and retail) are tailor-made for large and traditional actors. Such characteristics result in restrictions for prosumers from supplying energy directly to others and forcing some innovative businesses to present themselves as something they are not. New business ideas also appear restricted within the current legal framework that only allows consumers to contract with one supplier. Such restrictions can be seen as a barrier for online platforms who are offering local matching of supply and demand. Since the main objective of liberalised countries is promoting competition to deliver better prices and services to customers, it is vital to open new markets and ensure the participation of multiple alternative actors. Regulatory authorities must therefore embrace a process of redesigning current markets in a way that integrates new actors, services, roles and functions of such actors and, at the same time, addresses new challenges and complexities. Another interesting aspect found is that an incorrect design of net-

metering and feed-in tariff creates distortions in the market and unfairness to other consumers. This fact makes us agree that net billing is a much fairer remuneration system.

Although it is desirable that demand response programmes participate in both wholesale and retail markets, we found that demand response is more common in the wholesale market and oriented to large customers. Therefore, it is crucial that, while the market creates the correct signals and incentives to encourage small consumers, the regulator backs up such initiatives by promoting pricing of demand response in a way that encourages a broader range of participants. An attractive incentive is to pay the unit saved at the same price as the unit produced.

Finally, another relevant aspect discussed is the extension of consumer rights to prosumers. These consumer rights can be either adapted or new rights introduced for prosumers, or by stating clearly that existing consumer rights also apply to small prosumers, as is the case in the European Union.

Chapter 6: The Legal Aspects of Community Energy Projects

A scenario is emerging in which members of small cities or neighbourhoods come together to participate in projects that will bring multiple benefits to all their members. Community members are buying energy from others or investing together in local generation plants that can produce enough energy to supply the local demand and, even more, to supply energy to nearby towns. 'Localism' in energy projects implies producing and consuming locally, creating new opportunities for citizens and consumers.

The decision to become part of a community as a way to produce and consume energy collectively and to create benefits for the community also makes up part of the idea behind prosumerism. Prosumers, or active consumers, are those who individually, or as a collective, participate in the cost and benefits of the electricity industry beyond the payment of an electricity bill.

Community energy emerged as a response to the oil crisis in 1973 and developed further with market liberalisation and IT technologies.[1] However, there are some examples within national contexts of community energy before it, such as in Germany or Norway. In those countries, since the nineteenth century, given the lack of infrastructure, local actors formed energy cooperatives where parties invested not only in power generation but also to create an inclusive energy infrastructure. Such approaches declined after World War II when more prominent national players became involved and public administration favoured a centralised approach.[2]

The literature highlights multiple drivers that can lead a community to engage in a community energy project. According to Becker and Kunze,[3] those drivers usually go

[1] Binod Prasad Koirala and others "Energetic communities for community energy: a review of key issues and trends shaping integrated community energy systems" (2016) 56(C) Renewable and Sustainable Energy Reviews 722 at 725.

[2] Moritzl Hentsche, Wolfgang Ketter and John Collins "Renewable energy cooperatives: facilitating the energy transition at the Port of Rotterdam" [2018] 121 Energy Policy 61 at 63.

[3] Sören Becker and Conrad Kunze "Transcending community energy: collective and politically motivated projects in renewable energy (CPE) across Europe" (2014) 8 People Place and Policy Online 180 at 187.

beyond return and profit[4] and may range from distributional justice, environmental sustainability and better citizen participation. Consumers may also be motivated by the potential to create jobs within the community, growth of their skills, non-hierarchal structures[5], sustainable and ethical ways of living, reduction of carbon footprints, self-empowerment and a strong sense of community and belonging.[6] Ford and others[7] highlight the role of community energy in facilitating the participation of individuals with low and medium incomes as a way to address energy poverty.

McHarg[8] argues that community energy is also considered an example of energy democracy, attempting to promote high penetration in locally and cooperatively owned generation, energy infrastructure and services. Energy democratisation recognises and synchronises climate change and energy justice, emphasising the importance, at the local level, of decision making and citizen participation in the costs and benefits of the industry and not just as a passive consumer. In this sense, energy democracy can be the driver of community energy in so far as the benefit for communities and the environment is the purpose of the energy system rather than only making a profit.

Community energy is based on not only geographical 'closeness' but also on common interests and ideas about what is the best and most sustainable way of meeting energy demands. An community in the context of prosumerism faces different legal challenges

[4] The sociocultural process beyond the economic perceptions of return and profit in the context of a community. According to ethnographic studies, there are three types of return: in cash, in kind and intangibles. A cash return is a payment made by the energy receiver to the energy provider in the form of currency. In-kind return refers to the payment made by the energy receiver to the energy giver for the energy provided in the form of a thing, or work that has an economic value. Relies on that mutual agreement about the proportion and value. In the case of intangible returns, this category added unmeasured or unquantified social gesture and actions like good will or social support from the energy receiver to the provider. Here the concept of profit is absent which is common among socially intimate relationships. Abhigyan Singh and others "Exploring peer-to-peer returns in off-grid renewable energy systems in rural India: an anthropological perspective on local energy sharing and trading" (2018) 46 Energy Research & Social Science 194 at 196.

[5] Sustainable Economies Law Centre "Stranger things" (26 October 2017) Stranger things <www.theselc.org>.

[6] Josh Roberts *Prosumer Rights: Options for an EU Legal Framework Post 2020* (ClientEarth, London, 2016) at 15.

[7] Rebecca Ford, Juliet Whitaker and Janet Stephenson *Prosumer collectives: a review A report for the Smart Grid Forum* (University of Otago - Centre for Sustainability, Dunedin, 2016) at 7; Helena Connor, Nicholas Chisholm and Mary Shaughnessy *The contribution of Community Owned Renewable Energy to Sustainable Rural Development* (National University of Ireland, Dublin, 2017) at 40.

[8] Aileen McHarg "Community Benefit through Community Ownership of Renewable Generation in Scotland" in Lila Barrera-Hernández and others (eds) *Sharing the Costs and Benefits of Energy and Resource Activity: Legal Change and Impact on Communities* (Oxford University Press, 2016) 297 at 302.

regarding its size, participation in the market and even their configuration when compared to an individual prosumer.

6.1 Terminology and Scenarios

While the scholarship has widely defined energy projects within local communities or collective initiatives, there is no agreement regarding terminology or any agreed definition. Different terms have been used in the literature including 'community energy',[9] 'energy community',[10] 'community-based project',[11] 'organised prosumer groups',[12] 'energy cooperative',[13] 'community initiatives for renewable energy',[14] 'integrated energy communities' [15] or 'collective and politically motivated energy projects'.[16]

More than ten years ago, Walker and Devine-Wright[17] were the first authors to publish an article dealing with community energy and introduced, for the very first time, the term and concept of 'community renewable energy' to the energy policy scholarship. According to these authors, 'community energy' is a term often used in Britain that refers to an energy project run by and for the benefit of a local population. Following this definition, the geographical 'locality' is the centre of the community and not the common interests or objectives.[18] There are different legal forms of community energy

[9] Nasir El Bassam, Preben Maegaard and Marcia Schlichting *Distributed Renewable Energies for Off-Grid Communities: Strategies and Technologies Towards Achieving Sustainability in Energy Generation And Supply* (Elsevier, Oxford, 2013) at 66; Becker and Kunze, above n 3, at 174.

[10] Inigo Del Guayo "Regional and Local Energy Communities - A European Union Perspective on Community Benefits" in Lila Barrera-Hernández and others (eds) *Sharing the Costs and Benefits of Energy and Resource Activity: Legal Change and Impact on Communities* (Oxford University Press, Oxford, 2016) 42 at 49.

[11] Jessica Wentz and Chiaara Pappalardo "Scaling up Local Solutions: Creating an Enabling Legal Environment for the Deployment of Community-based Renewable Microgrids" in Jordi Jaria and others (eds) *Energy, Governance and Sustainability* (Energy, Governance and Sustainability, 2016) 99 at 103.

[12] Yael Parag and Benjamin K Sovacool "Electricity market design for the prosumer era" (2016) 1 Nature Energy 1 at 4.

[13] Benjamin Huybrechts and Sybille Mertens "The relevance of the Cooperative Model in the field of renewable energy" (2014) 85 Annals of Public and Cooperative Economics 193 at 196.

[14] Marieke Oteman, Mark Wiering and Jan-Kees Helderman "The institutional space of community initiatives for renewable energy: a comparative case study of the Netherlands, Germany and Denmark" (2014) 4 Energy, Sustainability and Society 1 at 9.

[15] El Bassam, Maegaard and Schlichting, above n 9, at 175.

[16] Becker and Kunze, above n 3, at 176.

[17] G Walker and P Devine-Wright "Community renewable energy: what should it mean?" (2008) Energy Policy 36 (2) 497 at 498.

[18] Christina E Hoicka and Julie MacArthur "From tip to toes: mapping community energy models in Canada and New Zealand" (2018) 121 Energy Policy 162 at 166.

which, in the United Kigndom, are cooperatives, charities and social enterprises, local energy service companies, local government-led projects and non-local cooperative ownership. [19] Walker and Devine-Wright also propose a way to define when a project can categorise itself as a 'community energy project'. For such a purpose, it is vital to answer four questions: Who is the project for? Who owns it? Who benefits from the project? And how do they benefit from it? [20]The definition of the process and outcome and use of the term 'community' when answering these questions can help to identify the nature of the project. For the authors, the 'true' community nature is identified by a high involvement of local people in planning, running and investment in the project.[21]

Since the article was published, the concept of community energy has evolved as an academic field developing empirical examples, theoretical reflections, international implications and usages and methodological tools.[22] In 2018, 10 years after the first article about community energy was published, Walker and Devine-Wright, together with early career researchers, revised this concept and the use that academia, society and politics have made of it. [23] The authors recognised the likely misappropriation of the word community to "manipulate or sugar-coat decisions and impacts relating to energy developments".[24]

The most relevant scholarship on community energy has established different concepts and implications. In general, there is no agreement about who should run a community project in order to be considered as one. There is a consensus about the community being the one with the idea to initiate the project and being the one receiving the benefits.[25] The 'closeness' in geographical terms is seen as one of the factors to identify a community but not the only one. Nowadays, thanks to globalisation, internet and social networks, the concept of the community has expanded beyond the 'locality' and refers more often to sharing common ideas and interests and the ability to pursue those

[19] Michael Peters, Shane Fudge and Angela High-Pippert "Community solar initiatives in the United States of America: Comparisons with – and lessons for – the UK and other European countries" (2018) 121 Energy Policy 355 at 358.
[20]Walker and Devine-Wright, above n 17, at 499.
[21] At 499.
[22] Emily Creamer and others "Community renewable energy: what does it do? Walker and Devine-Wright (2008) ten years on" (2019) 57 Energy Research & Social Science 101223 at 101226.
[23] At 101225.
[24] At 101225.
[25] El Bassam, Maegaard and Schlichting, above n 9, at 175.

interests. In the energy context, as Barton and Goldsmith rightly argue,[26] the community involves not only shared identity but also sharing of resources. The concept of sharing concept make us wonder about who the community will share something with and the issues such as space and territory, implying a boundary problem.

There are different levels of community engagement. [27] The basic level is to participate only in the design of the project. The second degree of engagement is a monetary contribution or volunteering labour. The last level is community ownership, where the members can access grants and subsidies to finance the project and own it collectively.[28] The final outcome of the project can be either profit or a community benefit in terms of supply, discounts or other social outputs. [29]Moreover, while a community energy project might mainly refer to the deployment of distributed generation, it does not necessarily mean the use of renewable energy resources. However, when one of the main drivers of the community is to become sustainable, tackling climate change and being environmentally friendly, the use of renewable resources is inevitable.[30]

Finally, community energy does not necessarily mean generation and supply for their members but the engagement in energy projects regardless of who consumes the energy. The outcome of the project should be beneficial for the community in terms of economic return or service. [31] Therefore, highlighting one or another issue will depend on the specific case and the particular settings of each community regarding the purpose and the expected outcomes of the project. Later on, in this chapter we will give different examples of the multiple settings a community can have.

Before proceeding to the next section, it is helpful to provide clarity about the use of the term 'community energy' instead of 'energy community'. According to Del Guayo,[32] there are three primary meanings for 'energy community'. One identifies the

[26] Barry Barton and Michael Goldsmith "Community and Sharing" in Lila Barrera-Hernández and others (eds) *Sharing the Costs and Benefits of Energy and Resource Activity: Legal Change and Impact on Communities (Oxford University Press, Oxford, 2016) at 27.*
[27] Wentz and Pappalardo, above n 11, at 105.
[28] At 104.
[29] El Bassam, Maegaard and Schlichting, above n 9, at 175.
[30] Oteman, Wiering and Helderman, above n 14, at 10.
[31] Parag and Sovacool, above n 12, at 4.
[32] Del Guayo, above n 10, at 59.

group of people that lives in an area with specific energy resources. Another meaning results from the national or supranational law granting an existing community several competences on energy to allow them to become an energy community, e.g. the European Union is an energy community in respect of the common energy market. Finally, the energy community can refer to a group of people who are affected negatively by the impacts of an energy project. None of these definitions refers to the active role of a local community engaging in energy projects which is the driver behind community energy.

6.2 The Pros and Cons of Community Energy Projects

The advantages of community energy projects can be enjoyed not only by their members but also by the energy system as a whole.[33] Such benefits include public acceptability, in contrast to the increasing social opposition to large scale and centralised projects mostly around issues such as land use and landscape impacts.[34] For instance, Azarova and others[35] have argued about the importance of community energy in increasing public acceptance of renewable energy projects. It creates positive regional, economic and environmental impacts for the area involved, as well as bringing more capacity to the system through the increased participation of distributed generation.

Nevertheless, community energy projects have to face a considerable number of obstacles that may affect their participation in the electricity sector and the degree to which they will become a widespread example for other communities. Most of these challenges are financial, such as access to capital and revenue support. Huybrechts and Mertens[36] have rightly pointed out some of the ways to tackle this issue, such as combining of public funds, bank credits and partnerships with the local or private sector, e.g. joint ventures. Financial constraints are even more challenging for low-

[33] Martin Barry and Ralph Chapman "Distributed small-scale wind in New Zealand: Advantages, barriers and policy support instruments" (2009) 37 Energy Policy 3358 at 3360; Lea Diestelmeier and Dirk Kuiken "Legal framework for prosumers in the Netherlands" (2018) 12 European Energy Law Report XII at 40, at 47.

[34] McHarg, above n 8, at 310.

[35] Valeriya Azarovaa and others "Designing local renewable energy communities to increase social acceptance: Evidence from a choice experiment in Austria, Germany, Italy, and Switzerland" (2019) 132 Energy Policy 1176 at 1180.

[36] Huybrechts and Mertens, above n 13, at 198.

income countries which may require public support in the short and mid-term.[37] There are also some human barriers, such as the lack of expertise in the community involved and the need for technical training programmes for high-quality maintenance. Problems can also come from a lack of collective commitment or slow decision making and questionable governance.[38] The definition of the members of the community is considered a challenge as well as the definition of who belongs to a community also implies who is considered an 'outsider'.[39]

The legal challenges for energy communities are multiple and deserve to have specific consideration in the next section.

6.3 Legal Aspects of Community Energy

Community energy faces multiple legal issues that include licensing procedures, support mechanisms, access to the network, access to markets, and the existence of legal vehicles to constitute the community, third party participation and unbundling rules. The next paragraphs contain real examples of community energy projects around the world. We will describe their main features, and we will introduce some legal challenges that the projects may face. Such legal aspects will work as an input that will later be used when analysing the legal issues regarding the three chosen jurisdictions.

In Australia, the first owned community project was Hepburn Wind in 2007. The plant comprises of two turbines with a total generation of 4.1 MW. This project is run by members who are also volunteers and, in exchange, they receive a return on their investment. It sells the energy to a retailer who buys the entire output. When customers buy energy from that retailer, they know they are supporting the community generation project.[40] However, members of the community cannot buy energy directly from the project because the community project would need a supply licence. As a consequence, the community produces energy which is sold to the supplier to be supplied somewhere else. It is an example of a shareholder model in which the community acts as a

[37] Wentz and Pappalardo, above n 11, at 107.
[38] Ford, Whitaker and Stephenson, above n 7, at 10; Prasad Koirala and others, above n 1, at 723.
[39] Barton and Goldsmith, above n 26, at 28.
[40] Ford, Whitaker and Stephenson, above n 7, at 13.

shareholder receiving a return on the investment but not being able to receive the energy (self-consumption). The example helps to raise the legal question regarding legal entry barriers for community projects given the need for a supply licence. Such a situation creates extra steps in the supply arrangement in which the community energy sell it to the supplier, and the supplier later sells it back to the community members. The opposite is the case in which the community project can supply power directly to the members. Another important question relates to access to the network. What are the connection rules for micro-grid communities that want to be connected to the distribution network, not only to withdraw energy as a back-up but also to feed energy into the network? Connection rules are also essential to enable micro-grids to connect with other community projects.

Another international reference is Som Energia. It is an energy cooperative who generates and supplies green energy in Spain. Founded by staff and students of the University of Catalonia in 2010, it currently has more than 65,000 members. The cooperative owns renewable energy plants and sells the energy to its members. It currently has 5 PV plants with 1 MW of capacity and one 500 kW biogas plant with a total generation of 17 GWh annually.[41] Som Energia has two main business models: share capital and generation kWh. Share capital consists of members investing in shares to finance generation projects by the cooperative.[42] The first period for investment in share capital was in October 2017, and about 15,000 members invested around five million euros at the time. Most recently, in March 2020, more than 1,500 people invested about 4.75 million euros.[43] The other business model is called 'Generation kWh' which started in 2015. In this project, energy shares can be purchased by each member to offset their consumption partially while loaning money to the project. Every energy share is €100 each which is equivalent to 170–200 kWh.[44] Such loans would be

[41] Som Energia "Producción de energía renovable" (2020) < www.somenergia.coop> (Translation: Renewable energy production).

[42] Susanne Hirschmann "Som Energia, Catalonia (Spain) A democratic alternative to the Spanish energy oligopoly" (14 November 2017) Energy Democracy <www.energy-democracy>

[43] Som Energia "Som Energia consigue 4,75 millones de euros de aportaciones voluntarias en menos de 24 horas" (5 March 2020) < blog.somenergia.coop> (translation: Som Energia obtains 4.75 million euros of voluntary contributions in less than 24 hours).

[44] Som Energia "Generation kWh: hi ha una quantitat mínima o màxima a aportar?" (2017) <www.ca.support.somenergia.coop> (translation: Generation kWh: there is a minimum or maximum amount to contribute).

paid each year for 25 years and, in the meantime, the members can offset part of their electricity bill.

Both models have proven highly successful despite the financial and economic crisis in Spain, and new members enrol every week. The project is expanding and now has a federal structure consisting of central and local boards with a certain degree of autonomy.[45] Different legal questions can arise from this business models. How can third parties interact and participate in this project?[46] How can local governments and private investors come on board offering investment, technical advice, and access to information, policy support and partnership?[47] Som Energia is currently acting as a generator and retailer, and so another question is, what is the relationship with the distributor operator? Is it possible for a community energy project to act as generator, distributor and retailer in its local area? To what extent do the unbundling rules applicable to distribution and retail affect the project? Does the regulation have to accept a re-bundling scenario applicable to community energies?

Another example of a community energy project is found on the island of Santo Antão in Cape Verde. This island is inhabited mainly by individuals involved in fishing, with the only resource of power being diesel generators generating energy for just four hours per day. Thanks to funds provided by a local consortium, a project was established using an off-grid solar plant with two storage batteries which provide 24 hours of energy and only relies on a diesel generator as a back-up resource. The community agreed to take part in a payment scheme based on a fixed amount of electricity paid by users at the beginning of each month, giving predictability about how much will be used and paid. The project was accompanied by training sessions to users and local technicians. Also in Scotland, the Renewable Energy Scheme and the Renewable Energy Investment Fund have provided grants and loans to the community to pursue energy projects. Such schemes are established by the Scottish Parliament and the regulator, OFGEM.[48]

[45] Becker and Kunze, above n 3, at 174.
[46] Prasad Koirala and others, above n 1, at 723.
[47] Eric O'Shaughnessy and others "Empowered communities: The rise of community choice aggregation in the United States" (2019) 132 Energy Policy 1110 at 1113.
[48] McHarg, above n 8, at 299.

The last three examples have in common the initiative from the national, local government and the private sector, to guarantee access to capital and revenue support schemes for the community projects. Since access to capital is one of the biggest obstacles, a clear policy framework and support programmes are needed to attract public or private investment in community energy. Mechanisms to guarantee access to capital also include an institutional structure to channel the implementation and the setting of national and regional targets for integration. As Connor and others argue,[49] the existence of a clear legal framework provides a coherent pathway for further regulation and support for these projects. For instance, Germany has experienced an expansion in the development of renewable energy technologies, including community projects, over the last two decades, facilitated by a policy framework for sustainable energy transition such as financial support including subsidies and feed-in tariff.[50] One last consideration is the availability of legal models that allow the formation of community energy projects as legal entities. These legal entities enable the project to be granted rights, to contract obligations and, also, enable proper interaction among members and the receipt of benefits, e.g. trusts, cooperatives, social enterprises or non-profit organisations.[51] Such organisations need to act as legal entities which are flexible enough to understand the complexities of community projects. The sort of legal entities will depend on the legal system and practices of each country.

After pointing out some of the more frequent legal challenges, the next section will explore how community energy projects have been developed and operated in the three chosen jurisdictions. Special attention will be given to the unbundling rules of each jurisdiction to analyse whether a community project is allowed to undertake generation, distribution and supply integration.

6.3.1 European Union Legislation

When evaluating the potential number of European citizens engaging in renewable energy production, CE DELFT, an independent research and consultancy organisation,

[49] Connor, Chisholm and Shaughnessy, above n 7, at 43; Wentz and Pappalardo, above n 11, at 108.
[50] Peters, Fudge and High-Pippert, above n 19, at 359.
[51] Sustainable Economies Law Center "People Power Solar Cooperative's First Community-Owned Solar Project Installed in Oakland" (25 March 2019) <www.theselc.org>.

affirms that at least 64 million households would be engaged through collective projects by 2050. [52] As a way of promoting not only renewable energy but a low carbon transition, a new energy package has been discussed since 2016 which includes the community as another market player to speed up the decarbonisation of the European Union. In the aforementioned 'Clean Energy for All Europeans' package, for the first time in the European Union legislation, and one of the first of its kind in the world, it included a legal concept of community energy. In this sense, it refers to two special terms: 'citizen energy communities' and 'renewable energy communities', of which legal definitions and implications are as follows.

According to Campos and others, [53] before the Clean Energy Package, the main regulatory challenges for collective prosumers included not being able to legally set up community energy projects and, also, a lack of incentives for the joint creation of collectives. Nevertheless, countries like France, Germany, the Netherlands and the United Kingdom already have a favourable framework while others, such as Croatia and Italy, do not. So the idea of the legal inclusion of communities as an energy player is not only to consolidate a clear and common approach in terms of rights and obligations but also to highlight the role as an active actor in the energy transition.

6.3.1.1 Citizen energy communities

The European Directive on 'Common rules for the internal market for electricity' Directive 2019/944, introduced the definition and framework of 'citizen energy community'.[54] This new term is defined as a legal entity based on voluntary and open participation, controlled effectively by its members with the main purpose of providing benefit to them and the local areas through an energy project.[55] This definition contains four elements: legal entity, members, purpose and activity. A legal entity means that it can take any legal form, e.g. association, cooperative, a partnership, a non-profit organisation or a small or medium-sized enterprise. In respect of members, the

[52] Bettina Kampman, Jaco Blommerde and Maarten Afman *The potential of energy Citizens in the European (*CE Delft, Delft, 2016) at 21.
[53]Campos Ines and others "Regulatory challenges and opportunities for collective renewable energy prosumers in the EU" (2020) 138 Energy Policy at 111212 at 111213
[54] Directive 2019/944 (EU), art 2(11).
[55] Directive 2019/944 (EU), art 2 (11)

Directive clarifies that they can be natural persons, local authorities or small enterprises. The main purpose of such an entity is to provide economic, social or environmental benefits to its members or to the local areas where it is located, beyond financial profits. In respect of the activity, the community may engage in general energy services such as generation, distribution, supply, aggregation, storage or energy efficiency services.

This Directive establishes a special duty on Member States to provide a regulatory framework to ensure the participation of citizens' energy communities. In this sense, the Member States must enable citizens to willingly join or leave a community and not to lose rights and obligations as household customers or active customers.[56] The Directive also requires Member States to provide access to fair compensation that should be facilitated by distributor system operators. At the same time, regulatory authorities assess the best way to ensure non-discriminatory and cost-reflective network charges. The assessment requires that when community projects access the network, there are proportionate and transparent procedures for registration and licensing.[57]

On the other hand, Member States must provide a regulatory framework regarding ownership and management of the distribution networks.[58] In this sense, when Member States decide to grant a citizen energy community the right to manage distribution networks, the community should be entitled to reach an agreement on the operation of the network with the distribution system operator and also to be subject to appropriate network charges and the same obligations as a traditional distributor operator.[59] These charges should be accounted for separately from the electricity fed into and consumed from the distribution network and not discriminate or harm customers who remain connected to the distribution system.[60] It is worth noting in this case that the EU framework foresees the scenario in which the unbundling rules will need to ease for community projects when the project pursues generation, distribution and supply together.

[56] Directive 2019/944 (EU), art 16.
[57] Directive 2019/944 (EU), art 16 (1).
[58] Directive 2019/944 (EU), art 16 (2).
[59] Directive 2019/944 (EU), recital (46)
[60] Directive 2019/944 (EU), art 16(4).

In any case, Member States are required to ensure different rights and accessibility in exchange for some obligations on the community. In terms of rights and market entry for the communities, it includes access to electricity markets directly or through aggregations, non-discriminatory and proportionate treatment when participating in any of the energy activities and interacting with other agents.[61] The entitlement to supply energy among their members is called, 'electricity sharing' by the Directive.[62] Electricity sharing means supply among the members without limitation because of physical proximity or being behind a single metering point.[63] This last provision is especially important because it means that a citizens energy community does not need a supply licence to supply energy to its members and allows self-consumption. In exchange, the energy community must be responsible for the imbalances caused in the system and to pay the appropriate network charges following a cost-benefit analysis undertaken by the competent authority. [64]

6.3.1.2 Renewable energy community

Another relevant European Directive is Directive 2018/2001 regarding the promotion of the use of energy from renewable resources. Differently from previous renewable energy directives, for the first time, it includes the community as an active actor for the promotion of renewable energies. In this sense, it introduces the term 'renewable energy community'. It is defined as a legal entity that is effectively controlled by shareholders and members that are located in the proximity of a renewable energy project developed by a legal entity.[65] As with a 'citizen energy community', their members can be natural persons, small enterprises or local authorities, and the main purpose should be a community benefit rather than economic profit. It must be stated at this point, that the main difference from a 'citizen energy community' is that in a 'renewable energy community' the members must be located close to the energy project. Therefore, remaining local is a central characteristic of such projects.

[61] Directive 2019/944 (EU), art 16(3).
[62] Directive 2019/944 (EU), art 16(3)(e).
[63] Directive 2019/944 (EU), recital (46).
[64] Directive 2019/944 (EU), arts 16 (3)(c) and (1)(e).
[65] Directive 2018/2001 (EU), art 2 (16).

Renewable energy communities have similar provisions to citizen energy communities in terms of access to the network, access to markets directly or through aggregators, participation in the different electricity activities and services and sharing electricity among their members.[66] Similarly, these communities cannot be subject to unjustified regulatory or administrative barriers.[67] Nevertheless, there is a special mention of the option to sell renewable energy through renewable power purchase agreements.[68]

Access to finance and information is also included in this Directive. The status of such legislation and effort should form part of the climate plan and progress reports of each Member State. It is important to note that Member States are required to take into account the needs of these communities when designing support schemes, so they can also participate on an equal footing with other market participants.[69]

Finally, it is worth noting that in the previous draft of the EU proposal on the promotion of the use of energy from renewable resources, there was a participation limit or percentage of voting rights required in order to consider a energy projects as a renewable energy community. [70] The new and final version does not contain such a restriction. These criteria were meant to ensure that the management of the local communities is made by local individuals while leaving space for corporate support. Although such participation limits are no longer in the text, future community projects should ensure that community engagement is maintained as a central component, leaving corporate or public support work as an enabler rather than a driver.

In the EU legislation, the introduction of these two entities (citizen energy communities and renewable energy communities) for the very first time, shows that it is vital to recognise increasing ways of generating and supplying energy that involves a more empowered role for individuals working together as communities in the electricity industry. However, the community, as an energy actor, is not a new concept among Member States. For instance, Denmark has been a pioneer since 1970 and currently has

[66] Directive 2018/2001 (EU), art 22 (2)(b).
[67] Directive 2018/2001 (EU), art 22 (4) (a).
[68] Directive 2018/2001 (EU), art 22 (2) (a).
[69] Directive 2018/2001 (EU), art 22(4).
[70] Proposal for a Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources 2016/0382, art 22.

around 1,100 communities.[71] Another example is Germany which has seen an incremental uptake of community energy, and mostly in the aftermath of the Fukushima Disaster in 2011, currently having more than 900 communities.[72] Therefore, the importance of recognising community energy as an active actor in the energy transition is not about a new concept that introduces it but about the clarity that it provides. Such clarity, in terms of rights and obligations, ensures the possibility of managing or owning a distribution network, access to markets and electricity sharing, which allow communities to supply energy among the members without the need of a supply licence. Such rights work together with clear obligations for market and grid participants such as paying network charges and being in charge of the imbalances that are created in the system. Those rights and duties create an obligation on Member States to update their legislation and to also consider community energy in the energy planning and tracking climate change progress. However, according to Campos and other authors,[73] the implementation of these Directives may create problems at the domestic level by increasing the complexity of the different collectives that already exist and how these new provisions apply to them. In my view, a way to solve this issue is by every Member State introducing a transitional regime that safeguards the existing advantages for communities and progressively introducing the obligations. The idea of the Directive is to harmonise the role of the communities and establish minimum requirements and guidelines for communities participating in the energy industry. It is up to the Member States to find the balance between the costs and benefits of a more favourable framework for communities, which will depend on the specific circumstances of each country.

Since both Directives are quite recent, they have not yet been implemented into domestic legislation in many Member States, as is the case in the Netherlands. Other countries have already implemented it, such as Greece, where, in January 2018, the Parliament voted for the first dedicated legislation on community energy in Europe. The law defines how it can be established, how it operates and the use of profits. The main issue is that community energy is constructed in a way that promotes

[71] August Wierling and others "Statistical Evidence on the Role of Energy Cooperatives for the Energy Transition in European Countries" (2018) 10 Sustainability 2 at 15.
[72] At 8.
[73] Campos and other, above n 53, at 111213.

sustainability, cooperation and innovation but not necessarily profit.[74] The next section will analyse the legal approach to community energy in the Netherlands.

6.3.2 Netherlands

In the Netherlands, around 500 collectives operate, ranging from wind cooperatives owning onshore wind turbines to local energy initiatives, which jointly invest in solar panels and engage cooperatively in energy efficiency.[75] In the Dutch legislation, there are two options for collective engagement in renewable generation: the Postal Code Area Arrangements and a Decree which allows experimenting with small scale pilot projects. These new legal instruments were the result of an Energy Agreement for Sustainable Growth. The agreement was signed by public and private parties in 2013 to promote renewable energy, highlighting the importance of decentralised generation, developing insights into future electricity legislation adjustments.[76]

6.3.2.1 Postal Code Area Arrangement (PCA)

This arrangement attempts to incentivise collective generation by granting a tax reduction to the members of an energy project. Members of the collective shall be located close to the generation installation, within or surrounding the postal code area. The idea is to encourage people living close to each other to invest in the local generation.[77]

The PCA on the Environmental Protection Tax has been in force since January 2014 and has been amended several times. The current regulation allows interested people to engage in or establish a cooperative which will be a legal entity in which small consumers or small businesses can also take part. Small businesses cannot hold more than 20% of the shares to be considered an energy cooperative. The cooperative has to

[74] Energy Cities "Unleashing the Power of Community Renewable Energy" (2018) Green Peace <www.energy-cities.eu>

[75] Anna Butenko "Sharing energy: dealing with regulatory disconnect in Dutch energy law " (2016) 7 SSRN 701 at 709.

[76] Diestelmeier and Kuiken, above n 33, at 48.

[77] Antonia Proka, Matthijs Hisschemöller and Derk Loorbach " Transition without conflict? Renewable energy initiatives in the Dutch energy transition" (2018) 10 Sustainability 1721 at 1723.

be recognised as a legal entity and entitles the owners of the generation installation to be eligible for a tax reduction from the Tax Authority.[78]

Diestelmeier and Kuiken,[79] when explaining this scheme, argue that the generation should come from renewable resources, and that the cooperative cannot sell the energy directly to their members. In consequence, the cooperative has to sell the energy to a supplier and also provide a statement stating the amount of electricity that corresponds to each member and, in exchange, the supplier may request an extra administrative charge. Thus, the PCA follows an indirect supply model. The arrangement allows it for a full tax reduction per member for the delivered electricity for volumes not exceeding 10,000 kWh on an annual basis. This is in contrast to the Dutch net-metering regime that allows to offset the total production with the total consumption with a cap of 5,000 kWh annually. Such a tax reduction creates strong incentives for individuals to invest in collective entities instead of those that promote individual self-generation. The number of collectives has consequently increased from 17 projects at the end of 2015, to 55 projects at the end of 2016.[80]

The main limitation of PCA is the restriction of the special tax regime to members within the postal code. De Boer and Zuidema[81] consider that such restrictions in the PCA do not add much value to the already established collectives, such as wind cooperatives, whose existing members live in other postal areas. However, it can add value to the new collectives. From a technical point of view, the PCA works as net-metering, referred to as collective net-metering. Boer and Zuidema argue that one problem is finding enough participants within the code area, which may reduce the envisioned size of the whole project.[82]

Different lessons can be learnt from the PCA. On the one hand, the importance of economic incentives to promote the participation of people in communities. It can be seen as a useful mechanism, mainly for urban areas, although there is a geographical

[78]Diestelmeier and Kuiken, above n 33, at 48.
[79] At 49.
[80] Diestelmeier and Kuiken, above n 33, at 48.
[81] Jessica De Boer and Christian Zuidema "The adaptation of Dutch energy policy to emerging area-based energy practices" (2018) 117 Energy Policy 142 at 146.
[82] At 148.

limitation to the incentive. On the other hand, a big limitation of PCA is the requirement for a supply licence. However, such an approach will need to be amended soon, to incorporate the new European Directive instructions regarding the concept of electricity sharing. It means that cooperatives would not have to sell the energy to a supplier to be later resupplied back, which is an unnecessary step and, instead, the cooperative can supply its members directly.

6.3.2.2 Experimentation Decree

The Experimentation Decree allows projects to increase renewable energy, combine heat and power at a local level, more efficient use of the energy infrastructure and increased involvement for energy consumers to provide their energy. The Decree distinguishes two types of projects based on their size, project grids with a maximum of 500 connected users and large grids with a maximum of 10,000 connected users. For Lammers and Diestelmeier, such projects can be collective generation and peer-to-peer supply, which are entirely novel to the traditional top-down governance. [83]

The Experimentation Decree empowers the Ministry of Economic Affairs to grant individual exemptions from specific provisions of the Electricity Act 1998 to specific projects. The projects can choose up to six provisions of the Act to be exempted from. The decree allows the exemptions to last for 10 years, with an official evaluation within the first four years.[84] The Ministry can grant 10 exemptions per year for small projects and 10 exemptions for large experimental projects in the period from 2015 to 2019.[85] The results of such experimentation will be the basis for future legal revisions and reforms. Eighteen out of 80 projects have been granted exemptions. Currently, 15 projects remain active.[86]

In 2016, five projects were allowed, of which two were large. At that time, seven projects deployed energy management through smart grids and six projects engaged in

[83] Imke Lammers and Lea Diestelmeier "Experimenting with law and governance for decentralized electricity systems: adjusting regulation to reality?" (2017) 9 Sustainability 1 at 7.
[84] At 8.
[85] At 9.
[86] Luuk Spee, Innovation through regulatory experimentation (presented to online debate, Florence School of Regulation, April 2020).

peer-to-peer supply, in which members could supply energy to each other via the collective entity. Another three projects established dynamic electricity tariffs and flexible use of the system. Although the collective entities have to be controlled by their members, five out of nine projects are led by professional project developers, PV installation businesses and real estate companies as members of the collective.[87] Such a fact shows the relevance of knowledge and expertise that energy projects demand.

The Decree applies to projects operated by associations (owners and energy associations), which have to be entirely controlled by their members.[88] Distribution system operators (DSO) and suppliers cannot exercise any control.[89] The previous provision means the association has to demonstrate that it possesses the organisational, financial and technical expertise and can ensure reliability issues, safety, technical standards, consumer and environmental protection requirements to be set by the Experimentation Decree.[90] According to Lammers and Diestelmeier, such requirements are necessary because the association itself is going to become a producer, supplier and system operator of a local network, which requires a level of expertise and financial capacity. It also means that the unbundling rules can be exempted for these projects. [91]

Nevertheless, governance and participation are different depending on whether it is a large grid project (10,000 connected users) or a small one (500 connected users). For the large grid projects, the regional DSO remains in charge, but for the small grid projects, the community can operate as a DSO.[92] In this case, the association, who also acts as DSO, has to comply with third party access obligations to the network, which means the customer retains the option of choosing a supplier outside the community.[93]

Hoicka and MacArthur[94] argue that such regulations do not give space for new actors to participate but primarily support vertically integrated projects, such as project grids. For the authors, this results in ambiguity in terms of third party access and, in general,

[87] At 1.
[88] Experimentation Decree (The Netherlands), art 7 (1) (q).
[89] Experimentation Decree (The Netherlands), art 7 (1)(j).
[90] Experimentation Decree (The Netherlands), art 4 and 7 (d, e).
[91] Lammers and Diestelmeier, above n 83, at 9.
[92] Experimentation Decree (The Netherlands), art 3.
[93] Lammers and Diestelmeier, above n 83, at 10.
[94] Hoicka and MacArthur, above n 18, at 165.

competition for electricity supply. The authors also argue that the bundling of the supply chain on that projects does not give space to other innovative approaches. However, one should highlight the critical effort the Dutch government is making to experiment with different approaches outside of those that are traditionally legislated for. By keeping relevant requirements when dealing with a large community project, it seems essential to balance out the enabling of community energy projects on one side, and ensuring of the security of supply to those communities on the other. The results of this exercise will help in evaluating current legislation and promoting future amendments.

6.3.2.3 Distribution unbundling rules

After liberalisation started in the EU in the late 1980s, the energy networks became unbundled, meaning the production and supply were separated in order to keep an independent network.[95] Such unbundling is not strict and allows distribution to be part of a vertically integrated company, as long as there is a legal, functional and operational separation of the distribution system operator (DSO). According to the EU legislation, such separation does not necessarily require separate ownership of assets (ownership unbundling).**[96]** However, distribution has to be independent in terms of organisation and decision making, and Member States are required to monitor vertical integration so it does not distort the market.

In the Netherlands, the rules for unbundling are far-reaching and include ownership unbundling.[97] It means full separation of the distribution activity from production and supply companies. The DSO is in charge of operating and maintaining the local physical grid context. As described in the Experimentation Decree, the community projects that want to integrate supply chain activities require to be granted an exemption from the rules of the Electricity Act. Then, in a typical scenario, the unbundling rules apply and do not allow community projects to integrate activities when it refers to

[95] Martha Roggenkamp and HK Kruimer EU "Climate Regulation and Energy Network Management" in E. Woerdman, M.M. Roggenkamp and M. Holwerda (eds) *Essential EU Climate Law* (Edward Elgar, Cheltenham, 2015) 235 at 242.

[96] Ignacio Perez-Arriaga *From Distribution Networks to Smart Distribution Systems: Rethinking the Regulation of European Electricity DSOs* (European University Institute, Florence, 2013) at 18.

[97] Electricity Act 1998 (The Netherlands), art. 10b.

distribution activity and supply or production. Only when granted the temporal derogation the community can then pursue vertically integrated projects. The future amendment of the Electricity Act and in particular the unbundling provision will not only depend on the outcomes of the Experimentation Decree but also on the implementation of Directive 2018/2001 and Directive 2019/944 regarding rethinking unbundling rules for community energy projects.

Overall, several lessons can be learned from the Dutch experience regarding community projects. The first is the critical space needed for experimentation which is essential when dealing with innovation and allowing new projects to test the current regulatory setup and rethink how to build it more efficiently to avoid regulatory gaps. Such an approach is coherent with the relationship between law and innovation when considering that even though the law is necessary to make the system work in an efficient, coordinated and secure way, the law can sometimes either block innovation because it takes a long time to change the rules and adjust them to reality or can perform a progressive role that can encourage innovation. The role of law and innovation, as we explained in Chapter 3, is related to the concept provided by social science regarding 'socio-technical transitions' in which the law makes part of an interlinked mix between technologies, organisation, market and regulations set up to deliver societal functions. Therefore, it is essential to find regulatory mechanisms to allow innovation to happen without disrupting existing arrangements. Regulatory experimentation is one of the ways that enable such space. Another lesson is the early and domestic approach which gives special encouragement to community energy is the case for the Postal Code Arrangement, which has fortified an increasing number of households to invest in local energy.

In this respect, it is clear that there is no regulatory disconnection between the energy community projects and the legal framework applicable to them. In the Netherlands there are legal and regulatory mechanisms that can be put into practice with a certain level of openness to try new projects. There is always space for improvement in terms of third party access to areas where community projects are located. Such third party access is a basis for liberalised industries where community members have the chance to choose between community projects, traditional suppliers and other emergent actors. In the case of the PCA, the limitation in accessing tax benefits, which is only available

to members close to the postal area, it is also an issue that could be improved. It would be preferable to open such a mechanism to more citizens that are willing to participate and invest in local initiatives, regardless of their location.

6.3.3 Colombia

The outcomes of distributed generation and community projects can be essential for off-grid areas in Colombia. These in Colombia are the ones that are not connected to the grid because they are isolated, and it is not economically feasible or attractive to expand the grid to supply energy to those areas. Traditionally, off-grid areas coincide with rural and vulnerable areas, some of which have been severely affected by the internal conflict Colombia has lived with for the past 60 years. The legal framework for off-grid areas is different from the one applicable for grid-connected areas, which have been the subject of analysis in the last three chapters. In the case of off-grid areas, usually, private investors are granted a monopoly over these areas, called 'exclusive service areas', to generate and supply energy. The authority in charge of granting the exclusive area is the Institute for Planning and Promotion of Energy Solutions for Non-Interconnected Areas (IPSE), which is part of the Ministry of Mines and Energy. Generally, diesel plants supply energy to these areas. [98]

However, taking into account the environmental problems that diesel creates, the high costs involved and the high electricity bill for consumers in already vulnerable and isolated areas, the energy planning authority (UPME) introduced in the planning documents 'Rural Plans for Providing Sustainable Energy' (PERS), new resources and ways to provide energy to off-grid areas. [99] Such new methodologies take into account more efficient energy alternatives, which can help in the development of economic and social projects where the community can finance its energy consumption through productive local projects.[100] Furthermore, the UPME recommends the diversification of technology to assist isolated areas and foster non-conventional energy resources such

[98] Superintendencia de Servicios Públicos Domiciliarios "Zonas no Interconectadas: Diagnostico de la prestación del servicio de energía eléctrica 2018" (November 2018) <www.superservicios.gov.co> at 38. (Translation: Non-Interconnected Zones: Diagnostic of the provision of electric power service 2018).

[99] Unidad de Planeación Minero Energética "Planes de Energización Rural Sostenible" (2017) <http://www.ipse.gov.co> at 1.(Translation: Sustainable Rural Energization Plans).

[100] At 4.

as solar, wind, tidal or biomass. To date, three PERS projects have been introduced in different regions: Orinoquía (Vichada, Casanare, Meta, Arauca), Cesar and Norte de Santander. Six PERS projects have also been completed in La Guajira, Tolima, Nariño, Putumayo, Chocó and Cundinamarca.[101]Some of these projects are financed with help from public funds for non-interconnected or rural or post-conflict areas and consist of distributed generation projects.[102] Some are still being formulated, others are awaiting evaluation in order to receive funds, while others are in the process of clarifying governance and community involvement.

6.3.3.1 Self-generators located in off-grid areas

Given the relevance of distributed generation and the possibility of encouraging community energy projects in off-grid areas as an alternative energy solution, this section will analyse the applicable regulation of self-generation in off-grid areas, emphasising the potential to embrace community energy. In Colombia, there is currently neither of the concept of, nor regime applicable to, community energy projects. However, it is essential to highlight that the development of community energy, especially for off-grid areas, would be very beneficial to create opportunities not only for self-generation and self-consumption but a productive and economic opportunity that brings investment to such isolated and vulnerable communities. Regulations applicable to self-generators located in off-grid areas is found in Resolution CREG 038 of 2018. Such Resolution can also apply to community energy projects in off-grid areas. Therefore, this section will highlight the most critical issues in the regulation.

This resolution applies to self-generators and distributed generation parties performing their activities in off-grid areas. The companies that are granted the 'exclusive service' can agree freely on the terms and conditions for the supply of energy and remuneration for the energy surplus with the self-generator. Such an approach is known as freedom

[101] At 3.

[102] Institute for Planning and Promotion of energy solutions for interconnected areas "Implementación de kit solares fotovoltaicos para 153 familias en las zonas rurales no interconectadas en el municipio de el Carmen en el departamento de Norte de Santander" (2018) <http://www.ipse.gov.co>. (Translation: Implementation of photovoltaic solar kits for 153 families in non-interconnected rural areas in the municipality of El Carmen in the department of Norte de Santander).

of contract. However, the parties to such contracts do not all hold the same bargaining power. One should note that companies granted the exclusive service have more bargaining power than the self-generator, which can lead to an asymmetric contract. The contract between a self-generator and the company granted the exclusive service might stipulate clauses against the self-generator or community energy located in exclusive service areas. Therefore, it would be better if the regulation foresee a provision to balance the contract and the duties and obligations of each party.

Regarding the connection of self-generation to the network managed by the company granted the exclusive service, a connection contract is required. The resolution defines the minimum provisions of the contract.[103] Self-generators with an installed capacity equal or less than 100 kW have a simplified procedure. In this procedure, the connection agreement should only be in a format requiring the connection. Such a procedure is different from larger self-generators (more than 100 kW) who require a more complex agreement which includes detailed connection studies.[104] There is a limit to participation by self-generators in the specific off-grid area being 15% of the nominal capacity of the grid.[105]

In terms of dealing with the energy surplus from self-generators in off-grid areas, the trader who is typically involved with distribution is obliged to buy the energy surplus from the self-generators. The imported and injected energy amount will be balanced. In the case of using more imported energy, the self-generator has to pay generation, distribution and trading services costs.[106] If the injected energy is more than the amount that is imported, the self-generator will get paid the price of the energy.[107]

Due to the lack of a specific regulatory framework applicable to community energy in Colombia and especially in rural areas, the above regulatory framework regulating self-generators in off-grid areas (usually granted as exclusive areas) will be applicable. Although the regulation contains the terms of connection procedure and remuneration for energy surplus, it is debatable whether there is any freedom of contract between the

[103] Resolution CREG 038 of 2018 (Colombia), art 5
[104] Resolution CREG 038 of 2018 (Colombia), art 17.
[105] Resolution CREG 038 of 2018 (Colombia), art 6.
[106] Resolution CREG 038 of 2018 (Colombia), art 20.
[107] Resolution CREG 038 of 2018 (Colombia), art 20(b).

parties, which are not on an equal footing. Another barrier is that self-generators cannot sell the energy directly to consumers but can sell it to the trader, who is typically the exclusive service granted company, who must buy the energy. As an exclusive granted area, there cannot be other suppliers in the same area, creating conflict with the self-generator who cannot become a supplier unless the contract allows it. As a consequence, there is an indirect supply model, in which the self-generator cannot sell the energy directly to the community members but, instead, shall sell it to the supplier, who later resupplies it to other members.

6.3.3.2 Unbundling rules

Law 143 of 1994 requires the unbundling of vertically integrated electricity companies.[108] There are some exceptions to this general rule. The first is the integration between generation and retail, or distribution and retail, where the same company can develop these activities by themselves or through subsidiary companies. Secondly, companies constituted before 1994 can continue as integrated companies but with accounting unbundling.[109] Given that most of the electricity assets were built before 1994, most of the electricity companies are currently covered by the exception. As a consequence, the most important electricity companies are vertically integrated in Colombia.

Nevertheless, the unbundling rules do not apply to off-grid areas or isolated areas, and traditionally, in off-grid areas, a sole integrated company performs all the activities in exclusive granted areas. Such a situation provides some options for community energy initiatives. The first option is to submit the project to the IPSE who will study whether to grant the supply to an exclusive area which means the community energy group will be the sole supplier in the area. However, in order to be granted this title, it needs to have enough financial, technical and economic capabilities to prove that a starting community is capable of assuming a sole supplier role. Instead, a second option involves an agreement with the company granted the exclusive area. Such an agreement can contain the terms and conditions for enabling the community energy project to

[108] Law 143 of 1994 (Colombia), art 74.
[109] Law 143 of 1994 (Colombia), art 80.

undertake the project in a specific zone within the granted area. The regulator, CREG, and, most importantly, the IPSE can support the procedure and even offer technical and economic support to the initiative.

To conclude this section, one should state that even though there are no examples of community energy project in Colombia, there are legal opportunities to develop them. For instance, there are no strict unbundling rules, especially in off-grid areas and there are financial funds available that can be invested in such community projects which are needed most in rural, isolated or post-conflict areas. There are also regulations that can help to guide the relationship with energy providers in exclusive areas or distribution companies regarding connection and selling of energy surplus. It would be better to have special rules that apply to specific community energy projects. However, in the meantime, the regulation for self-generation in off-grid areas can be applied. It is also vital that there is a contractual relationship between the community energy project and the exclusive service operator to allow a community to develop effectively and coordinate with other operations in the area.

6.3.4 New Zealand

Raglan Local Energy is an example of what can be done under the current settings in New Zealand. It is a community project that is under development in Raglan. Some citizens living in this town decided to invest in local generation to self-generate and self-consume renewable energy, having in mind, to create a more sustainable way of living as the main driver.[110] Together with WEL Networks, the distribution company of the Waikato region and the retail company, Our Energy, the community project started a trial in February 2020. The existing local generation can be matched with local demand in real-time thanks to the online platform provided by Our Energy.[111] WEL Networks will allocate the energy, and the members of the community will get special price deals from joining the community. The community is also expecting, in the mid and long term, to invest more in local generation, firstly in a solar farm and later in wind turbines. Currently, there are 100 people in Raglan engaged in the project. In the

[110] For more information: www.raglanlocalenergy.co.nz

[111] Our Energy "A fresh approach to enable local energy markets" <www.ourenergy.co.nz/why-our-energy/>

future, the community will be able to sell the energy surplus to customers outside the community and even outside Raglan, to other customers in the Waikato region.

In New Zealand, community energy projects can take different legal forms. According to studies by Hoicka and MacArthur[112] focusing on community energy in New Zealand, 5% of the projects are cooperative, 16% partnership or joint venture, 10% indigenous projects, 13% municipalities, 4% community associations and 52% community trusts. Therefore, trusts are the type of organisation most used in New Zealand for this purpose, compared to more frequently used types of organisation in Europe such as cooperatives, municipalities or community benefit societies.[113]

6.3.4.1 The Energy trusts

Most of the consumer energy trusts started as local lines companies and now are investment entities. Barton explained the historical and regulatory reason behind the use of trusts in the electricity sector. [114] The Energy Companies Act 1992 attempts to give corporate form to the business of public entities and remove legal monopolies because at the time the entities providing electricity were entirely publicly owned. Later local distribution companies were created from electric power boards and municipal electricity departments where obliged to choose to be either lines businesses or energy businesses. Most of the local distribution companies retained the distribution lines. However, the Energy Companies Act 1992 required that each entity adopted a corporate form but did not mention who would own the shares of the company. The most common arrangement was for the shares to be vested in a consumer or community trust established for that purpose.[115] However, the community can own the shares but has little control over the company.[116].

[112] Hoicka and MacArthur, above n 18, at 164.
[113] At 165.
[114] Barry Barton "Electricity regulation in New Zealand: the early stages of a new regime" (2008) 26 Journal of Energy & Natural Resources Law 207 at 209.
[115] At 213
[116] Barry Barton "From public service to market commodity: electricity and gas law in New Zealand" (1998)16 Journal of Energy & Natural Resources Law 351 at 363.

The role of the trust in New Zealand is so significant that community and consumer electricity trusts own 65% of distribution networks in New Zealand.[117] According to data from Energy Trusts New Zealand, consumer trusts have investments of over $7 billion in lines companies.[118]

Instead of acting for the needs of members in the way a cooperative does, a trust acts on behalf of a group of beneficiaries. Here, the 'settlors' allocate some assets and funds for the trust and elect a 'trustee' as the person in charge of administering the trust property for the advantage of the 'beneficiaries'.[119] The 'trust deed' is the founding document of the trust, which incorporates the reason why the trust is formed, the identification of the trust property, who the beneficiaries are and the responsibilities of the trustee.[120]

The question that arises is, in an energy trust, what revenue do the beneficiaries receive? The answer is depends on the trust deed. In most cases, the funds go back to the community in the form of power bill discounts, cash or cheque payments. These payments could be every month or once a year, or take the form of discounts in individual electricity accounts.[121] Sometimes the trust can also promote positive outcomes, such as grants.[122] Energy trusts are private bodies established under a trust deed and subject to the Trustee Act 1956.[123]

Most of the energy trusts form part of the Energy Trusts of New Zealand (ETNZ), which includes 22 energy trusts that own distribution companies and operate networks on behalf of local consumers. Through this organisation, they bring the consumer perspective to the regulatory process and participate actively in it.[124]

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[117] Hoicka and MacArthur, above n 18, at 165.
[118] ETNZ "Energy Trusts of New Zealand" (2019) <www.etnz.org.nz/>.
[119] Greg Kelly and Chris Kelly *Garrow and Kelly Law of Trusts and Trustees* (7th edition, Lexis Nexis, Wellington, 2013) at 52.

[120] Jessica Palmer "Controlling the Trust" (2013) 3 Otago Law Review 473 at 475.
[121] Ministry of Business, Innovation and Employment "Line company discount and energy trust distribution analysis 2018" (2018) <www.mbie.govt.nz>
[122] WEL Energy Trust "Brand Guidelines" (2013) <www.welenergytrust.co.nz>
[123] Recently, the Act has been replaced by the Trust Act of 2019.
[124] ETNZ, above n 118.

According to Burcher,[125] one of the central debates regarding the role of energy trust in the electricity sector is the lack of accountability. According to Burcher, there is little control of energy trusts by the state, even though they hold local public wealth. The New Zealand government has put pressure on the ETNZ to establish some guidelines in terms of strengthening the accountability of trustees to the beneficiaries. Such procedures are mostly internal, such as self-regulation, transparent protocols and financial reports for beneficiaries or independent auditing.[126] The Electricity Industry Act requires customer and community trusts to prepare and submit financial statements for audit[127] and make them publicly available.[128] The Act also promotes accountability of the customer and community trust. The regulation can either require trustees to disclose specified information to beneficiaries of the trust, about specific procedures to obtain information, responses to such requests and the right to review the response, or require trustees to hold meetings for the beneficiaries.[129]

As was previously discussed in Chapter 4, the general rule introduced in the Commerce Act is that all electricity lines services (distribution) are subject to information disclosure[130] and also subject to default/customised price-quality regulation[131] set by the Commerce Commission. However, consumer-owned lines services are exempt from price-quality regulation.[132] The question is, who is a consumer-owned lines service? According to the Commerce Act, it is a line service in which one or more customer trusts, community trusts or customer cooperatives hold all the control rights and equity return rights, and at least 90% of the consumers of that supplier benefit from the income distribution.[133] According to Barton,[134] these companies are only subject to information disclosure, not price quality regulation because it is expected they do not have the incentive to charge excessive prices. However, the exemption of default/customised price-quality paths can be lost if the Commerce Commission advises the Minister to do otherwise or because there is a consumer petition to apply a

[125] Richard Burcher "Energy trusts – the sleeping giant" (2006) 5 Chartered Accountants Journal 18 at 21.
[126] At 22.
[127] Electricity Industry Act 2010, s 99.
[128] Electricity Industry Act 2010, s 100.
[129] Electricity Industry Act 2010, s 114.
[130] Commerce Act 1986, s 54F.
[131] Commerce Act 1986, s 54G.
[132] Commerce Act 1986, s 54G (2).
[133] Commerce Act 1986, s 54D (1).

[134] Barton, above n 116, at 224.

price-quality regulation path to the consumer-owned lines service.[135] It means that consumer-owned lines services, many of them electricity trusts, are not bound by the price-quality paths set by the Commerce Commission and instead, the consumer-owned companies self-regulate such paths with little regulatory intervention. Such narrow intervention creates debate around the need for control over the management and investment decisions that the trustees can make. However, it is essential to remember that in any case, consumer-owned lines services can lose that exemption if there is a petition by consumers of such line services, to the Commerce Commission. In relation to information disclosure, the regulations apply to consumer trustees to enable transparency and public control.

The community trust is the legal entity most commonly used in New Zealand that owns the shares of distribution companies, which creates some financial outcomes for the beneficiaries. However, there is not much scope for participation by the beneficiaries in the development of the energy projects beyond appointing the trustee and receiving some financial return. It is interesting to note the lack of accountability of the trustee and the limitation over the control or oversight of their decision-making and that they are not bound by price-quality paths.

6.3.4.2 National Policy Statement on Renewable Electricity Generation (NPS) and the Blueskin Energy Project

The National Policy Statement on Renewable Electricity Generation (NPS) of 13 May 2011 guides local authorities on how renewable electricity generation should be dealt with under the Resource Management Act 1991. [136] The Statement applies to the generation of renewable energy (RE) including construction, operations and maintenance applicable to large, small and community-scale renewable energy activities. The objective of the policy is to recognise the national significance of renewable electricity generation activities, so the proportion of electricity generated from RE increases to a level that meets or exceeds the New Zealand Government's national target. This objective is expected to be achieved by eight policies, including

[135] Commerce Act 1986, s 54H.

[136] The Resource Management Act is likely to be reformed in couple of years. Stuff "The end of the Resource Management Act is nigh" (30 July 2020) < www.stuff.co.nz>

policy F, requiring that Regional Policy Statements and District Plans include objectives, policies and methods to provide for the development of small and community-scale distributed generation projects in the region or district.[137]

A case demonstrates the difficulty in establishing the level of importance given to renewable projects, mainly community-scale distributed generation projects when weighed against other values and interests. A community-scale project proposal was finally declined in September 2017, by the Environment Court, after deciding the appeal against the decision of the Dunedin City Council to decline resource consent.[138] The case in question relates to the Blueskin community. This community, decided to come together with a local energy solution after a flooding event in 2006 that affected the energy supply of the area. The Blueskin Resilient Communities Trust (BRCT) was created in 2008 which later established the Blueskin Energy Limited (BEL) as a social enterprise to develop a local energy project consisting of the installation of a single 3 MW wind generator in the North of Dunedin. This turbine would be capable of generating electricity for the community and feed the energy surplus into the grid. The project required resource consent from the City Council of Dunedin, who declined the proposal. This decision was appealed in the Environment Court, whose final decision was to confirm the refusal based on adverse landscape and visual effects and significant effect on amenity values of the chosen site for the wind turbine.[139]

What really motivated the Court was the consideration of Dunedin's District Plans together with the NPS. The District Plan highlights the amenity values associated with the character or the rural area of the chosen site and that the activity shall not adversely affect the quality of the landscape. So if amenity values are maintained and enhanced and the quality of the landscape is not adversely affected, then the activity may be established within the zone. Another provision to take into account from the District Plan is that people and communities are to be protected from noise and glare which may impact their health, safety and amenity.[140] At the same time the District Plan encourages the development of renewable energy generation as long as the development avoids

[137] New Zealand Government *National Policy Statements on Renewable Electricity Generation* (New Zealand Government, Wellington, 2011) at 6.
[138] *Blueskin Energy Ltd v Dunedin City Council [2017] NZEnvC 150.*
[139] Resource Management Act 1991, s 7.
[140] *Blueskin Energy Ltd v Dunedin City Council* at [126]

significant adverse effects on the visual amenity and character of the zone and significant adverse effects on the amenity of surrounding residential activities.

Therefore, a key issue in the case is whether the turbine would maintain or enhance the landscape, rural character and the amenity values of the area.[141] The Court, after describing the residence's existing amenity values, evaluating the expert's opinion on the existing amenity values, in terms of noise, visual effects, avifauna, among others aspects, finally decided whether the turbine would maintain or enhance the amenity values of the chosen location. The Court found that the turbine would create "…significant adverse landscape and visual effects and significant adverse effects on amenity values…" which would be experienced within the coastal landscape.[142] An interesting point worth noting is that the Court, in its decision, criticised an argument given by Blueskin, who argued that the site selection criteria included the visibility of the turbine, which could be seen as a symbol of community projects; a community turbine. The Court stated that the intention of this argument "politicised the landscape" instead of placing greater emphasis on a more appropriate location for the turbine or considering the attributes that residents and community valued.[143] The Court finally recommended the appellant to advance the application on other alternative sites within Blueskin Bay, but not within the chosen area because it is a sensitive landscape.[144]

Although the Court's decision is based on adverse landscape effects, special attention needs to be given to one of the arguments refer to the application of the National Policy Statement of Renewables and the category of 'national significance' competing with local environmental values which the Regional and District Plans aim to protect, such as landscape.[145] The Environment Court stated that local authorities must amend their local plans to include an analysis of the relevance of renewable energy projects. Such amendments imply the weight given to those matters which does not mean, *per-se,* the consent should be granted. The effect of the NPS is that decision-makers give the appropriate weight to the benefits of renewable generation without undermining the purpose of the Resource Management Act and associated planning documents.

[141] At [157]
[142] At [337]
[143] At [353]
[144] At [354]
[145] At [52]

Consequently, although the Court recognised the positive benefits of the project and its contribution to national targets for renewable generation, by avoiding carbon dioxide emissions and contributing to energy security in the Dunedin region and within the community, the Court finally concluded other values and interests also needed to be considered in the process of granting consent. [146]

It seems essential that, at the national level, better direction and guidance should be provided to local authorities to recognise the significance of community renewable energy projects. And at the local level, the planning documents should include and consider the national objectives, outlining specific criteria about which interests prevail or how to harmonise the multiple interests involved in the development of a renewable energy generation project, especially small community projects. The 'national significance' of a renewable community project is not in terms of the amount of electricity produced or the reduction of greenhouse emissions but in showing that community energy projects can be pursued and that a local and national government bodies supports such initiatives.

The outcomes of this decision show the complexities of the multiple interests that should be evaluated when a small-scale renewable project applies for a resource consent. This fact is confirmed by a survey in New Zealand which identifies the barriers to pursuing small-scale renewable energy projects.[147] This survey identified that obtaining resource consent under the Resource Management Act (RMA) is the second most crucial barrier, after financial constraints, because the cost of obtaining resource consent is similar regardless of whether it is a small or sizeable renewable project. Some costs involved in the RMA process include an impact assessment (visual, noise and landscape effects) and consent hearings. Therefore, there is a need for simplified procedures that recognise the specific nature and advantages of community projects which would also be essential to ensure that affected parties all agree with the project.
So, what can a community group do to avoid the same problem happening again? It would need to make sure the community has taken into account the multiple interests involved when choosing a site to develop a project, and mostly the opinions and

[146] At [349].
[147] Barry and Chapman, above n 33, at 3361.

consideration of the people that would be affected. It is vital finding a consensus and making sure that everyone or nearly everyone surrounding the project is on the same side. Also, the debate about the relevance of the project and convenience of the site should be discussed and solved before applying for a resource consent.

Blueskin Resilient Communities Trust (BRCT) is still working for alternative energy solutions that strengthens the community and creates a local climate solution. The BRCT started a new energy project, called the Blueskin Energy Network (BEN).[148] BEN is a solar sharing venture started in 2017, in which so far 60 households buy and sell local solar power for competitive and attractive prices. The project is run in collaboration with emhTrade, who provide the retail service and trading algorithm for the peer-to peer trading.[149]

It is worth mentioning that the MBIE is consulting about the barriers to greater uptake of small-scale community energy projects and the option to facilitate community energy.[150] Such an issue is included in the discussion of a policy for accelerating renewable energy and energy efficiency in New Zealand.

6.3.4.3 Unbundling rules

In general terms, there is a separation of distribution from generation and retailing. According to the Electricity Industry Act, such a separation has different levels depending on the following factors:[151]

- If a company is involved with both distribution and generation with more than 250 MW of generation directly connected to the national grid. In this case, ownership separation is applicable.
- If a generator that generates more than 50 MW and is involved in distribution. In this case, corporate separation and arm's-length rules apply.

[148] For more information, consult the following link: www.blueskinenergynetwork.nz
[149] MBIE "Discussion Document: Accelerating renewable and energy efficiency" (December 2019) <www.mbie.govt.nz> at 95.
[150] At 93.
[151] Electricity Industry Act 2010, s 72 (2).

- If a retailer that retails more than 75 GWh per year to customers is connected to the distributor's network and is involved in the same distribution business. In this case, corporate separation and arm's-length rules apply.

What can be concluded from the above regulation is that in cases where the generation capacity is too small, the unbundling rules do not apply. From this provision, we can imply that any project that goes below the limits mentioned above are not required to follow the separation between generation and distribution or distribution and retail. Therefore, it is significant that the setting of unbundling rules in New Zealand is not a legal barrier for small projects undertaken by communities

There are different lessons to be learned from the New Zealand case. There are currently different legal entities that can be used by the community to manage better the return of profits and benefits for the members, such as a trust. There is also a need for guidance from the national government to local governments to promote the benefits of local renewable energy projects, such as the ones that can be undertaken by communities, and for the role of local planning documents need to reflect and consider national energy objectives. Finally, the unbundling rules need to be flexible enough to enable small, vertically integrated projects to be carried out by communities. Thus, there is no regulatory disconnection and the current legal framework is flexible enough to enable communities to produce and consume their energy. However, undertaking such an enterprise requires certain financial and technical capability or the proper arrangements with other traditional players to make it possible, as is the case for Raglan Local Energy or Blueskin Energy Network. Moreover, a burdensome result is that community projects must go through the same environmental and land use regulatory procedures as any other project, and therefore there is a need for special or simplified procedures for small-scale and community energy projects.

Currently, in New Zealand, there are no special incentives or revenue support schemes to ensure community projects have access to capital. There are no special or simplified procedures, and, rather, the development of community energy depends on market mechanisms and individual promotion which can be seen as an obstacle for community projects.

6.4 Key Points

A more active role for consumers can also mean belonging to a community energy project to not only satisfy the energy need for oneself but as a collective. The concept of 'community' can refer to different scenarios where a group of people decide to get together for a common purpose. Such purpose can be financial or a common worldview that attempts to develop a more sustainable way of living which includes self-generation of energy and self-consumption.

Community energy faces legal challenges that consist of burdensome procedures which do not consider the particular characteristics of community projects; the need for a supply licence that makes the way a community supplies energy to their members onerous, creating extra steps; and the need for a variety of legal entities that enable communities to interact in the best way for their organisational needs. The ability to participate in the market and the availability of remuneration schemes that ensure the return of investment or access to capital is also a problem. Another issue is the need for more flexible unbundling rules.

Some of those legal barriers are present in the three chosen jurisdictions, but there are also alternative approaches and interesting responses to some of the challenges. In the case of the European Union, it is vital to highlight its role as a model for other countries in the way it legally recognises community energy projects by the concept of a 'citizen energy community' and 'renewable energy community'. It also provides rules and guidance about the proper way to regulate them concerning the participation in the market and electricity sector. One example is the recognition of 'electricity sharing' as a possibility for energy communities to supply energy to their members without the need for a supply licence or a supplier or retailer acting as an intermediary.

In the Netherlands, there are interesting examples which provide opportunities to develop projects freely controlled in a context of experimentation that later will be used as a basis for probable future amendments to the electricity legislation. The Postal Code Agreement allows the consumer in mainly urban areas to invest and participate in renewable energy projects, giving an alternative solution to the lack of opportunity or money to invest in self-generator devices.

In Colombia, although there are no current examples of community energy, there are multiple opportunities to deploy such projects. These opportunities would work particularly in the context of rural and isolated areas or even as an opportunity for post-conflict areas to generate energy and create economic opportunities to their citizens. Some regulatory issues need to be addressed, such as the freedom of contract regarding relationships between the energy providers granted an exclusive zone and self-generators or distributed generators in their area. However, it raises questions about the fairness of the contract.

New Zealand has different types of legal entities to enable a community to be viable; the most common being the trust. The energy trust has been used mostly to hold the shares of local distribution companies, and the return that beneficiaries receive is mostly economic or in tariff reductions. A very different energy trust was examined, the Blueskin Resilient Communities Trust which objective is to generate energy for its members and create local alternative solutions to climate change. One of its projects (the installation of one wind turbine in coastal landscape) was opposed due to landscape impacts and a lack of clarity and guidance from national authorities on the promotion of locally generated renewable energy, and the failure of local authorities to include national directions in local planning documents. There is also no guaranteed access to funds or capital for community projects, but rather it is driven by the market or by individuals.

Finally, it is crucial to rethink unbundling rules which is essential for the development of community energy projects, and particularly if these projects hope to integrate the distribution and supply of the energy that the community self-generates.

Chapter 7. What is the Role of Law in Shaping the Electricity System for a More Active Role for Consumers?

When answering the question, what is the role of law in shaping the electricity system for a more active role for consumers, the answer does not only refer to the role of the 'consumer'. This thesis recognises that it is also important to analyse the role of law regarding other industry actors such as distributor operators, markets and suppliers who are challenged by a more empowered consumer.
The thesis has paid particular attention to five main issues:

- Access to networks by prosumers, while increasing participation in the network, challenges the role of the distribution operator's role in managing it.
- Access to markets that result in questions about the limits to the participation of prosumers in the wholesale and retail markets and questioning the need to create new markets that better promote the benefits that consumers offer to the industry.
- Access to markets that also includes fair remuneration for prosumers who are offering energy and other services such as demand response to the market. In this respect, the role of the market and the retailer/supplier are challenged and require rethinking.
- Extending the scope of consumer protection rights to small prosumers. In this way, the role of the regulatory authority, consumer protection bodies and even retailers should be reformulated or updated.
- Finally, a more active role by consumers can also mean the possibility of belonging to communities or groups of people who want to be active agents of change and, consequently, engage in energy projects. Once again, the role of the distributor operator needs to be questioned, together with the market and relationships with suppliers and retailers.

The research carried out in this thesis has shown that the failure to address these new issues can lead to regulatory disconnection, leaving the regulations out of kilter with progress and changes in the industry. A way of promoting competition as the central core in liberalised countries is the creation of a level playing field for traditional and

new actors to work together in a more complex structure that will create greater benefits for the system and the customers. It is essential to rethink the roles of the diverse actors in a much more complex system.

Also, when facing innovation, the electricity sector will witness new and continuous technological change, of which little is known or understood. The question that arises is what can law and regulation do to make sure that the benefits of these new technological innovations are procured without delay? Therefore, based on the research that this thesis has carried out so far, this chapter will put together three main aspects that have been discussed and that result important to revise or rethink. The first issue is the role of the different industry participants, starting with the role of traditional actors, such as retailers, distributors and markets. The second issue is the role of the consumer when they become a prosumer. And the last issue is the role of law in responding to innovation in the electricity sector, where we will attempt to answer the question, what is the role of law and regulation in integrating prosumers into the electricity industry?

7.1 The Importance of Rethinking the Role of Traditional Actors

A frog is placed inside a pot with cold water. The water is heated up slowly and gradually, and the frog eventually lets itself be boiled alive. The frog is so comfortable with its environment that does not realise the danger and fails to change its behaviour. This is a well-known fable that has been reminding generation after generation to be aware of the change and the importance of adaptation which is necessary to survive. There are three main actors whose roles are being challenged by consumers taking a more active role. These actors are suppliers/retailers, markets and distribution operators. Such a reformulation is needed because their traditional functions are now causing a regulatory disconnection. The role of the regulatory authority and, in some cases, even the legislators, it is to update their regulatory functions, procedures and relationships with traditional and emerging actors.

7.1.1 Rethinking the role of the traditional retailer/supplier

The role of the retailer as the traditional supplier of energy to consumers is being challenged because some consumers, who used to be clients, are now producing their

own energy. This fact reduces or eliminates the dependence of consumers on retailers/suppliers. Besides, retailers, instead of selling energy to consumers, are now buying energy from them. For example, as we explored in Chapter 6, regarding community energy, in those countries where holding a supply licence is a requirement to supply energy, the community must sell its energy to the retailer who later resupplies it to the members of the community. Such a requirement creates an unnecessary loop which adds additional costs and procedures. Another example discussed in Chapter 5 is that suppliers/retailers represent prosumers in both the wholesale and retail markets. All these events produce different questions, for instance, shall the retailer buy the energy from the prosumer? Who decides the price of the energy? Does the retailer have the duty to supply energy to the prosumer as a back-up resource? Is the retailer an intermediary for the prosumer in the market? As discussed in previous chapters, especially Chapter 5 and 6, such questions are being answered differently through regulation in its multiple forms.

Does the retailer have to buy the energy from the prosumer?

According to the studied material, there are a variety of options. One is to have no legal barriers regarding who can buy the energy surplus. None of the chosen jurisdictions follow this option. Another alternative is for the legal framework to restrict who can buy the energy surplus. That is the case in New Zealand where the regulation establishes that only the retailer or clearing manager can buy the energy surplus. However, it remains silent concerning any duty to buy such energy. In practice, the retail market decides whether to buy the energy surplus and the price. Hence, in New Zealand, it is a market decision.

A different alternative is for regulation to limit buyers to only one actor, such as retailers. However, in this case, the regulation should establish a duty to purchase the energy surplus and establish some control or mechanism over the price. That is the case of the Netherlands' net-metering mechanism, in which the retailer is obliged to accept the energy surplus offered by the household prosumer. However, there is a legal limit to the annual amount that can be offset. This type of regulation can be considered a command control regulation, which also takes into account the consequences of an increase in the energy load in the distribution system and therefore imposes limits. Such

regulation is similar to the situation in Colombia where the incumbent retailer shall buy the surplus energy. In this case, there is no legal restriction on the amount that can be offset. Thus, regardless of the chosen scenario, the regulation should guarantee either that there are multiple options for the prosumer to sell the energy surplus to, or in the case of only one actor, such shall buy the energy. In this case, the regulation should establish a mechanism over the price.

When the retailer purchases the energy surplus, the contractual arrangements of the traditional supply contract should be updated with the new terms and conditions regarding the purchasing. In terms of regulation, the contract should establish limits over the energy surplus that can be bought or offset to prevent network distortions, as long as the regulation is updated when the market and network conditions change.

Who decides the price of the energy surplus?

In the chosen jurisdictions, two main perspectives were found. One perspective is a conventional regulatory one, in which the regulator establishes the remuneration mechanism for the energy surplus. The mechanism chosen can be either net-metering, net billing or feed-in tariff, as explained in detail in Chapter 5. In Colombia and the Netherlands, the chosen mechanism is net-metering with further regulation over the different scenarios and components. The other approach is market-driven. If regulation does not establish the methodology to set the price, the market comes into play. Such is the case in New Zealand, where the price is established by the retailer and referred to as the 'buy-back rate'. This rate is often less than the retail rate of electricity. In this situation, the prosumer can shop around the retail market and look for a better purchase deal.

However, a market-based approach does not create enough incentives or certainty over the return of investment for prosumers to purchase of generation devices to self-generate and sell energy surpluses. The research shows that the introduction of regulation offering an attractive remuneration mechanism is necessary when the regulation aims to promote the uptake of self-generation. This mechanism does not have to be net-metering or feed-in tariff but instead, the option of net billing is more desirable as was shown in Chapter 5.It is worth remembering that the European Union recently

recommended net billing instead of net-metering due to the market distortions created in the long term. So net billing can be the way in the future to remunerate power feed from prosumers.

It is also important to discuss who bears the cost of recognising a financial incentive for the prosumer when the selling energy surplus. As was discussed in Chapter 5, it is vital to ensure a scheme that allows prosumers to recover their investment in the medium or long term, while being aware of the extra cost created to the system. In this sense, it is mandatory to carry out a cost-benefit analysis of the market distortions that the system can stand and overcome and for how long such special treatment should be in place. When choosing a scheme that results in extra costs for the system, the extra costs should not burden other households by charging those more to incentivise those who have the financial capabilities to purchase a generation device. Extra costs create inequalities for other consumers, therefore does not align with concepts of energy justice and should be avoided.

Should the retailer supply energy to the prosumer as a back-up resource?

This obligation is vital since without a back-up service, prosumers will be forced to tolerate outages when self-generation is insufficient to meet their demand. The retailer/supplier should not retaliate against consumers who decide to install self-generation devices. In this scenario, the material studied, especially in Chapter 5, illustrates two regulatory perspectives: conventional regulation establishing the duty on retailers to back up self-generators, as is the situation in Colombia, and a market-driven approach, in which the prosumer is left to look for a supplier who is willing to sell energy as a back-up. The situation is more complicated for small prosumers who, due to their reduced bargaining power, may not reach an agreement with retailers or the agreement is unfavourable or even unfair. That is the reason why this thesis recommends that regulation includes an explicit provision that ensures prosumers are backed up by retailers.

Is the retailer an intermediary for the prosumer in the market?

In the traditional legal framework, a supplier/retailer is required to have considerable financial or organisational credentials, which result in a legal barrier to entry by smaller market players. As was shown in Chapter 5, for instance, in the Netherlands supply licences are required, whereas Colombia, requires them to demonstrate financial, technical and institutional capabilities. These requirements make sense when involving large actors. They are responsible for supplying electricity to a wide variety of consumers which essentially demand sufficient technical and financial proficiencies to ensure a continuous, safe and quality supply of energy. However, what happens with small transactions in which prosumers and communities want to engage? In the three chosen jurisdictions, prosumers cannot sell energy to other consumers directly. Instead, they can only sell energy surpluses to the retailer who may resupply it to others. In New Zealand, the closest example of prosumers selling energy directly to consumers is a retail company that acts as an intermediary between the prosumer and anyone whom the prosumer chooses to receive the energy from at any chosen rate, as is the case with Solar Buddies.

In New Zealand and the Netherlands there are also online platforms that act as a retailer to match local energy supply and demand, such as Our Energy and Vandebron. These business initiatives attempt to engage retailers in the prosumer business within the current legal framework, integrating its benefits into the supplier services and market, instead of opposing or denying it. This approach is well-directed to adapt the businesses to the future realities and finding ways of making the best of the emerging technology, based on the concept of prosumer-oriented marketers. However, a market approach within the traditional legal framework still faces regulatory barriers that prevent them from testing out new approaches and innovating within the business. There is also a need for a safe space to act outside the rules that impose restrictions to niche innovation. That is the case with the approach in the Netherlands and the Experimentation Decree.

Currently, the Netherlands allows innovation by permitting some projects to operate with greater freedom within a regulated and supervised space. The Experimentation Decree grants several legal exemptions for projects to develop, in terms of energy projects that would otherwise be illegal to undertake, as explained in Chapter 6. The Netherlands is committed to legal experimentation that may help underpin future regulation of the sector, while recognising the changing energy market. The

experimentation process is considered to be a vital part of responding to innovation where there is no clear answer as to how best to regulate the changing market

In respect of energy communities, as described in Chapter 6, in countries where becoming a supplier requires a supply licence or a burdensome administrative procedure, this lead to a model of indirect supply (community energy selling to a retailer, so later the retailer can sell back to community members). Such an approach creates unnecessary extra steps. In this regard, the new concept of 'electricity sharing', which allows the community to supply energy to its members and was included in the 2019/944 European Directive, is pioneering. It is a good example that can be replicated in other countries.

This research recommends an approach based on conventional command-control regulation, resulting in the introduction of simplified procedures or tailor-made rules for prosumer projects. It is especially important for communities that want to supply energy to their members, without having to sell the energy surplus to a retailer or having to comply with complicated and burdensome procedures to be a supplier to its community.

7.1.2 Rethinking the role of the distributor

The traditional role of distribution companies is transporting power from the transmission grid to a large number of consumption points through distribution lines. Thanks to new technologies, the role of the distributor also involves interacting with an increasing number of generators located along the distribution network (distributed generation). The increasing penetration of distributed generation devices requires the deployment of smart technology throughout the network and an update on the functions of the distributor and its relationship with network users. Concerning the functions of the distributor discussed in Chapter 4, its role needs to be assessed in regarda to incorporating emerging services and technologies to the network, such as helping the transmission operator to balance the local network, data handling and becoming more active in the rolling out of smart meters.. In re-evaluating these functions, it is also vital assessing a better remuneration scheme for distribution companies.

The function of the distributor:

There are different regulatory approaches explored in each of the chosen jurisdictions. One perspective is found in the Netherlands as was analysed in Chapter 6, where, due to the application of the Experimentation Decree to specific projects, the distributor operator is not allowed to control the operation of community projects. This approach differs from the traditional role of distributor companies where they were the only actor in charge of controlling the transportation of energy locally. Based on the results of the experimentation, an emerging regulatory approach is expected to develop the best way of regulating the distributor interaction with prosumers.

Another perspective is found in the 2019/944 European Directive which legally added other functions to the role of the distributor. These functions include providing flexibility to the network using services from distributed generation, demand response, energy storage or energy efficiency. Another role is the balancing function when agreed with the transmission operator (who traditionally is the one in charge of balancing). The regulatory approach promoting the distributor's engagement in such functions is through investment incentives. These incentives imply a remuneration scheme that encourages the distributor to innovate.

Regarding incentives to encourage investment in innovation by the distribution companies, the discussion in Chapter 4 identified the different regulatory instruments used to determine distribution pricing, since finances underpin the reasons why distributors choose to promote distributed energy resources in the management of the network. An outcome-based approach or command control regulation where the regulator sets clear inputs of the kind of investment the distributor is allowed to make. The outcome-based regulation applies in New Zealand where the Electricity Authority decided to allow the distributor to accommodate the impact of distributed energy resources themselves and, depending on their performance, the authority will regulate more extensively later. In this first stage, outcome-based and self-regulation come together and the Electricity Authority and Commerce Commission will monitor progress and accountability.

Another critical aspect explored extensively in Chapter 4 also involves the role of the distributor in relation to the connection of distributed generation (DG) to the distribution network. The regulatory authorities in charge of the three jurisdictions comprehensively regulate these procedures. In general, the regulations have different requirements depending on the capacity of the device to be connected and even the type of energy resource. For instance, in the case of European legislation, renewable energy has priority access. The main difference in the three jurisdictions is the level of discretion given to the distributor in deciding to connect a DG device. In this regard, although every case of denial of connection should be technically justified, there are other criteria considered. For example, in Colombia, the electricity regulator, CREG, establishes the capacity limit for the participation of distributed generation to the network. Once that limit is met, the distributor can deny connection because there is no network availability.

The arrangements are different in New Zealand, where limits or standards are not established so the distributor decides how much capacity the network can take. The Dutch take an opposite approach where, even though the distributor can deny a connection for lack of capacity, the distributor should take appropriate steps to avoid future refusals when possible and structural congestion.[1] Such an approach is interesting and can be taken as an example for other jurisdictions because it imposes a duty on the distributor to update network capacity depending on the change of circumstance and, in that sense, keep up with the connections requiring more capacity in the network.

Unbundling rules:

Another important issue is who can be a distributor and whether a distributor can be involved in other supply chain activities. Thus, it is critical to be clear regarding the unbundling rules. As explained in Chapter 1, one of the main elements of liberalisation was the unbundling of the supply chain. Thus, vertically integrated electricity companies are discouraged, given that the main objective is to promote competition in each sector whenever possible. The concept becomes more significant when applied to

[1] Dirk Kuiken and Heyd F Mas "Integrating demand side management into EU electricity distribution system operation: A Dutch example" (2019) 129 Energy Policy 153 at 155.

natural monopoly activities such as transmission and distribution. Given that it is not economically possible to promote competition in these sectors, rules are needed to enable the activities to operate in a non-discriminatory manner, allowing every actor to use their services. It is likely that if a generator or retail company owns the distribution or transmission activities, they would monopolise the market and create entry barriers for others, hence the need for the unbundling rules. Nevertheless, as explained in Chapter 6, a community currently can become involved in the generation, distribution and supply of energy which can be integrated to ensure a better and more efficient service to their members. Arguably, this possibility highlights the need for more flexible unbundling rules, especially for community energy projects.

For instance, in the Netherlands, although it has far-reaching and strict unbundling rules, exemptions are possible under the Experimentation Decree. Such exemptions can allow communities to integrate supply chain activities and be entitled to operate distribution. Another more flexible approach is one where the absence of unbundling rules applies to projects located in rural and isolated areas, providing opportunities for community projects to be encouraged, as is the case of Colombia. New Zealand has only established strict unbundling rules for larger generation and retail projects involved with distribution, and these rules do not apply to small projects. This latter approach is considered beneficial for the development of community energy and individual projects that attempt to pursue small vertically integrated local projects.

On rethinking the role of the distributor, there is another issue that deserves consideration. Electricity distribution is a highly regulated sector because it is a natural monopoly, and the lack of competition requires the regulator to ensure the quality of the service and efficient prices. It could be argued that more regulation is needed to address a more complex and active role of distribution that responds to the new market and technological circumstances. However, regulators worldwide are still uncertain about the best way to do this, without compromising the security and functioning of the electricity system as a whole. A question that arises is whether there is a need for more detailed regulation specifying how to regulate new technologies, for example, more detail in Network Codes. Although this approach may provide more certainty about the duties and obligations in the use of new technologies, the extra details are unlikely to

be flexible enough to respond to future innovation and require further time and more new rules to be introduced.

Another approach is to allow innovation based on a principle-based regulatory approach or outcome-based approach, which can leave more space for distributors to deal with innovation according to the needs and possibilities of their businesses and with the supervision and permanent guidance of the regulatory authority. Hence, one approach represents certainty, and the other represents flexibility. The question that the regulator must ask in facing innovation is how to balance certainty with flexibility. A necessary step is to enable experimentation to happen, which provides outcomes that will guide the regulatory activity in the best way to regulate and the faster the rule-making process can respond to new technical possibilities the better. Later, in this chapter, we will discuss in more depth the different scenarios for regulatory experimentation.

7.1.3 Rethinking the role of the market

In terms of the market, as analysed in Chapter 5, currently prosumers experience legal entry barriers to participation in the wholesale and retail market to sell energy or reduce consumption. Traditionally, legal entry barriers were established to ensure the industry participants have the financial and administrative capabilities and expertise to participate in the electricity market. Thanks to new technologies and business models, more actors can participate in the industry. However, the legal requirements are outdated and tailor-made for traditional, centralised and large industry participants. The market also has different alternatives or scenarios to accommodate new and non-traditional actors like prosumers, communities or aggregators. One alternative is that the market accommodates these resources within the current legal framework. Another alternative is to update the current market settings and eliminate either the legal entry barriers or adjust the current requirements to accommodate the new actors according to their specific characteristics. A further approach is the creation of new marketplaces, tailor-made to integrate these resources.

On the one hand, due to legal barriers where entry to both wholesale and retail market is restricted, prosumers cannot interact directly in the market but have to do so through intermediaries or retailers/suppliers. In this respect, there are new entrants and

traditional companies who are trying to innovate and create new market platforms. This is the case with Vandebron in the Netherlands and Solar Buddies and Our Energy in New Zealand. Such new markets involve new contractual arrangements between the parties involved and supply obligations to the retailer/intermediary instead of the prosumer. This scenario does not involve legal changes in the short term. However, in the future it will, because the increasing participation of prosumers means more complex relationships that will require a proper treatment that recognises new realities. Besides, a scenario in which the market accommodates new actors within the current legal framework implies that new businesses are treated as something they are not, instead of having clear rules that recognise the changing circumstances and services provided by those businesses which differ from traditional services. Here, it is worth recalling the case of Our Energy, which provide an online platform to match local demand and supply. However, it must behave as a retailer to be able to participate in the market. In this sense, regulating online platforms for what they are is essential in dealing with new concepts and businesses representing the 'Sharing Economy'.

When the market creates space for new businesses within the legal framework, businesses may provide prosumers with services rather than the technologies or the energy itself. This is the case for prosumers in solar-tariff, in which the solar company owns the solar panel and takes responsibility for installing, financing and maintaining the generation device. The consumer buys the energy generated by the generation device on their roof. This model is known as 'solar-as-a-service' as is emerging in the United Kingdom.[2]

In another approach, the market and the law enable space for new entrants and products, such as the aggregator and demand response. This approach differs from examples of regulation that limit the offering of demand response in the market to only suppliers/retailers, as is the case in Colombia. The aggregator can represent demand response under contracts with business, commercial customers and households to curtail electricity use. The main challenge to this new actor is the lack of regulation or clear rules regarding responsibilities and relationships between the multiple market

[2] Donal Brown, Stephen Hall and Mark E Davis "Prosumers in the post subsidy era: an exploration of new prosumer business models in the UK" (2019) 135 Energy Policy 110984 at 110987.

participants. The European Union and New Zealand have provided guidelines that identify the main elements that should be regulated in this regard, as explored in Chapter 5.

One further scenario is creating new markets, outside the retail and wholesale market, such as peer-to-peer trading among small players or local markets. Although this approach can be market-oriented, there may be regulatory obstacles such as entry barriers, licences, burdensome procedures or capacity limits to participate in energy trading. That is why a regulatory approach that regulates developing markets is needed. This approach does not mean extensive, detailed and commanded control regulation but, instead, it leaves space for regulations allowing experimentation. As stated in this thesis, new technologies, roles and businesses are innovating in the industry, and it is not possible to be 100% sure of what form the regulation should take. Both the market and regulation must enable a safe space to allow pilot projects that are carefully analysed to help the regulator and market become more aware of the likely outcomes of these ideas and, therefore, what is the best regulatory approach and smart regulation. This will be discussed further in the section on regulatory experimentation later in this Chapter.

7.2 Rethinking the Role of the Consumer/Prosumer

Empowering consumers in the electricity sector involves access to the network, access to the market, a set of rights and special protection for small prosumers and a set of proportionate and precise duties and obligations. An ideal regulation provides mechanisms to ensure prosumers, individually or collectively to have access to the network; access to relevant markets; and receive payment for the energy or services they offer to the network or market.

In general, conditions and obligations for *access to the network* and market will depend on the size of the prosumer. Also, it will depend on the deployment and settings of smart meters that are vital to physically connecting the prosumer to the market. Small prosumers should be able to expect simplified procedures to connect to the network and clear rules over the distributor's discretion to connect them to the system.

In terms of *access to markets*, it has already been argued that large and small prosumers should be able to participate in either the wholesale or retail market directly or through an intermediary. This requires a greater variety of options and contractual arrangements to enable a more direct and diverse approach to the market. In terms of *remuneration*, five models are being utilised in the different jurisdictions: net-metering, feed-in tariff, net billing, auctions and retail market prices. This thesis considers that rule makers should analyse which scheme will help the prosumer in the medium to long term to recover their investment. Another issue to consider is the market distortions that the scheme will create and whether the market can withstand and overcome these distortions and for how long. Special remuneration schemes, such as net-metering or feed-in tariff, if selected, should be chosen as a temporary mechanism because there is likely to be a distortion in market prices and the sharing of grid costs. Price distortions, in the end, will financially affect other consumers.

In the case of *community energy projects*, these projects should also be entitled to access the market, network and, supply energy to their members. Simplified procedures are essential, and they should recognise the particular characteristics of the community energy project, as well as connection policies and unbundling rules. An interesting example of how to address legal obstacles for communities is the incorporation of the concept of 'electricity sharing' in the European legislation which allows communities to provide energy to their members without the need for a supply licence.

Another critical issue discussed in Chapter 5 is the individual entitlement for small prosumers or households to consumer protection rights. Some of the consumer rights that are also relevant for small prosumers are universal access, change of supplier, access to relevant information and the use of new technologies for addressing energy poverty issues. This thesis supports Roberts' position that such rights should be extended to the small prosumer.[3] A legislative example of this clarification and extension is found in the 2018/2001 European Directive, in which renewable self-consumers are entitled to maintain their consumer rights. Such clarity and certainty

[3] Josh Roberts *Prosumer Rights: Options for an EU Legal Framework Post 2020* (ClientEarth, London, 2016) at 36.

should set an example for other jurisdictions where there are currently legal gaps that can result in contractual vulnerability for small prosumers.

In respect of empowering the consumer in sharing the costs and benefits of the industry, as discussed in chapters 5 and 6, there are not only rights for prosumers and communities but also some duties. The obligations should be proportionate and non-discriminatory, considering the size of the project. There are different examples of duties that are included in the legislation of different countries. In the European Union, active customers are financially responsible for the imbalances caused to the grid. This provision is vital because, for the first time, it provides clarity over the duties of prosumers when using the network and contributing financially and proportionally to the system. Nevertheless, the fact that it does not discriminate in favour of small parties such as household consumers when they act as active consumers, calls into question the proportionality of the obligations and how unnecessary and burdensome obstacles for prosumers can be avoided following the principles of energy justice and energy democratisation. Further regulation is needed in each Member State to give content to such provision.

Another essential duty for the prosumer is sharing the overall costs of the distribution system. The European Union recently clarified that prosumers should continue contributing to the distribution network costs. This duty was debated in Court by the solar industry in New Zealand which argued that sometimes an extra cost in delivery prices could be considered a 'solar tax'.[4] The thesis considers it important that prosumers continue contributing to and sharing in the cost of distribution in order not to distort the network or result in increased costs for traditional consumers. However, the fairness of these charges will depend on how proportionate they are to the size of the project and which elements are taken into account to establish the distribution charge. An ideal situation involves prosumers sharing the costs of the network and, also, a tariff reflecting the different use that industry participants make of the network. In this regard, the 2019/944 European Directive gives an example of how to deal with such issues, stating that active customers should contribute to the network charges based on the use they make of it. This means distinguishing between the energy fed into

[4] *Unison Networks Ltd v Solar City New Zealand Ltd* [2017] NZHC1343.

the network and the energy consumed from it. In this sense, distribution tariffs or their methodologies should not discourage participation by prosumers while at the same time ensuring fairness.

Regarding demand response, a regulatory example of duties studied in Chapter 5 occurs in the European legislation, in which the final customers shall financially compensate other market participants when demand response is activated. Such compensation aims to cover the resulting costs incurred by the suppliers to provide balance during the activation of demand response. Although the provision says that this should not create a barrier to market entry by participants engaged in aggregation or a barrier to flexibility, it is not clear why this provision establishes such a compensation duty on the final customers. We see it as a duty to compensate traditional market players by emerging actors justified by the creation of imbalances. Time is needed to understand the factual implications of such arrangements and how they will affect final customer decisions to engage in demand response. This provision does not clarify whether it is only applicable to large final customers or also to aggregators or households. As a consequence, proportionality must be addressed.

Another duty on the prosumer is to comply with regulation or standards regarding the security of the system to avoid congestion. In Chapter 4 we analysed the importance of updating standards of technical specification of distributed generation devices for the security and reliability of the network and the system as a whole. The importance of not only updating such standards by the regulation but the compliance of the party interested in connecting the distributed generation to the network is vital. In this sense, we recall the massive power disruption that occurred in Australia was aggravated because various generators, including solar rooftop systems, did not comply with standards for inverters to reduce the output to the system, leading to grid imbalances resulting in blackouts. The question that arises from this duty of compliance is who is in charge of ensuring the quality of the distributed generator's connection which, in this case, involved the quality of the inverters? We can ask whether the owner of the generation device has the knowledge and expertise to keep up with the standards. It is reasonable that such a duty should be shared with the distribution company that allows the device to be connected and continues monitoring it by making annual visits to check its installation. There should also be a shared duty with the providers of the technology

and solar companies, by providing ongoing advice and guidance throughout the process. This issue highlights the importance of distribution companies having a greater role in balancing local networks by complementing the role of the transmission operator.

7.3 The Role of Law in Dealing with Innovation in the Electricity Sector

After rethinking the roles of each actor, we continue analysing what the role of the law is in shaping the electricity system to allow a more active role for consumers. Once the legislator and the regulator are aware of the new roles that different industry actors play, the law and regulation should create alternatives to deal with such new changes. It is the role of law in responding to innovation and creating space for technological advances to procure the changes in the industry without delay. An opposite scenario opens a regulatory gap between innovation and the applicable regulation, irrelevance, undesirable or opposite effects, known as a regulatory failure. The existence of a regulatory gap shows the need for regulation to maintain the connection to technology.

An example of regulatory disconnection highlighted in this thesis was the increasing participation of distributed generators in the distribution network and the regulation relating to the expected role of the distributor operator. Following the model of Leenes,[5] which was introduced in Chapter 3, we are going to analyse three aspects to see whether we are witnessing a regulatory disconnection. Firstly, we will analyse the technology in terms of what the relevant characteristics and interests promoted are. In this sense, distributed generation technologies enable generation at the consumption point or near to it, reducing dependency on the transmission grid and connecting directly to the distribution network. Local generation promotes interests such as more competition, energy access to off-grid areas, sustainability and energy security in instances of grid disturbances or blackouts.

The second aspect is what the potential risks or problems of the technologies are and how the current law addresses them. They include an increased injection of energy into

[5] Ronald Leenes "Regulating New Technologies in Times of Change" in Leonie Reins *Regulating New Technologies in Uncertain Times* (Springer, the Netherlands, 2019) 26

the distribution network that may impact its capacity, leading to congestion, peak-loads or voltage variations and imbalances between off-takes and intakes. The different current regulations within the jurisdictions show us that the role of the distributor is still a traditional one and does not have to deal with balancing the local grid or being a market facilitator for decentralised service providers. The negative financial impacts that the distributor can experience in managing an increasing load of distributed generation requires a regulatory arrangement to compensate for the negative impacts and, at the same time, encouraging the connection of distributed generation. However, it was revealed in the chosen jurisdictions, the regulatory authorities in charge of price control and the distribution activities do very little to address the need to promote investment in innovation. The three jurisdictions all have legal requirements to implement energy efficiency measures or real-time use of the network. However, it is still debatable whether these measures open the door for more investment in smart grid technologies that enable better management of the network and especially the proper integration of distributed energy resources.

The third and final aspect is based on the conclusions of the first two aspects which lead to identify whether there is a regulatory gap. This reserarch concluded that there is a regulatory gap between the distributor's current role and what is expected from it when dealing with the increasing participation of distributed generation and the recognition of new services, such as demand response, distributed generation and energy storage by prosumers and by other decentralised actors. For the Netherlands, Directive (EU) 2019/944 provides an example of how to address this regulatory disconnection and recognise new regulatory realities and roles. However, for Colombia, and New Zealand, although the legal role is still restricted and traditional, contractual arrangements can stipulate a more active role for the distributor in dealing more actively with distributed generation in specific areas. However, it depends on case by case scenarios and on the willingness of the distribution company to engage in those activities. Hence, we consider it important to update the role of the distributor through the introduction of new regulation, including the functions that come with dealing with increasing distributed generation.

The research found a regulatory disconection between the need of the distributor to invest in new technologies and the aspects that regulators see as essential to invest in.

This conclusion is based on the regulatory approach, which is not sufficiently directed to promoting investment in innovation. Innovation includes smart technologies to deal with the increasing load of distributed generation and, also, for the hiring of the multiple services that new technologies offer to keep balance in the network. Once one identifies the existence of regulatory disconnection, and therefore the need to update the regulation, we may explore the best way to regulate or adapt the regulation to the changing nature of technology. Based on the relationship between law and innovation, and the concept of risk-based regulation that has been explored in Chapter 3, we can ask what are the risks of the technology that empowers consumers and how can regulation address them?

An increasingly active role for consumers and the use of emerging technologies that enable them have inherent uncertainty which is one of the biggest challenges for regulators. It means the regulator, when facing innovation and changing contexts, is unsure about what requires regulation or through what instruments to regulate. The regulator must be able to understand how things are changing and what kind of future these changes create. In doing so, the regulator should recognise the emerging technologies and think about the multiple ways they will impact the electricity industry. Such an understanding requires an analysis of multiple scenarios, the development of more research and developments in the industry, exploring how a different future will look and how technological developments and regulation may interact in a more complex industry.

In order to take a more accurate and informed approach, the regulator should have a flexible attitude, willing to try new things and to utilise a more experimental, trial and error approach from the outset, instead of creating definitive rules. The literature on law and innovation recommends a principles-based approach or an outcomes-based approach, allowing electricity actors to interact more freely with technology. Following an outcomes-based approach, in which the regulator defines the desired outcomes and agrees on measures of success, the regulator can define, for instance, that one of the desired outcomes for retailers and distributors is to enable and encourage more active participation for consumers in the short and mid-term. An outcomes-based approach implies, for example, that the distributor makes the necessary arrangements to connect more prosumers to the network by facilitating the injection of energy with only

reasonable restrictions and update the capacity of the network to be able to receive the injections. For the retailer, the desired outcome requires rethinking how to interact with the consumer and to create business initiatives that attract the consumer to participate in self-generation, e.g. providing attractive prices for the energy surplus. Alternatively, the retailer can diversify its business of selling energy and extend it to merchandise, selling the technology to generate energy with attractive deals that appeal consumers to buy or rent solar panels or participate in community energy projects sponsored by the retailer. This is consistent with the concept of 'prosumer-oriented markets', explained in Chapter 3, recommended by Kotler to encourage traditional industries to facilitate prosumer activities instead of fighting innovation.[6]

However, an outcomes-based approach and a principles-based approach rely more on the willingness of the firm and its internal management to apply them, than the ability of the regulator to enforce a specific way of doing things. Such an approach can jeopardise the expected outcomes and the recommended measures. On this point, it is crucial to consider the recommendations of Julia Black[7] when pointing out the lessons learnt from the principles-based regulation in the run-up to the financial crisis. She emphasises that when following such a regulatory approach, more intense supervision of the regulated firms is needed, including being more sceptical rather than over-trusting the management's ability or willingness to deliver the defined outcomes and to guide and help firms during the processes of reaching for such outcomes. An excellent example of this approach discussed earlier in this thesis, in Chapter 4, are the Advisory Groups within the Electricity Authority of New Zealand. They work closely with distribution companies encouraging them to use distributed energy resources for congestion management and, in general, for better management of the network using innovation. Another level of the discussion is whether the lessons learned from this process will be considered by the Electricity Authority who delegate this work to the Advisory Group, and later incorporate its recommendations in regulatory provisions.

[6] Philip Kotler "The prosumer movement: a new challenge for marketers" *(1986) 13 Advances in Consumer Research: 510 at 513.*

[7] Julia Black "The rise, fall and fate of principles based regulation" (2010) LSE Law, Society and Economy Working Papers at 8.

At the same time, dealing with innovation requires facilitating diverse responses by companies to test innovation and different regulatory interventions to build knowledge around possible impacts as was explored in Chapter 3. The electricity industry is a highly regulated sector because it is composed of complex, closely-connected activities that operate continuously and the roles and responsibilities of the activities involved are there to make it work efficiently, safely and competitively. However, some of the rules prevent the industry from testing new things and, in this sense, can block innovation because it takes time to change them and adjust them. Different regulatory approaches allow experimentation, without disrupting what is in place. At a recent conference about innovation in energy networks through regulatory experimentation, led by the Florence School of Regulation in April 2020, members of electricity regulatory authorities from three European countries — The Netherlands, Authority for Consumers & Markets; the UK, OFGEM; and Italy, Autorità di Regolazione per Energia Reti e Ambiente — exchanged their experience in regulatory experimentation. One of the insights of the event was that there are four regulatory ways of doing this: waiver, exemption procedures, regulatory pilots and regulatory sandboxes.

In the waiver approach, the regulation defines activity and actors exempt from particular regulations. Waiver is different from the exemption procedure, in which the innovator asks the regulator about granting and exemption and the regulator decides whether or not to grant it. In the case of regulatory pilots, projects are guided and led by the regulator with the companies involved, and the project is allowed regulatory exemptions. This approach was used by Italy when it allowed charging stations for electric vehicles to have special distribution tariffs. Finally, a regulatory sandbox opens the door to innovators to ask them what they want to do, and the regulator will study case by case how to achieve it. Companies and regulators consider which rules can be exempted on a case scenario. This approach is used in the Netherlands and the Experimentation Decree.[8]

Considering these four regulatory options, New Zealand has legally included the exemption procedure. The provision enables industry participants to request a special

[8] Luuk Spee Innovation through regulatory experimentation (presented to online debate, Florence School of Regulation, April 2020).

exemption from some rules of the Code, understanding 'exemption' as a temporary release from an obligation of the Code.[9] The Electricity Authority may grant an exemption based on the relevance for promotion of competition, reliability of supply or efficient operation for the benefit of consumers.[10] This kind of legal provision can allow some room for experimentation which is a valuable exercise when regulating innovation and new system perspectives and complexities.

In Colombia, there is room for experimentation, especially in off-grid areas. As explained in Chapter 1 and Chapter 6, Electricity Law 143 of 1994 does not apply to off-grid areas. Instead, some of these areas are granted an exclusive service to a company that will be responsible of providing the service. In this sense, legally, waivers are applicable for off-grid areas. It is highly recommended that these new market models for off-grid areas be implemented, especially the local market and community energy projects. The implementation should have few regulatory restrictions and always for the benefit of the consumers in those areas. When developing the project in areas that have already been granted as exclusive areas, it is possible to make contractual arrangements with the respective company to implement such schemes. In the case of experimentation for grid-connected areas, the room for experimentation is narrower. However, it is possible to start with pilot projects led by the regulator and the government, which can later result in meaningful learning that will inform the regulatory activity.

Another aspect to consider when dealing with experimentation is how long exemptions apply. In the Netherlands, the Experimentation Decree allows exemptions to last for 10 years, a generous time-frame which is justified because the community makes an upfront investment, so the they need enough time for a return on it. Hence, the time-frame of exemptions depends on how long it will take to see results from the project.

Another issue to consider is discriminatory treatment. When the exemption only applies to particular projects, as is the case with exemption procedures and regulatory sandboxes, the exemptions provide considerable advantages to some projects. Such

[9] Electricity Industry Act, s 11.
[10] Electricity Authority "Current exemptions from the Code" (August 2019) <www.ea.govt.nz>.

special treatment results in decisions being made by the regulator when allocating the exemption and discriminating between different initiatives or allocating costs.

Different approaches mean a different regulatory effort. In the case of regulatory pilots, it is the regulator who leads experimentation and engages with other industry actors, while in regulatory sandboxes or exemption procedures, the regulator analyses the viability of the request and decides whether to grant the exemption. Another critical issue is the protection of consumers that are inside the areas or projects in which experimentation or exemptions apply. This issue was highlighted in Chapter 6, which examined the case of the Dutch Experimentation Decree, which enables groups of consumers to engage in energy projects, some of them vertically integrated, and third party access was an issue criticised by the scholars. The criticism was based on the ambiguity of the rules which could affect consumers located within the project's geographic area.

A final comment is required concerning the role of law in stimulating technological change. In the particular case of prosumers, the role of law in promoting a more empowered consumer due to the emerging technologies is also speeding up the uptake of such technologies including smart meters, distributed generation technologies and energy storage. The socio-technical literature recognises the role of law and regulation as an essential policy tool that can speed up the rate of technology innovation and increase its uptake speed as was explored in Chapter 3. There are different regulatory instruments that can be used to stimulate such uptake. It can be done, for example, through the creation of benefits, such as financial incentives, setting binding targets, subsidies or feed-in tariff. Based on the material studied throughout this thesis was found examples showing how to create a level playing field for emerging actors, such as active consumers, and how to introduce attractive incentives encouraging them to actively participate in the market. Such schemes were explored in Chapter 5 about the remuneration schemes for prosumers' energy surplus, including net-metering and feed-in tariff. Both schemes offer substantial incentives to consumers to become prosumers because, in the case of net-metering, the compensation paid is higher than the real value of what is offered by the prosumer. In the case of feed-in tariff, the scheme guarantees a return on the investment. As we can see, both schemes contain an economic incentive for prosumers to self-generate and sell energy surpluses. However, both schemes create

market distortions and extra costs for traditional consumers. In this sense, the regulators should undertake an analysis of the degree to which the market and industry participants, such as a retailer and distribution companies, can manage and overcome the market distortions and for how long this special treatment should be in place. Special remuneration schemes tend to be temporary.

Another incentive to promote the uptake of emerging technologies, such as distributed generation technologies, is through priority access or guaranteed access as the special regime used to promote renewable energy generation in some European Union countries, as we explored in Chapter 4. Preferential access rules ensure access to the grid or network whenever the resource becomes available. Such a guarantee of access can be seen as an essential incentive mechanism. However, as we have already explored the disadvantages of such an approach including potential grid distortions and the limited possibilities for network operators to deal with congestion, resulting in non-efficient outcomes. Another example of incentive regulation is the existence of revenue support schemes for community projects that address one main obstacle of community energies, access to capital. Clear policy frameworks and support programmes to attract public or private investment to community energy are essential.

Therefore, the role of law in promoting new technologies that empower consumers requires special treatment and incentives. However, these can create market and grid distortions which, in turn, create extra costs or extra burdens to other industry participants, such as consumers, retailers and distributors. Therefore, when a government wants to allow development and innovation in the industry, the government should set out how convenient or desirable it is to promote specific technologies, bearing in mind the cost to the system. In a different scenario, not of promotion but recognition of new realities and emerging actors, the legal framework, instead of promoting specific technologies, can adapt the legal framework for a level playing field between traditional and emerging actors. Such an approach requires either tailor-made regulation for the emerging actors or the removal of legal entry barriers and the creation of space for experimentation for innovators which will later inform changes in the regulations.

7.4 The Role of Law and Regulation in Integrating Prosumers into the Electricity Industry

When the market and legal frameworks cannot accommodate new ideas quickly enough and, instead, stifle new entrants and innovation because of lack of competition, or incumbents or traditional actors opposed to change, new regulations should come into play. Regulation and policy should lead the way in shaping the electricity system to facilitate the introduction of more competition to the electricity market and a more sustainable, democratic and efficient way of generating and supplying energy. Such an approach is consistent with a more active role for consumers.

The regulation should first allow emerging technologies, business ideas and new actors to interact in a contained environment free of specific legal restrictions, which can be subject to later analysis by the regulatory authority. The outcome and conclusions of these pilot projects, exemption procedures, experimentation, studies and advisory groups will be a basis for regulating these disruptive technologies and actors and their interaction with the electricity system. Such outputs can lead to legal and regulatory reform. In the meantime, the role of contractual practices between the different actors is vital.

In light of this, it can be argued that the role of law in shaping the electricity system and allowing a more active role for consumers is to avoid regulatory disconnection and ensure values such as energy justice, community involvement and adaptation to climate change are acknowledged. The law should ensure a level playing field for emerging participants such as prosumers to participate in the market together with traditional actors.

Different lessons can be learned from the multiple regulatory perspectives of the chosen jurisdictions that can be applied from one to another. For instance, Colombia can reform its regulation along the lines of New Zealand about the incorporation of a much more simplified procedure for small producers (<10kW). Also Colombia and New Zealand can learn from the European legislative experience, specifically Directive 2019/944, through the recognition of the emerging functions of the distributor acting as a market

facilitator, balancing functions based on agreements with the transmission company and procuring flexibility through decentralisation. Likewise, Colombia and New Zealand should employs provisions used in the Netherlands regarding the connection of distributed generation to the distribution network. Where if the distribution operator denies the connection for a technical reason, the distributor has to address the issue in its network. This means the distributor is called to update the capacity of the network and prepare itself for increasing penetration of DG in the future. Also regarding the remuneration of the energy excess supply for prosumers, Colombia, the Netherlands and New Zealand could follow the recommendation of the European Commission on applying net billing instead of net metering (in the case of New Zealand and Colombia) since it offers incentives for self-consumption and a fair distribution of network costs. Colombia and the Netherlands could acquire ideas from the initiative that New Zealand is exploring regarding multiple trading relationships, which implies contracting with multiple traders at a single point of connection. In terms of prosumer rights, Colombia and New Zealand can learn from the European Union Directives regarding the incorporation of the concept and specific regulatory framework regarding active consumer and communities energies, and the concept of electricity sharing, and their entitlement that prosumers can maintain their rights and obligation as consumers.

Overall, as a closing statement bringing together the main features discussed throughout this thesis, the law, in its role of shaping the electricity industry to allow for a more active role for consumers, should incorporate: a different legal treatment to prosumers, depending on the size of the project in terms of duties and rights held by prosumers, for example, simplifying licensing and procedures for small prosumers. Also, to ensure fair remuneration schemes for the supply of energy and services provided by prosumers. Other market actors should promote the integration of prosumers in the energy system instead of opposing it. The ability of traditional players to accommodate new features and ideas will determine their capacity to compete in the market in the long term. In addition, distribution tariffs or their methodologies should not deter prosumers from participation and at the same time should ensure fairness in which prosumers also participate in sharing the costs of the system. Regulatory authorities should also be responsible for promoting a new understanding of the electricity system, leading the way in this regard and updating regulation as market conditions change. In terms of

demand response to establish more precise rules regarding responsibilities and relationships between the different market participants. For community energy projects, there is the possibility of more flexible unbundling rules that enable vertically integrated projects are necessary. Finally, it is vital to undertake pilot projects and legal experimentation to ensure better regulatory outcomes, especially when dealing with innovation where there is no clear answer as to the best way to regulate changing realities.

8. Conclusions

The research question underpinning this thesis is, what is the role of law in shaping the liberalised electricity system, allowing for an emerging and more active participation by the consumer? This research has argued that law has a vital role in shaping the electricity system to enable a more active role for consumers in liberalised electricity industries. Law and regulation have the role of creating a level playing field for emerging participants, such as prosumers, to participate and compete in the market together with traditional actors. In this sense, the participation of prosumers brings more competition into the market and represents a more sustainable, environmental and democratic way to supply energy. Furthermore, law and regulation have the role of responding to innovation and creating space for technological advances to procure the changes in the industry without delay. In this sense, coming back to the Prometheus myth, law and regulation can break the chains that are trapping innovation and, in doing so, enable it to interact and integrate its multiple benefits for the electricity system.

One of the more significant findings to emerge from this study is that not only should consumer's rights and duties be rethought but also the role of other industry participants such as distributor operators, markets and retailers. New considerations are needed because their traditional functions are also causing regulatory disconnection, making it mandatory to update the regulations governing their functions, procedures and relationships with traditional and emerging actors.

The thesis has also found that, generally, the legal barriers in liberalised countries come from several sources; for instance, the traditional role of the distributor when responding to increasing distributed generation in the network; prosumers unable to decide to whom they can sell their electricity to; the price of the energy or even whether to participate more actively in the demand response process. A further issue is the lack of clarity about whether small prosumers are entitled to consumer protection rights and legal challenges regarding configuration, access to the network, access to markets and

strict unbundling rules for community energy projects. The following conclusions can be drawn from the present research:

- The electricity industry was built based on the technologies available at the time. To guarantee universal access, centralised models were developed characterised by a limited number of generators located far from consumption points, long grids located through the country and multiple points of consumption, where the consumer is merely passive. Each activity is separated and subject to different legal frameworks. The role of the state and private sector in such developments differs across countries and corresponds not only to the chosen regulatory model but also to the needs of each country.

- This thesis illustrates that the traditional characteristics of the electricity system are being challenged by a more active role for consumers which is now possible thanks to distributed generation technologies, smart grids, demand response, smart meters and advanced metering infrastructures as was explored in Chapter 1. These technologies and concepts enable consumers to produce their own energy, manage their consumption pattern, sell the energy back to the system and interact with other industry participants, integrating bottom-up or decentralised approaches into the industry. The coexistence of a traditional understanding of the electricity system and emerging concepts creates some legal barriers and gaps that diminish the active role of consumers in the market and participation in the system. As was introduced in Chapter 2, the main legal challenges are access to the networks, access to the markets, consumer legal protection and the legal aspects of community energy supply.

- Multiple sociological and political perspectives provide a context and deeper understanding of the many reasons behind the existence of prosumers. Chapter 3 explored the origin and significance of prosumers, the sharing economy and the concept of localism and bioregionalism. Also, new concerns and values underpin a new understanding of aims and objectives in the electricity sector. Most of these values relate to awareness of climate change, energy justice, energy democracy, community participation in energy projects, energy security and energy transition.

- This thesis has shown that the technologies that enable a more active role for consumers can be considered as disruptive technologies. Disruptive technologies are often accompanied by uncertainty regarding their impact. In addition, when disruptive technologies occur, they exacerbate regulatory gaps creating regulatory lacunas that challenge the adaptation of the correct regulatory environment. The gap between innovation and the applicable regulation may result in problems that can lead to regulatory failure. A further legal challenge is promoting the benefits of emerging technologies while at the same time, overseeing and addressing their potential risks.

- One legal challenge, explored in Chapter 4, is access to the distribution network. Three aspects are essential in this regard: First, promoting a new role for the distributor operator in helping to balance the local system, providing a market platform for new services, integrating these into the management of the network and being active in the roll-out of smart meters. Second is ensuring connection procedures for distributed generation. Third, clarifying who decides how and what components are taken into account when establishing price-control over the use of the distribution network and whether those components recognise or promote investment in new technologies and innovation for more efficient management of the network. After discussing the multiple approaches to such issues, it can be stated that the functions of the distributor in the chosen jurisdictions are still mainly traditional. From a regulatory point of view, regulation has not yet responded to the new realities and challenges that the distribution network is facing. An exception to this statement is the regulation of the European Union introduced in the Directive 2019/944. Although regulatory disconnection was found in the other jurisdictions, there are some studies and pilot projects analysing how the role of distributors affects prosumer initiatives. Concerning the procedure for connection of distributed generation to the distribution network, it is noted that this procedure is regulated in the three jurisdictions and receives different legal treatment depending on the capacity of the distributed generators, distinguishing between smaller and larger installations. The connection procedures and their requirements are vital to

ensure the process does not create unnecessary burdens to enable access to the network and is aware of the transaction costs and reasonable requirements. Here, we found there is no regulatory disconnection in any of the chosen jurisdictions. On price control over the use of the distribution network, all the chosen jurisdictions rely on traditional practices with the inclusion of mechanisms that aim to encourage new features. These new features are energy efficiency, demand-side management and real-time use of the network. However, it is still debatable whether these mechanisms open the door for more investment in smart grid technologies that result in better management of the network and proper integration of distributed energy resources. Finally, in discussing whether the prosumer should contribute to the share of the overall costs of the distribution network, together with the traditional consumers, the clear answer is yes. However, the conditions or proportions remain unclear. It is recommended that all system users contribute to the overall cost of the system in a fair, proportionate way depending on the use that users make of the network.

- In relation to access to the market for small and large prosumers explored in Chapter 5, market mechanisms together with regulatory incentives should reward the energy and services that prosumers can offer and benefit the system. Nevertheless, according to the material studied, was found that the existing markets (wholesale and retail) are tailor-made for large and traditional actors. Such characteristics result in restrictions for prosumers from supplying energy directly to others and forcing some innovative businesses to present themselves as something they are not. New business ideas also appear restricted within the current legal framework that only allows consumers to contract with one single supplier. These restrictions are a barrier for online platforms who are offering local matching of supply and demand. It is important to implement new markets, beyond the wholesale and retail market, such as peer-to-peer, local markets or prosumer to grid models. Although various entrepreneurs are already implementing some of these new markets in different parts of the world, they are also facing legal barriers and unclear rules that jeopardise their businesses. It was found that there is a level of regulatory disconnection between the possibility for prosumers to supply energy to other consumers and the regulatory limitations that either restrict such transactions or establish requirements tailor-made for

traditional large actors. Thus, regulatory authorities must embrace a process of redesigning current markets to integrate new actors, services, roles and functions of such actors and anticipating, at the same time, new challenges and complexities.

- As to remuneration for the energy surplus of prosumers, in Chapter 5 was analysed net-metering, net billing, feed-in tariffs, fixed-prices and auctions. The conclusion found was that three aspects are imperative and must be taken into account when establishing a remuneration model to be followed. First, whether the scheme will ensure the prosumer can recover the investment made when buying the generation device in the medium or long term and maybe allow for some profit. The second aspect is the market distortions that the system can withstand and overcome and for how long any special treatment should occur. Thirdly, when choosing a scheme that results in extra costs for the system, the extra costs should not be paid by households and especially not by vulnerable customers. In this regard, we consider the remuneration mechanism of net billing more efficient and fairer when it comes to sharing of the costs of the system.

- When considering demand response, although it is desirable to participate in both wholesale and retail markets, we found that it is more common in the wholesale market and is oriented to large customers. It is crucial that, while the market creates the correct signals and incentives to make it more accessible for households and small businesses, the regulator should support and guide such initiatives by promoting the pricing of demand response that encourages a broader range of participants.

- Small prosumers should be entitled to consumer protection rights when they are actively participating in the market. Such an extension is essential because of their weak position in the market and reduced bargaining power. Current consumer rights can be either adapted or new rights introduced that apply to prosumers stating clearly that consumer rights also apply to small prosumers, as is the case in the European Union. There is a need to expand traditional consumer rights, responding to new realities and new protection needs for protection,

principally in terms of consumer data protection, access to relevant information, change of supplier, universal access and making technologies available especially for vulnerable or low-income consumers as a measure to tackle energy poverty.

- A more active role for consumers can also mean belonging to a community energy project to satisfy energy needs as a collective as was explored in Chapter 6. Community energy faces particular legal challenges that range from the need for simplified procedures consistent with the particular characteristics of community projects. Also, it may be necessary to rethink the function of a supply licence which can be burdensome for the ability to supply energy to the community members. A form of legal entity should be available which can be developed in the way the community decides; clear connection rules, participation in the market, more flexible unbundling rules and access to funds or capital for community projects.

Therefore the contribution of my thesis to the existing literature is in terms of identification of regulatory and legal barriers that challenge a more active role of consumers in the chosen jurisdictions. As we stated, such barriers are present in the current regulation of distribution, retail and consumers. Also, the research answers the question about the role of law in shaping the electricity system for a more active role for consumers. The role of law is to ensure a level playing field for emerging participants, such as prosumers, to participate in the market together with traditional actors. The main features that this legislation should include are different regulatory treatments depending on the size of the project and fair remuneration for the supply of energy and services provided by prosumers. The distribution tariffs or their methodologies should not deter the participation of prosumers together with simplified licensing and procedures for small prosumers. It is also vital to undertake pilot projects and legal experimentation to help underpin future regulation.

Finally, further research in this field would be of great help to energy law studies. For instance, research is needed regarding the role of political and regulatory institutions over redesigning electricity system. Research is also needed in regard to whether the current regulatory institutions can deal with reshaping relevant issues or if there is a

need for more powers or other institutions to do so. Similarly, more research is necessary in regard to the role of law in promoting distributed renewable energy to reduce the subsidies for fossil fuels and address the climate change emergency. Additional research is also needed regarding energy storage and the legal implications of grid redesign and studies exploring the legal implications of implementing smart grid technologies in terms of duties, rights and cost-sharing. Another possible area of future research is to analyse the different contractual arrangements among actors that are being used to integrate emerging actors and businesses in specific cases. On this point, it is recommended to look at the pilot projects, studies and regulatory experimentation that are being implemented in different countries to redefine the legal and regulatory instruments. Further legal studies are also required concerning data protection and ensuring an environment free of cyber-attacks when implementing IT technologies within the electricity system.

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