What drives the development of community energy in Europe? The importance of the national energy systems

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Abbreviations and acronyms

CAI: Collective Action Initiative

DSO: Distribution System Operator

SME: Small-Medium Enterprise

TSI: Transformative Social Innovation

WP: Work Package

Contribution history

Date	Comment	Contributors
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5	JRC	Joint Research Center – European Commission	Belgium
6	DTU	Danmarks Tekniske Universitet	Denmark
7	VITO	Vlaamse Instelling Voor Technologish Onderzoek	Belgium
8	ECOLISE	European Network For Community-Led Initiatives On Climate Change And Sustainability	Belgium
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1 Introduction

The aim of this report is to provide an analysis of the unique historical factors, incentive structures and key actors in each of the six national case studies. This analysis will provide context for the current local situations and it will help to explain the differences in the emergence and development energy communities in different countries. For each country, we will try to outline the evolution over the last two decades and characterize the major changes in the policy, economic, social and technological landscape.

There are large differences in the development of community energy projects among European countries. Various factors have been explored to explain such disparity. A major role in shaping the evolution of community energy is played by the historical evolution of a specific "energy system" or "energy regime" (Geels, 2002). Main elements or dimensions of this energy regime are: markets/economy/financial-industrial structure, science-technology, policy/politics/legislation and social-cultural situation. More specifically, drawing from the existing literature[1], we will focus first on the evolution of market structure and technology. The development of energy communities is influenced by specific challenges and boundaries of electricity production systems: concerns about security of supply, network integrity, governance of fragmented production systems, prize volatility of the fully market driven multiple actor production models – to name a few. Slowly but surely is the electricity becoming the single most critical resource for the modern civilization that all the other systems are heavily depending on. This new *total dependency* is calling out for new set of norms and values that is changing the governing of energy sector. Other major influences on the occurrence of locally owned community energy projects are national and EU legislation, formal institutional rules, such as support mechanisms for renewables and spatial planning, along with societal norms including attitudes toward the cooperative model and cultures of local energy activism.

1.1 The historical background: the liberalization process

As early as 1988 the European Commission began considering how the Single European Act of 1986—which paved the way for the European Single Market—might be applied to the energy sector, specifically to electricity and gas supply. This began a long process of opening national

[1] See for example S. Agterbosch, W. Vermeulen, P. Glasbergen, Implementation of wind energy in the Netherlands: the importance of the social–institutional setting, EnergyPolicy 32 (18) (2004) 2049–2066; M. Bolinger, Community Wind Power Ownership Schemes in Europe and their Relevance to the United States, Lawrence Berkeley National Laboratory, Berkeley, 2001; S. Breukers, M. Wolsink, Wind power implementation in changing institutional landscapes: an international comparison, Energy Policy 35 (5)(2007) 2737–2750; A. Goldthau, Rethinking the governance of energy infrastructure: scale,decentralization and polycentrism, Energy Res. Soc. Sci. 1 (0) (2014) 134–140; B. Huybrechts, S. Mertens, The relevance of the cooperative model in the field of renewable energy, Ann. Public Coop. Econ. 85 (2) (2014) 193–212; M. Oteman, M. Wiering, J.-K. Helderman, The institutional space of community initiatives for renewable energy: a comparative case study of the Netherlands, Germany and Denmark, Energy Sustain. Soc. 4 (1) (2014) 11.

wholesale and retail electricity and gas markets to trade and competition across the single market area.

The primary legislative means by which the EU has brought about this change is through three electricity market directives in 1996 (96/92/EC), 2003 (03/54/EC) and 2009 (09/72/EC). These directives have required member states (and Norway as a non-EU member) of the single electricity market to meet certain requirements in their national legislation, as well as setting out pan-European policy. The electricity sector comprises a number of elements, each of which has been affected by the directives: generation (power plants); transmission (high voltage wires); distribution (lower voltage wires); retail suppliers (who bill final customers); customers (who might choose suppliers); the degree of unbundling (both horizontal and vertical between generation, transmission, distribution, retail); and cross-border trading over interconnectors.

Prior to the 1996 directive a few single market countries—such as Norway, Sweden, and the UK—had liberalized their electricity sectors to create wholesale power markets and introduced competition in the early 1990s. The liberalization trend has even reached the former centrally planned economies in Central and Eastern Europe: in 1995 the Polish state energy monopoly gave rise to 34 production companies, one transmission company and 33 distribution companies, while in Hungary the former state-owned vertically integrated monopoly was decomposed into 8 production and 6 distribution companies in 1992. However, across most of Europe, generation, transmission, distribution, and retail supply were largely in the hands of incumbent domestic monopolists (such as EdF in France, or ENEL in Italy). *Horizontal bundling* was the norm, with no competition in each segment of the industry. Often incumbent monopolists were established as a system wide stabilizing force in national energy systems with activities dominating across generation, transmission, distribution, and retail; they exhibited large degrees of vertical bundling of assets and an exclusive access to the customers.

2 Belgium

2.1 Market overview

2.1.1 Energy Consumption trends

Between 1990 and 2018, final energy consumption in Belgium increased with almost 30%. The final energy consumption by sector is relatively stable over the past 30 years: industry represents the largest share (26% in 2018), followed by the transport and residential sector (resp. 22% and 21% in 2018).

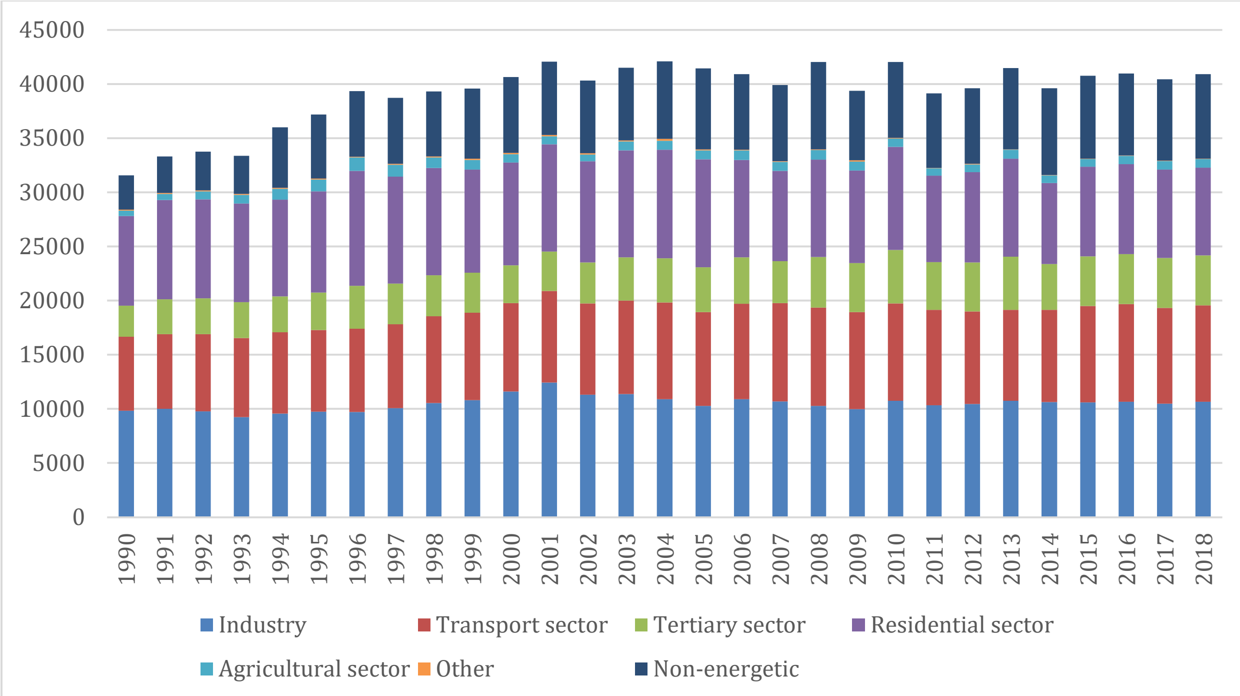

Figure 2.1 Final energy consumption (Belgium, 1990 – 2018) - Statbel (extracted on: 30/06/2020)

This is also confirmed by the "Analysis of Energy Efficiency trends and policies in Belgium using ODYSSEE-MURE databases and tools" (Econotec&Odyssee-Mur, 2018). In the period 2004 – 2016 final energy consumption remained rather stable. Yearly differences show a drop of energy consumption caused by the economic crisis in 2009 and some climatic peaks (2010 and 2013 both being cold years for example). Also the evolution in energy mixes of the total final consumption is rather stable, with a fall of the share of coal, from 6% in 2003 to 4% in 2016, as well as the penetration of renewables, from 2% to 6%. Oil is still the biggest energy carrier in Belgium (42% in 2016) followed by gas (27% in 2016) and electricity (20% in 2016).The main energy consumer is industry, but its share is lightly diminishing. It is followed by the transport and the residential sectors.

The Energy intensity of GDP (in chain linked volumes) decreased over the past 20 years with app. 28%. Since 2014 the indicator has stabilized.

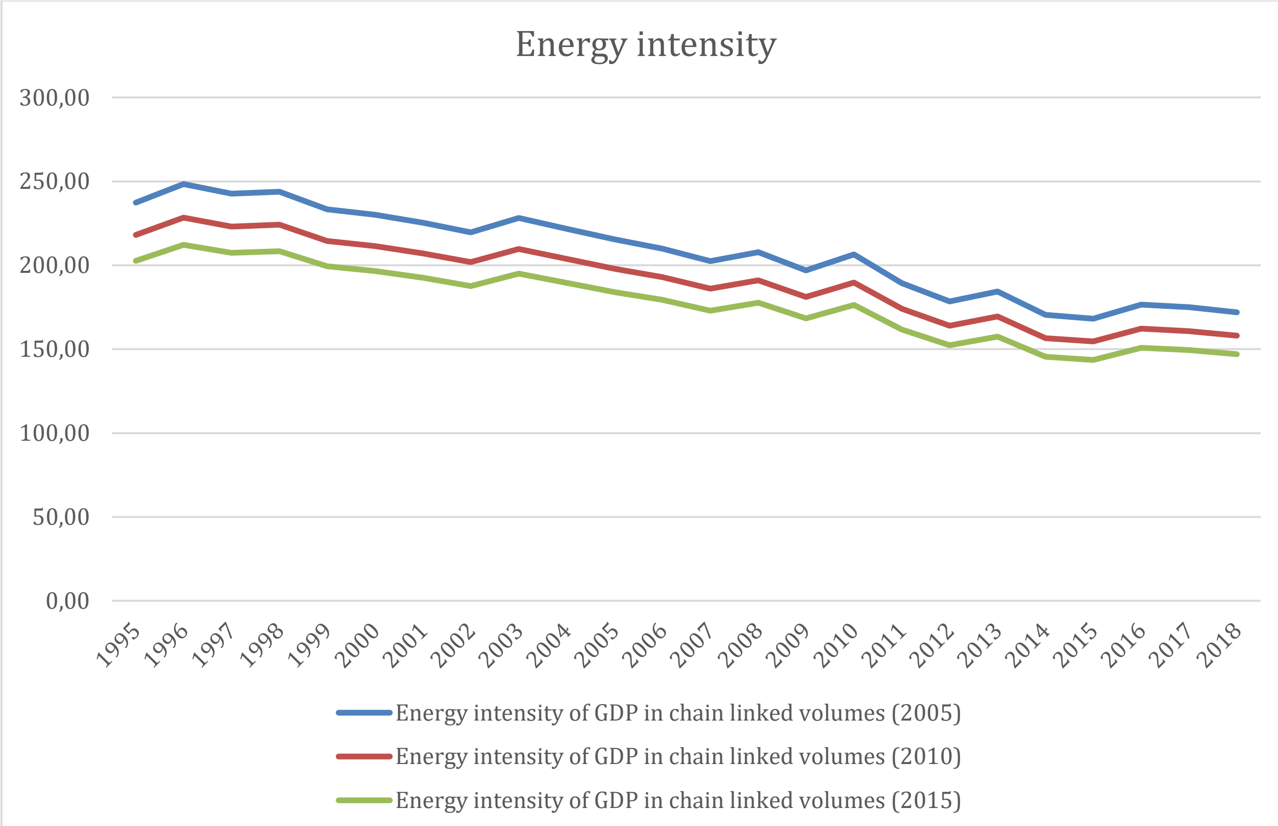

Figure 2.2 Energy intensity (Belgium, 1995 – 2018)- Statbel (extracted on: 30/06/2020)

This trend is also confirmed by the "Analysis of Energy Efficiency trends and policies in Belgium using ODYSSEE-MURE databases and tools" (Econotec & Odyssee-Mur, 2018). The energy intensity is obtained by dividing the energy consumption of a sector by its value added or, in case of the transport sector, by the GDP. The figure below shows the evolution of the energy intensity of both primary and final energy consumptions. The general decreasing trend confirms the decoupling of energy consumption from the economic activity over the whole period. However, the reduction in energy intensity has taken place at a lower rate from 2008. Like in every EU Member State, the low hanging fruits have been plucked and more effort is needed to realize the same rate of reduction.

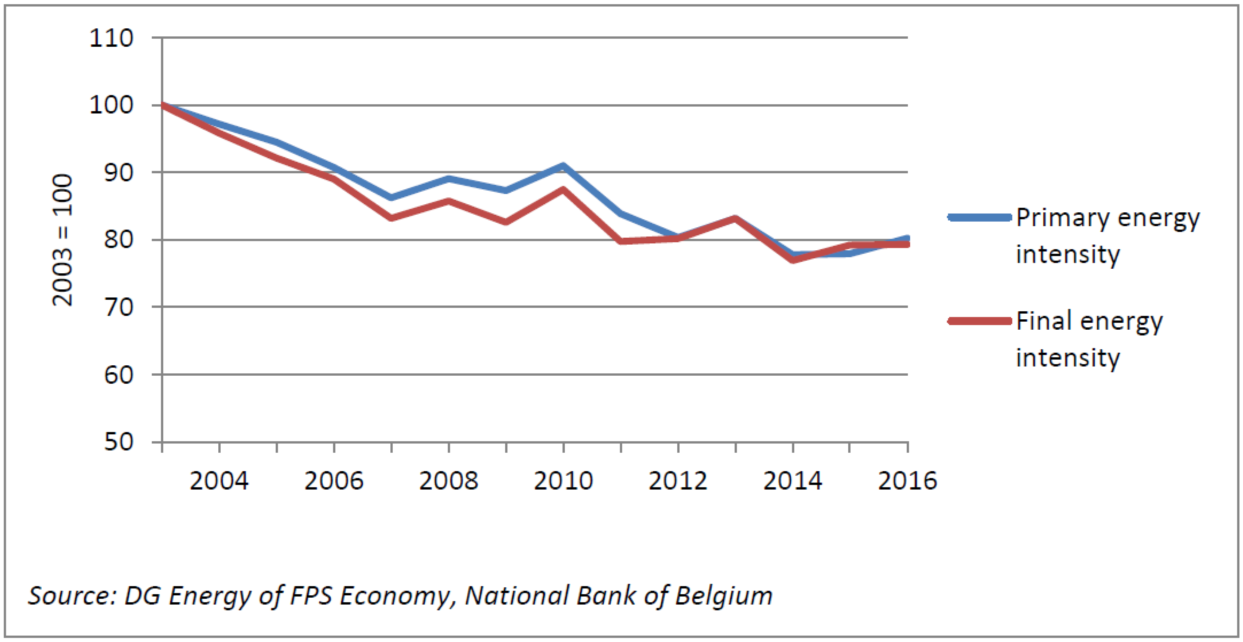

Figure 2.3 Evolution of energy intensity - Source: Analysis of Energy Efficiency trends and policies in Belgium using ODYSSEE-MURE databases and tools (Econotec & Odyssee-Mur, 2018)

In 2019 net imports (= imports minus exports) of electricity turned negative for the first time since 2009 due to the high availability of the Belgian electricity production park.

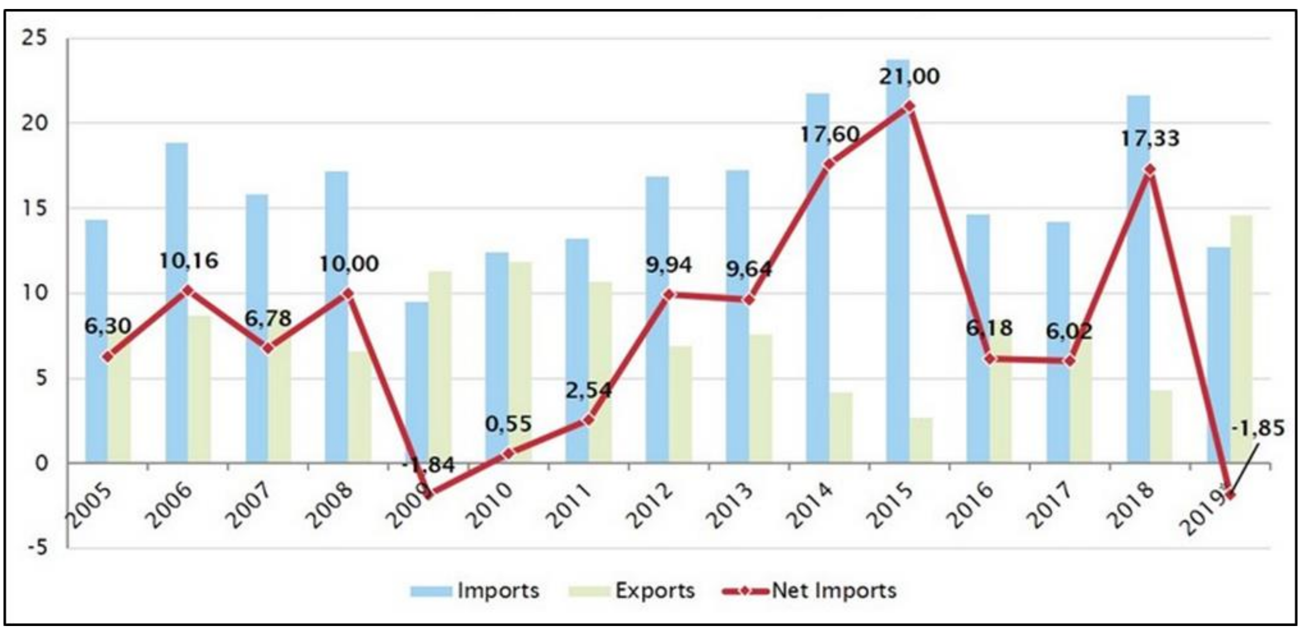

Figure 2.4 Imports, exports and net imports of electricity (Belgium, 2005 – 2019) - source: https://www.febeg.be/statistieken-elektriciteit

The indicator "energy imports dependency" represents the share of total energy needs of a country met by imports from other countries. It is calculated as net imports divided by gross available energy. Belgium is a net importer of natural gas, liquid and solid fossil fuels. The import dependency fluctuates only slightly over the period 1990 – 2018 and was 78% on average.

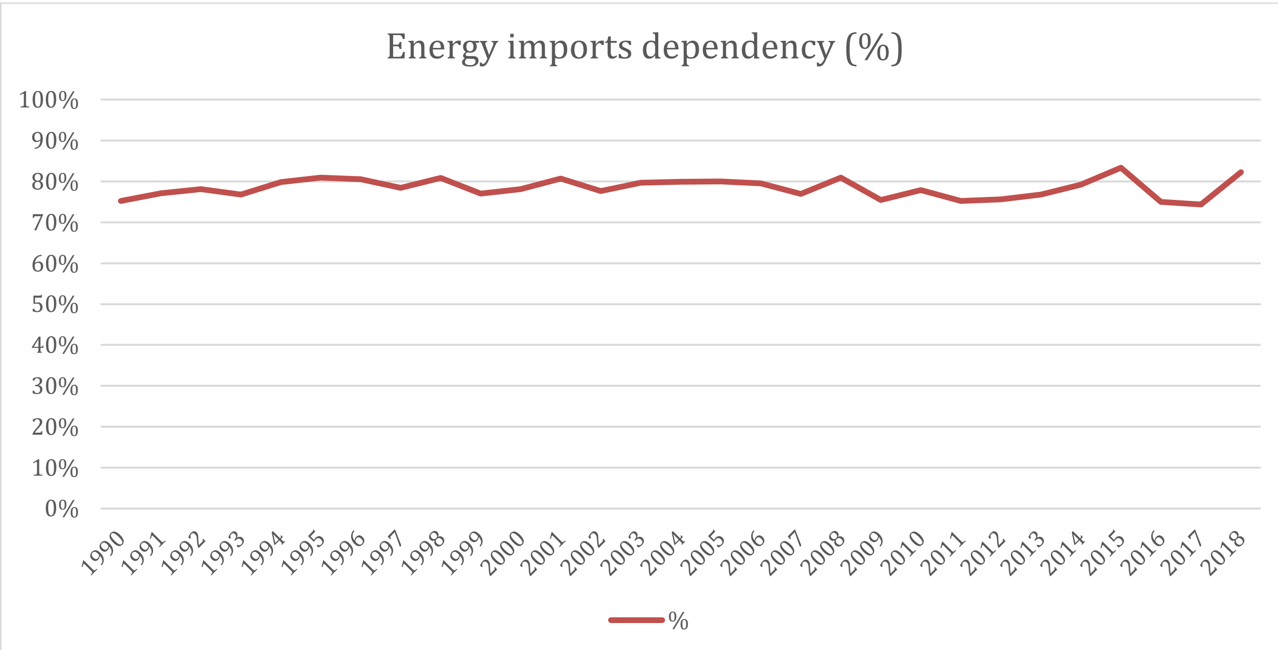

Figure 2.5: Energy imports dependency (Belgium, 1990 – 2018) Source: Eurostat (extracted on: 30/06/2020)

2.1.2 Market structure: generation, distribution and retail market

Flanders opened the energy market to competition in 2003, Wallonia and the Brussels-Capital Region followed in 2007. Before the liberalization, the electricity market was held by Engie Electrabel and SPE Luminus, who were responsible for production and transport of electricity to the distribution network. The gas market was regulated by Distrigas that was responsible for the purchase, storage and supply of natural gas to the distribution network. The intermunicipal companies (public companies established by an association of municipalities) distributed the gas and electricity to the homes and invoiced the consumption to the households. These companies therefore had a monopoly on the distribution and supply of electricity and gas.

With the liberalization of the energy market the activities are split and divided between the commercial suppliers (such as Luminus, Eneco, ...) - which sell electricity to the consumer - and the intermunicipal companies, which still operate the distribution network in their territory. A distinction can be made between following market actors.

The electricity producers sell the produced electricity to the suppliers and to industrial consumers. Although, this activity has been opened up to competition and new companies have entered the market, Engie Electrabel and SPE Luminus still remain the largest electricity producers in Belgium. The transmission system operators (TSO) have to manage, maintain and improve the high-voltage lines and high-pressure lines. They are responsible for the supply of energy from the power stations and gas terminals to industrial customers and distribution network. In the past, Electrabel did this for electricity and Distrigas for gas. Today, it is respectively Elia and Fluxys who are responsible for this and who in turn also hold a monopoly position. Distribution system operators (DSO) are responsible for the conversion of electricity into low voltage and gas into low pressure and then the direct supply of households through a network of cables and pipelines. They have a monopoly in the area in which they operate, which means that they have been one of the preferred contact points for consumers since the opening of the market. The Federal regulator (CREG) certified S.A. Elia System Operator (Elia) as the Belgian TSO for electricity as fully ownership unbundled on 6 January 2012, along with S.A. Fluxys Belgium as TSO for natural gas on 12 October 2012 and Interconnector (UK) on 11 July 2013. The core shareholder of Elia is the municipal holding company Publi-T (45.22%), founded in 2001 when Elia was established. Major shareholders of S.A. Fluxys Belgium are Euronext Brussels (10,03%), Belgium State (1%) and Fluxys Holding (89,97%). Fluxys Holding, parent company of S.A. Fluxys Belgium, is owned by a municipal holding Publigas (77.7%) and Caisse de dépôt et placement du Québec (20%).The regional governments of Flanders, Wallonia and Brussels-Capital have also transposed the DSO unbundling provisions of the Third Energy Package in their respective legislations for the 24 electricity and 18 gas DSOs[2]. The suppliers resell energy that they have purchased from producers / importers or that they have produced themselves. Within the scope of this commercial activity, they offer different types of contracts, each with a specific duration and certain prices for electricity and / or gas, allowing suppliers to compete with each other. However, a recent study of the CREG (Studie over de componenten van de elektriciteits- en aardgasprijzen, 21/03/2019) indicates that since the liberalization of the energy market the average electricity bill for household customers in Belgium increased by 66.41% between 2007 and 2019. The average gas bill for household customers in Belgium increased 18.70% between 2007 and 2019. Also for professional customers the average electricity bill increased with 21.15% and the average gas bill with 0,49% between 2007 and 2019. This evolution can be mainly explained by an increase in distribution tariffs, contributions for RES and increase of the price of electricity and gas[3].

The 'protected customer' is entitled to a social maximum price for electricity and gas that is determined by the CREG (Commission for Regulation of the Electricity and Gas market – federal

[2] https://ec.europa.eu/energy/sites/ener/files/documents/2014_countryreports_belgium.pdf

[3] https://economie.fgov.be/nl/themas/energie/energiebronnen/elektriciteit/de-belgische; https://www.energie-vergelijker.be/blog/vrijmaking-energiemarkt/)

government). The social maximum price is lower than the commercial tariffs for natural gas and electricity. All energy suppliers in Belgium are obliged to use the same social maximum price. To determine the social maximum price, the cheapest supplier in the cheapest distribution network area in Belgium is searched every six months. (Source: https://www.vreg.be/nl/beschermde-klanten)

Although the market share of the largest generator in the Belgian electricity market decreased significantly after the liberalization of the electricity market, the largest generator still represented a share of more than 50% in 2018.

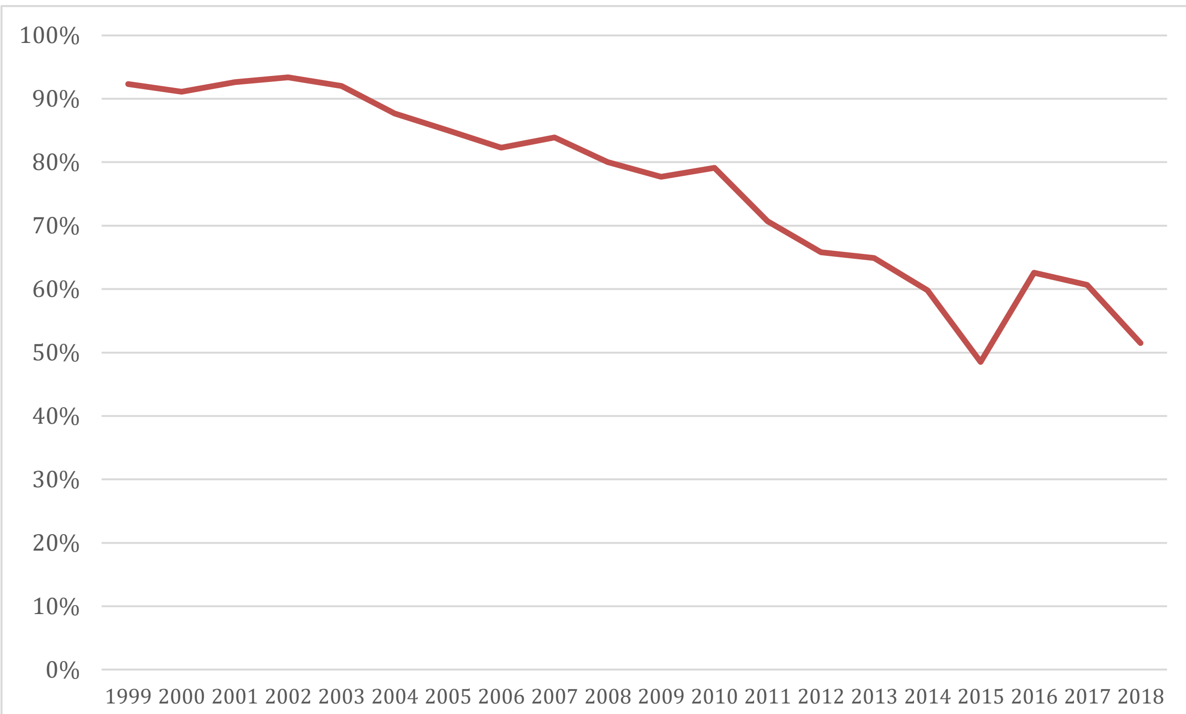

Figure 2.6 Market share of largest generator in the electricity market (Belgium, 1999 – 2018) - Eurostat (extracted on: 30/06/2020)

Shortly after the liberalization of the retail market, energy suppliers Engie Electrabel and SPE Luminus had a combined market share of approximately 97%.

As in many European countries, the Belgian electricity industry was also impacted by the European wave of mergers, acquisitions and holdings that took place after the liberalization.

At the end of 2005, approximately 97% of Electrabel's shares were owned by Suez. The other Belgian electricity producer, SPE, came into French-British hands when Gaz de France, a French (state) gas company and Centrica, a British energy group, joined forces in 2005 and acquired 51% of SPE's shares. As a result, the electricity suppliers who were active in Belgium at that time, namely

Luminus, City Power and SPE, ended up within one and the same group, together with a small natural gas supplier ALG Négoce. (Source: De liberalisering van de Europese elektriciteitsmarkt: case België, Stefan Vinck, 2008)

In 2006 also Suez got into a tight spot when the Italian company Enel made a takeover bid. As the French government did not want the French energy group to fall into foreign hands, another scenario was conceived: the merger of Suez with Gaz de France (GdF). The merger generated considerable controversy and the European Commission and trade unions were strongly opposed to the plan. There was also opposition from the Belgian energy regulator CREG as Suez owned Electrabel, that dominated the Belgian energy market. Although there was some competition from SPE Luminus, one of its shareholders was GdF. As such, a merger between Suez and GdF would eliminate the small steps towards competition on the Belgian electricity retail market. In 2008 the EU regulators cleared the merger on condition that the Suez and GdF sold certain Belgian units[4].

[4] https://www.eurofound.europa.eu/publications/article/2008/gdf-suez-merger-achieved-amidst-controversy

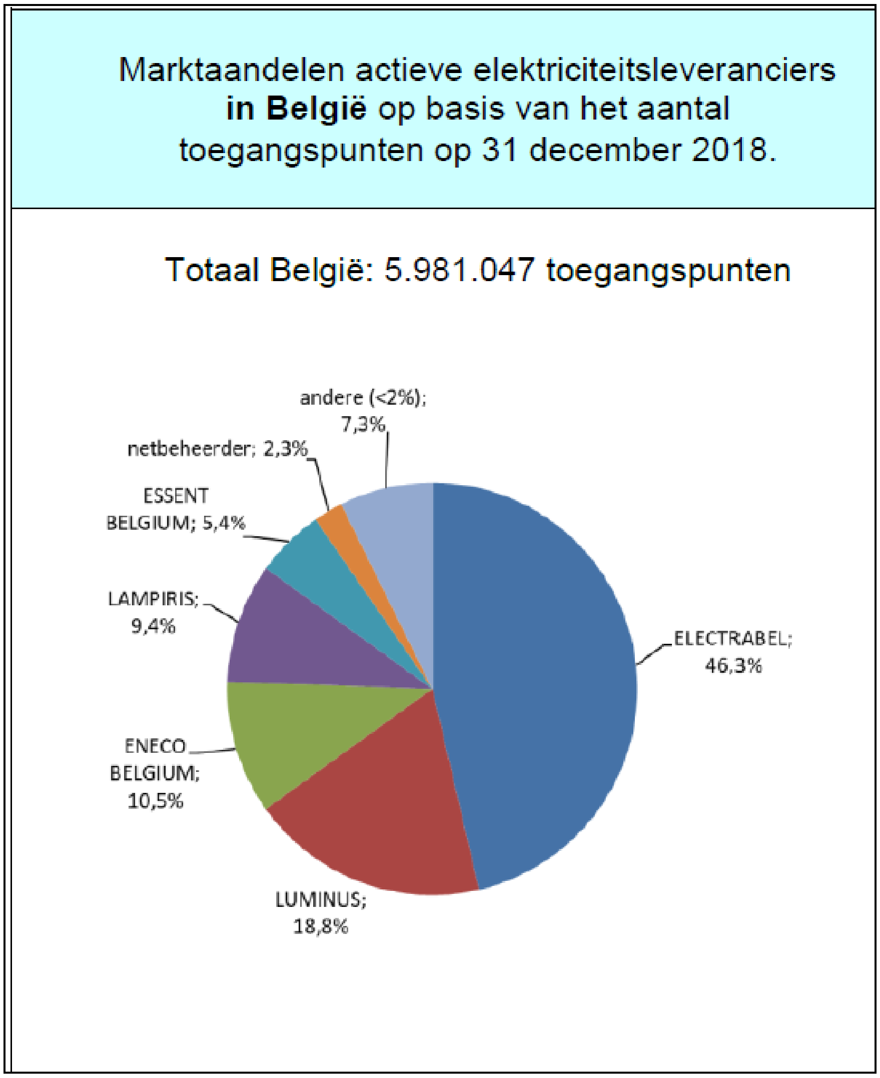

Figure 2.7: Market share of active electricity suppliers in Belgium (based on number of access points, 31/12/2018) - Gezamenlijk rapport over de ontwikkeling van de elektriciteits- en aardgasmarkten in België – jaar 2018, CREG, VREG, CWAPE, Brugel

After a consolidation wave on the Belgian (retail) market that started in 2016 and peaked in 2018, with the merge of Belpower, Comfort Energy, Energy People, Join, Zéno / Mega, Lampiris / Total and Eni / Eneco, the number of active suppliers remained stable in 2019. The consolidation had an impact on the market shares of Engie Electrabel and SPE Luminus that represented a combined market share of approximately 97% at the time of the liberalization of the energy market. In June 2019 Electrabel and Luminus still held a joint market share of app. 56% in Flanders, 63% in Wallonia and even 74% in Brussels[5].

In terms of market concentration, the available data show a mixed picture. The C3 index, the metric that reflects the combined market shares of the three largest suppliers in Belgium at the end of June

[5] Jaarlijkse monitoring van de prijzen op de elektriciteits- en aardgasmarkt voor gezinnen en kleine professionele verbruikers (CREG, 17/10/2019

2019 was 70% in Flanders, 93% in Brussels and 78% in Wallonia. The C3 index in the three regions was virtually the same for electricity and natural gas.

The HHI index shows instead a slight improvement in competition on the electricity market for Belgium, but rather a status quo on the natural gas market. The positive trend of the recent years continued in 2018, with exception of an increase in HHI index for the Flemish natural gas market. However, this increase can largely be explained by the fact that a few players left the market and one major player won a number of collective purchase contracts. In the Brussels Capital Region, where the degree of concentration is still significantly higher than in the other regions, the HHI index decreased significantly in 2018, particularly in the electricity market. The relatively higher degree of concentration in the Brussels Capital Region can be explained by the fact that, in contrast to the other regions, only one standard supplier was designated at the start of liberalization. In Wallonia, both the electricity and the natural gas markets recorded a decline in the HHI index in 2018 compared to 2017, indicating increasing competition in the market. Although the indices did not reach a level that is represents full competitiveness in 2018, the markets are approaching the target of 2,000.

	2017	**2018**
Brussel - elektriciteit	4.912	4099
Vlaanderen - elektriciteit	2.287	2188
Wallonië - elektriciteit	2.821	2572
Brussel - aardgas	4.679	4641
Vlaanderen - aardgas	2.059	2421
Wallonië - aardgas	2.541	2473

Figure 2.8: HHI index (Belgium, 2017- 2018) (based on number of access points)- Gezamenlijk rapport over de ontwikkeling van de elektriciteits- en aardgasmarkten in België – jaar 2018, CREG, VREG, CWAPE, Brugel

Finally, the number of active energy suppliers also provides an insight into the degree of competition in the energy market.

	2017	**2018**
Brussel - elektriciteit	23	22
Vlaanderen - elektriciteit	37	39
Wallonië - elektriciteit	37	36
Brussel - aardgas	22	23
Vlaanderen - aardgas	33	35
Wallonië - aardgas	31	27

Figure 2.9: Number of active suppliers of electricity and gas (31/12/2017 and 31/12/2018) - Gezamenlijk rapport over de ontwikkeling van de elektriciteits- en aardgasmarkten in België – jaar 2018, CREG, VREG, CWAPE, Brugel

In its annual monitoring report the CREG states that "the analysis of market shares and market concentration shows that there is not only increasing competition between the existing suppliers but also new suppliers are competing with each other and try to conquer market share". Also, "it is not because competition is increasing that this simplifies the consumer's choice. Consumers wishing to change product and / or supplier are still having difficulties in finding accessible and understandable information to make objective and robust choices"[6].

2.1.3 The technological landscape

Belgium has been relying on coal for its electricity generation for decades. Since 1990 the coal units have gradually been replaced by gas-fired generation. This evolution was completed in 2016 with the closure of the last coal-fired unit. Natural gas became the second-most used primary resource for electricity generation from 2000 and has gradually increased in importance to actually represent around 30% of generated electricity today. Belgium has been relying on nuclear energy for most of its electricity generation for more than 40 years. Nuclear generation, representing 50% of the total electricity produced, is planned to be phased-out in the next 5 years[7]. Over the past 10 years there is a notable increase in the production capacity of renewable electricity in Belgium, mainly solar and wind energy. In 2018 the installed capacity of these 2 renewable energy sources amounted 7,2 GW or 30% of the total installed electrical capacity and exceeded the Belgian nuclear capacity (5,9 GW or 24% in 2018). If we take a closer look at the solar capacity, we notice that about 64% comes from small photovoltaic solar panels below 20 kW. This type of PV installations are mainly installed by households. The investment in PV and wind was pushed forward with the introduction of the green certificate scheme.

[6] Jaarlijkse monitoring van de prijzen op de elektriciteits- en aardgasmarkt voor gezinnen en kleine professionele verbruikers, CREG, 17/11/2019).

[7] Adequacy and flexibility study for Belgium 2020 – 2030, Elia

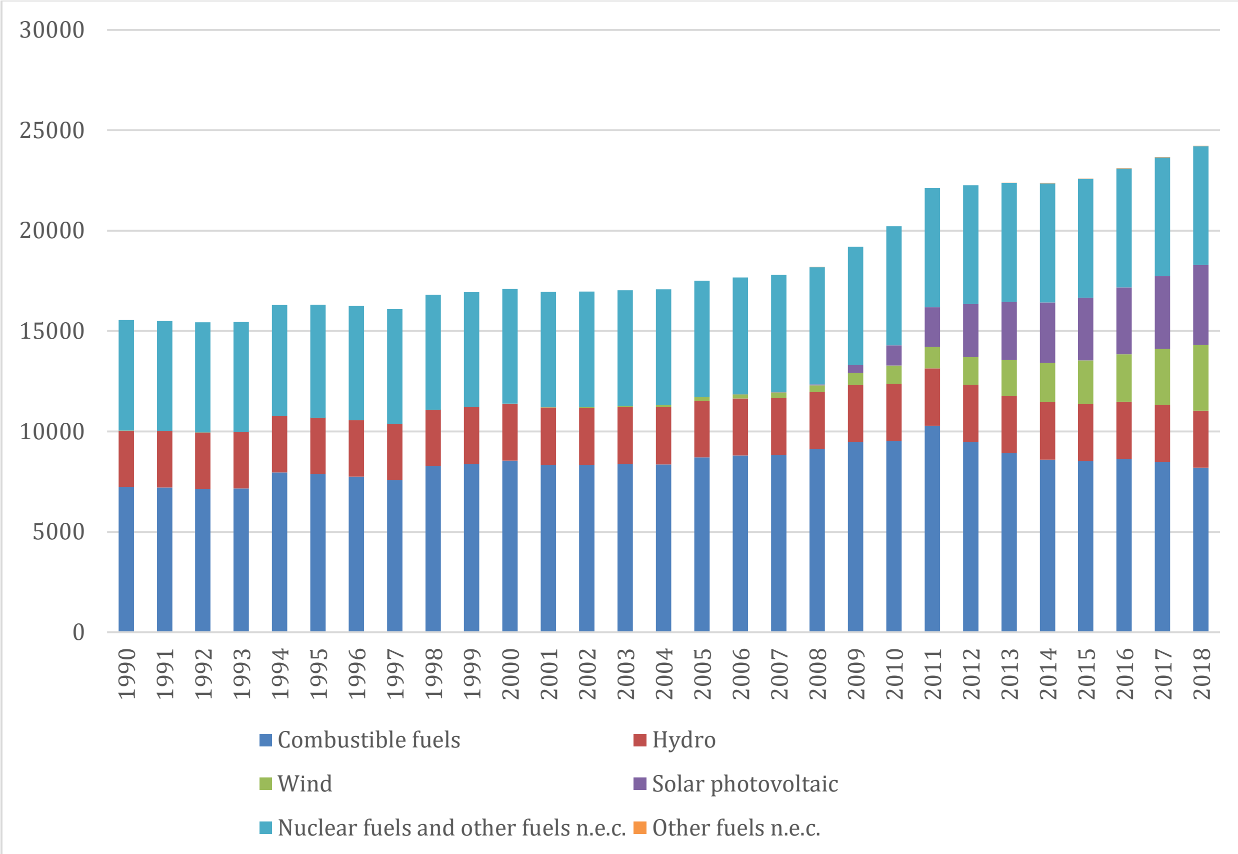

Figure 2.10 Installed capacity for electricity production per fuel (Belgium, 1990 – 2018) (MW) - Eurostat (extracted on: 30/06/2020)

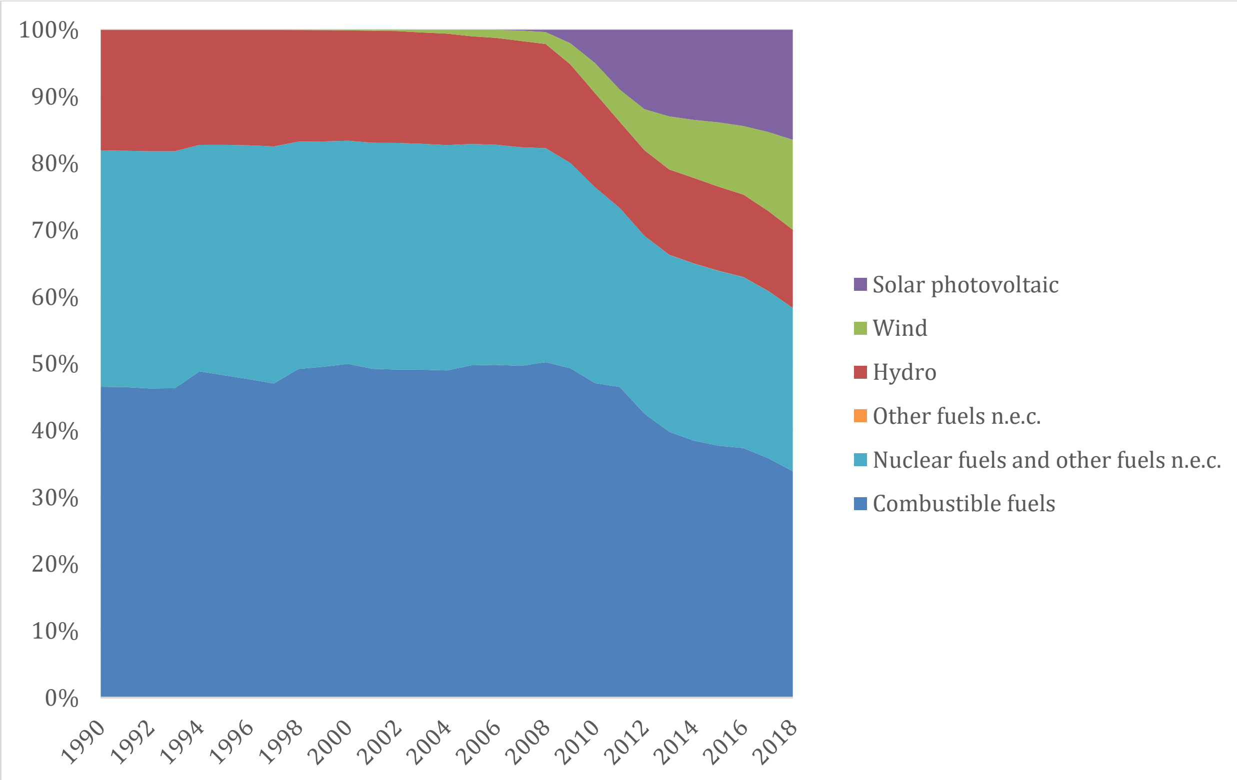

Figure 2.11 Installed capacity for electricity production per fuel group (Belgium, 1990 – 2018) (%) - Eurostat (extracted on: 30/06/2020)

Although electricity production in Belgium is still dominated by nuclear power and fossil fuels, renewable electricity production has increased significantly in the past decade (with a share of 18.2% in total electricity production in 2017). The production of electricity based on solar energy has stagnated in recent years. Production based on solid biomass has been restored since the decline in 2014. Wind energy has become the most important source of renewable electricity production in Belgium (6.5 TWh in 2017), partly due to the offshore wind farms become a source of renewable electricity. The offshore wind farms produced 2.9 TWh of gross renewable electricity in 2017 powering about 819,000 households (assuming that an average household consumes 3,500 kWh of electricity annually)[8].). Despite the fact that Belgium has the smallest exclusive economic zone in the North Sea, offshore wind generation capacity will reach 2.3 GW by the end of 2020. Additionally, a future increase of this capacity to 4 GW is also planned. Although Belgium has very good wind conditions, such an increase will bring new challenges regarding the ability to operate the electrical system and to ensure a reliable electricity supply[9].

[8] Source: Energy key data, editie maart 2019, FOD Economie, KMO, Middenstand en Energie
[9] Adequacy and flexibility study for Belgium 2020 – 2030, Elia

In the last ten years, the integration of variable, renewable and decentralised energy has led to a growing demand for digitalisation, flexibility and smarter grid management as well as investments in the grid. The different Regions and Federal State take measures to ensure flexibility by matching supply and demand, expanding connections between countries, making energy networks smarter and creating opportunities to store renewable energy over a longer period.

In order to enable all citizens and businesses to anticipate periods of low and high electricity prices and to reap the benefits of digitalisation, Flanders aims to maximise the deployment and use of digital meters by 2024 (roll-out started 1/07/2019). This allows suppliers to develop new contractual arrangements and market participants to be flexible. With the deployment of smart meters and smart devices and controls households, SMEs and local energy communities will be able to participate in the energy market. The involvement of network users in the energy system will be facilitated by digital tools, such as geographic systems, web portals, the Internet of Things (IoT), big data, blockchain, digital twinned technologies, etc. ... In transposition of the European Directives on electricity and RES, the Flemish Government is currently setting up the necessary regulatory frameworks for e.g. flexibility, local energy communities and energy storage. The Flemish Government will introduce, e.g. a regulatory framework for the use of support services and flexibility for the Distribution System Operator (DSO). This system will be open to different users (households, local authorities, companies, etc.), sources (demand, production, storage, electric vehicles, etc.) and technologies. (Source: National Energy and Climate action Plan 2030)

In 2010, the regulator on the demand of the Walloon Minister of Energy was asked to formulate a report on the Sustainable and Intelligent Electric grid (fr. REDI) which concluded that the smart grid is an energy management tool, that allows to strengthen as well as better manage the maintenance of the electrical grid in order to meet the 20/20/20 objectives (CWaPE, 2012). It also enables less energy losses, an increasing participation of renewable energies, as it facilitates the integration of the renewable energy production to the grid, and an improved participation of the consumers, not only as an energy manager but also as an energy actor, namely a prosumer. (CWaPE, 2012). The document concludes that this transition will require great investments to adapt the grid originally not designed to accommodate decentralized productions, while its security should be preserved (CWaPE, 2012). The first step that they have chosen to implement the transition towards smart grids is the flexibility or demand-side management, thus, "a generalization of a wise flexibility of the access to the grid can help allowing the distribution system operator to limit the quantities injected on the grid according to the availability of the latter. But instead of reducing the production of renewable energies, an active demand side management occurred to the eyes of everyone as the most pertinent approach to accompany this evolution smoothly" (CWAPE, 2012, p. 4). This technical flexibility also called curtailment has been subject to a Governmental decree of November 10, 2016 'related to the cost/benefit analysis and to the calculation methods, and of implementation of a financial compensation'. Practically, curtailment prevents producers of renewable energies occasionally to produce in order to keep the security of the electrical network, through financial compensation. Balancing, or commercial flexibility refers to services provided to

Elia, the federal transport system operator, to keep the grid at its 50Hz frequency, for the security of the grid (Delvaux, 2018).

2.2 Governance

2.2.1 National regulatory framework

In general, regulators monitor the proper functioning of the electricity and gas market. There is a federal regulator (for the whole of Belgium) and there is a regulator in each Region (Flanders, Wallonia, Brussels). They work as an independent body with legal personality and their tasks, competences, organizational structure and financing are defined by law.

The Commission for the Regulation of Electricity and Gas (CREG) is an independent authority that supervises the transparency and competition of the electricity and natural gas market, approves the transmission tariffs, protects the interests of consumers, assesses if market conditions take the public interest into account and are in line with the general energy policy and advises the government.

The regional regulators are Flemish Regulator of the Electricity and Gas Market (VREG), Commission Wallonne pour l'Energie (CWaPE) and The Brussels energy regulator (BRUGEL). The regional regulators are responsible for the organization and operation of the regional electricity and gas markets. They advise the regional authorities and monitor the application of decrees and decisions and they approve the distribution network tariffs and support consumers that have problems with their supplier or distribution system operator.

Since July 2014, the competence for setting distribution tariffs has been transferred to the regions, which are also responsible for the control of tariffs regarding public distribution of gas and electricity (low-voltage (≤ 70kV) or low-pressure networks.

The federal and regional regulators have to monitor the liberalized production and consumer markets and the regulated network monopolies to which everyone has access on equal terms.

The subsidiary principle within Belgium as a federal state does not apply because the distribution of the competences between the Federal Authority, the Communities and the Regions, is based on the principle of exclusiveness and autonomy.

Pursuant to Article 10 of the Special Institutional Reform Act, the communities and regions as well as the federal government can act in matters for which they are not competent. However, the applicability of this article is very limited in practice as it can only be applied under very specific conditions (for instance, if the actions are necessary for the execution of their own powers). Under the sixth State Reform a substitution mechanism was introduced in favor of the federal government with regard to international climate obligations (Article 169 of the Constitution and Article 16, § 4 of the Special Law for Institutional Reform). However, this mechanism is highly unlikely to be activated because of the complexity of the procedure and the dominant view on Belgian federalism linked to the principle of autonomy.

In the Walloon Region, CWaPE is the competent authority to receive and analyze the demands of authorization for the renewable energy communities. It also surveils the development of the renewable energy community and control their conformity with their obligations. In that sense, it means that it is an independent authority wich receive the demands and control the renewable energy communities.

2.2.2 Support mechanisms

The major policy to promote electricity from renewable sources is the Green Certificate System. Although initiatives to promote RES date back to the 2000s, the acceleration of the deployment of renewable energies in Belgium is due to the European context and its targets embedded in the European Energy and Climate package of 2008 (Collard, 2015).

The Green certificate system is a market mechanism since the price of the certificate depends on the supply (producers of green electricity) and the demand (suppliers, fixed per quotas). The number of green certificates allocated depends on the sector and is based on the over-cost of production estimated for the sector as well as the environmental performance of the latter (e.g. CO2 avoided).

It is a mechanism that has been adopted at the federal level, but which has been implemented per Region (Collard, 2015).

In Flanders, the green certificate policy was applied in 2001. To benefit from this policy, one needed to introduce a demand of certification to the regulator, the VREG. Once approved, the producer would receive a green certificate per MWh produced, be it to be injected to the grid, or consumed by the producer. The producer could either sell its certificates on the market, directly to the supplier or via Belpex, the Belgian electricity exchange, or sell them at a guaranteed minimum price by its distribution system operator (Eandis, Infrax, etc.) or by the transmission operator network (Elia). The minimum price varies according to the RES technology, and the date of operation of the RES. The energy supplies have to buy green certificate according to the percentage of electricity sold in Flanders during the previous year, otherwise he/she would receive an administrative fine. This mechanism became so popular within a few years that the market wasn't able to absorb the mechanism correctly. From 2010 onwards, the Government decided to decrease the minimal value to 350 euros per certificate for the residential PV, and a decrease over time of the support mechanism for new installations. In 2014, Flanders decided to remove the incentive mechanism for the residential PV (Collard, 2015). In the meantime, a subsidy mechanism was put into place which it limited the depreciation period of the investment made by the green energy producer, i.e. between 10 and 15 years depending on the sectors.

In the Walloon Region, policy to incentivize the development of renewable energies can be traced back to 2002, and the current regime stands in a Governmental regulation of November 20, 2006 (Collard, 2015). To this end, it has been chosen to incentivize renewable energies through 'green certificates', which are quarterly granted by the regulator "to each producer of green energy, proportionally to the gross electricity produced, the estimated overcost of production foreseen related to the renewable source, and environmental performance" (Collard, 2015, p. 49). In December 2007, the Regional Walloon Government launched a generous policy through Soliwatt plan to promote individual solar PV through the attribution of those 'green certificates', as 95% of the installations at that time were in Flanders (Collard, 2015). The mechanism was designed as such that the incentive was differentiated per sector which means that for residential PV, from 2007 to 2011, one green certificate equated to 7 certificates per MWh produced. In the end, it became such a great success that the system almost collapsed and was revised through the Qualiwatt plan, a subsidy mechanism, enforced in 2014 to cover the 2014-2020 period (Collard, 2013). The 'green certificate' policy is secured until 2024 (AWAC, 2016).

In Brussels, the green certificate mechanism was put into place through a modification of the Order of 19 July 2001 related to the organization of the electricity market for the Brussels-Capital Region. Like in Flanders, the producer of green energy needs to ask for a certification to be regulator, the BRUGEL. Since 2011, for residential PV installation, such a certification is not needed. It is also a market mechanism, through which the certificates have to be put on the market. Given the urban context of the Region, Brussels has encouraged electricity production through co-generation. (Collard, 2015).

2.2.3 Planning Policies

The Walloon Region adopted a decree that explicitly mentions that it modifies the organization of the regional electricity market and the tariff methodology applicable to electricity and gas DSOs, to favor the development of renewable energy communities. In that sense, legally allowing energy communities since 2019, to be set up is one way to encourage actively the concept.

In Flanders, reflection on how to design a framework for the energy communities in the making, as declared in the government's accord, and various pilot projects are ongoing. In that sense, there is a political willingness to move towards an incentivizing framework for energy communities. Moreover, the National Energy and Climate action Plan 2030 (NECP) mentions that by the end of 2020, an incentivizing framework will be in place to encourage the development of local energy communities and remove administrative burden and legal barriers. NECP iterates a willingness to develop an adequate regulatory framework to support and facilitate the active role that citizens, local authorities and undertakings can play in the transition through local energy communities. The Government will focus on information, awareness and worry alleviation from the participants and the project developers.

In Brussels, pilot projects concerning collective self-consumption will be authorized from 2020 onwards to better define a legislative framework for renewable energy communities.

With specific reference to the smart grids, in order to enable all citizens and businesses to anticipate periods of low and high electricity prices and to reap the benefits of digitalization, Flanders aims to maximize the deployment and use of digital meters by 2024 (roll-out started 1/07/2019). This allows suppliers to develop new contractual arrangements and market participants to be flexible. With the deployment of smart meters and smart devices and controls households, SMEs and local energy communities will be able to participate in the energy market. The involvement of network users in the energy system will be facilitated by digital tools, such as geographic systems, web portals, the Internet of Things (IoT), big data, block chain, digital twinned technologies, etc...

In transposition of the European Directives on electricity and RES, the Flemish Government is currently setting up the necessary regulatory frameworks for flexibility, local energy communities and energy storage. The Flemish Government will introduce, for instance, a regulatory framework for the use of support services and flexibility for the Distribution System Operator (DSO). This system will be open to different users (households, local authorities, companies, etc.), sources (demand, production, storage, electric vehicles, etc.) and technologies.

2.3 **Bottom-up initiatives**

2.3.1 Legal framework

For the Flemish Region, there is not yet a framework but the debate is ongoing, supported by various pilot projects across the Region. The Flemish Government has approved on February 2020 the Thor Park science and technology park in Genk as the first living lab to benefits from a regulatory sandbox for energy, as defined in the revised Energy Decree of 8 May 2009. It is the first site to benefit of such a legal framework in Flanders, in order to test and demonstrate among other things “the optimization and exchange of locally generated (renewable) energy through new market organization models for energy services in a locally organized energy community”.

The Walloon Region elaborated a framework, which was approved on April 30, 2019 to favor the emergence of renewable energy communities. It is the Decree of May 2, 2019 which states that it partially transposes the Directive (EU) 2018/2001, but no reference to the Directive (EU) 2019/944 is made. The testing of pilot sites in Wallonia is also allowed thanks to a regulatory sandbox called “regulatory innovation zone”, an exemption to market rules and tariff rules granted by the regulator, the CWaPE, for a limited period to develop solutions to the problematic of the connection of the decentralized production to the distribution grid.

In the Brussels-Capital Region, there is an existing legislation, the Order of 23 July 2018, which defines collective self-consumption and an exemption framework for pilot projects in Title V. However, it is an incomplete framework.

In the Walloon Region was adopted the Decree of April 12, 2001, related to the organization of the regional electricity market, that is incomplete and in contradiction with the directive RED II. This Decree defines “renewable energy community” as a legal entity consisting of a set of participants for the purpose of sharing, via the public distribution or local transmission system, electricity produced exclusively from renewable energy sources or quality cogeneration, by production and, where appropriate, storage units owned by that legal entity, within the local area where it carries out its activities and whose primary objective is to provide environmental, economic or social benefits to its participants rather than to seek profit. With specific reference to social benefits, there are energy cooperatives engaged in poverty alleviation such as Bronsgroen, which allocates a portion of its benefits to projects, which tackle energy poverty. The participation to a renewable energy community is free and voluntary. Any natural person, local authority, small or medium enterprise located in a local parameter can participate in a renewable energy community. Local authorities can participate in renewable energy communities’ projects in the Walloon Region.

For the Walloon Region, the community has to be a legal entity, without specificities about the type of legal form, but should not be focused on profit. For the other two regions, it is not yet known what type of legal form they can benefit from.

Concerning the energy cooperatives, a cooperative can be a cooperative society with limited or unlimited liability. Following the new Code of undertakings and associations, the general principles for cooperatives are the following. There is requested a minimum of three persons to constitute it, who are called the founders. The other “members” are called shareholders. A register of nominative shares must be held. The cooperative is administered by one or more administrators constituting a board. They are nominated by the general assembly but they can also be nominated in the statutes. The shares are nominative shares with voting rights, the statutes can limit the number of vote that each shareholder has at the assemblies, provided that this limitation is imposed on any shareholder. The cooperatives can be “approved” by the Minister of Economy and can seat to the National Council of Cooperation. The Council promotes the cooperative ideal as defined by the ICA. It is unclear in practice what it means when cooperatives are not “approved” with respect to how they fit the ICA principles. The renewable energy cooperatives are owned by their members, instead of investors and “net earnings are usually divided pro rata among the members not according to their shareholding – but according to the volume of transactions they have conducted with the firm” (Bauwens & al., 2016). They are also a democratic organization, respecting one person one vote rule, and “the absence of barriers for new entry members (Bauwens & al., 2016).

Moreover, the new Code of undertakings and associations provides that CAIs can also be not for profit organizations, called associations.

From the cooperative's perspectives, the commercial licensing, the development and the connection to the grid are considered complex administrative procedures.

2.3.2 Attitudes toward the cooperative model

The cooperative movement dates back to the first half of the nineteenth century in Belgium, when the cooperative ideas from the Rochdale Society of Equitable Pioneers in England, created in 1844 spread across the borders. The principles defended by the Rochdale Society remain substantially alive throughout the International Cooperative Alliance. Belgian saw its first legal framework in 1873, though the fundamental principles were optional at the time leading to a double lecture of the cooperative type of undertaking; one following the principles inspired by the Rochdale Society, and one aiming for this legal form for the convenience of the model. To embed the Rochdale principles, the National Council for Cooperation was created in 1955. The cooperative movement saw a boom in the 1980s thanks to the flexibility of the legal definition. This side effect resulted in a weakening of the image of the cooperatives, which were seen as undermining other legal forms, such as the private companies with limited liability. This effect lead to a revision of the legal framework in 1991, giving the possibility to create a cooperative society with limited liability, or a cooperative society with unlimited liability. Those traditional cooperatives would be found in primary and tertiary industries, such as insurance, pharmaceutical distribution, agriculture. Those have been impacted by the economic globalization through increasing competition, and technological advances. By the early 2000s, they evolved from consumer cooperatives to financial cooperatives (Defourny et al., 2002). Concerning energy cooperative, the same pattern can be observed. Some cooperatives follow the cooperative ideal, while others are incumbent-owned power companies which create a cooperative to make their wind projects come to life, while obliged to have a percentage of citizens' participation into the latter (Bauwens et al., 2016)

One historical example of energy cooperative is the one of Ecopower, founded in 1991, the first energy cooperative in Belgium. With respect to attitude towards the cooperative model in the sector of energy, the "top-down" initiatives, using the cooperative model to finance RE production plants undermines the legitimacy of the "bottom-up" approach as the cooperative doesn't allow the members to co-own the wind-turbines. To counter this phenomenon, REScoop Belgium was created in 2013 to voice and promote the cooperative ideal. (Bauwens and al., 2016).

2.3.3 Local activism

Anti-nuclear mobilization has been marginal in the public debate in Belgium. Still, several cooperatives had, at its origin, a link with local protest movements against nuclear waste or nuclear energy (Bauwens and al., 2016). For wind projects, Belgium has conducted a "first come, first-served" policy, which lead eventually to a wind rush for available lands, making it difficult for cooperatives to develop projects compared to large-scale wind power producers (who have more time and resources available). Since 2011, onshore wind projects in Wallonia are recurrently blocked through juridical appeal before the Council of the State, as the population shows resistance to projects developed by big companies. To solve the problem, the Government adopted in 2013 a regulation that would make compulsory the participation of citizens for up to 24.99% and for 24.99% participation for municipalities to the capital of new projects.

3 Estonia

3.1 Market overview

3.1.1 Energy Consumption trends

In the period of 1999-2018, the energy consumption in Estonia has increased by 30%. The fastest growing sector in terms of energy consumption has been the services with an increase above 100%. Consumption of the households has been rather stable with a marginal increase of 10.2% despite the growing popularity of the consumption electronics and an increasing habitation footprint. The growth of transport sector is correlated with the fundamental shift of transport modalities from public transport to a growing private car-based transport system. Increase of the transport expense is also correlated with the growth of the service industry and the commerce sector.

Energy intensity continues to be one the highest in EU with 317 following only Bulgaria. The energy intense production model is the heritage from the pre-independence period and has been flourishing with the help of energy hungry foreign and national investments, supported by relatively low environmental fees and penalties. This model is already starting to change due to the growing EU environmental regulations.

Import dependency of energy carriers has decreased from 33.8% in 2000 to 4.1% in 2017 and is continuing to decrease further. Share of Renewable Energy Sources in Gross Final Energy has increased from 17.4% in 2005 to 29.2% in 2017 (17% in electricity).

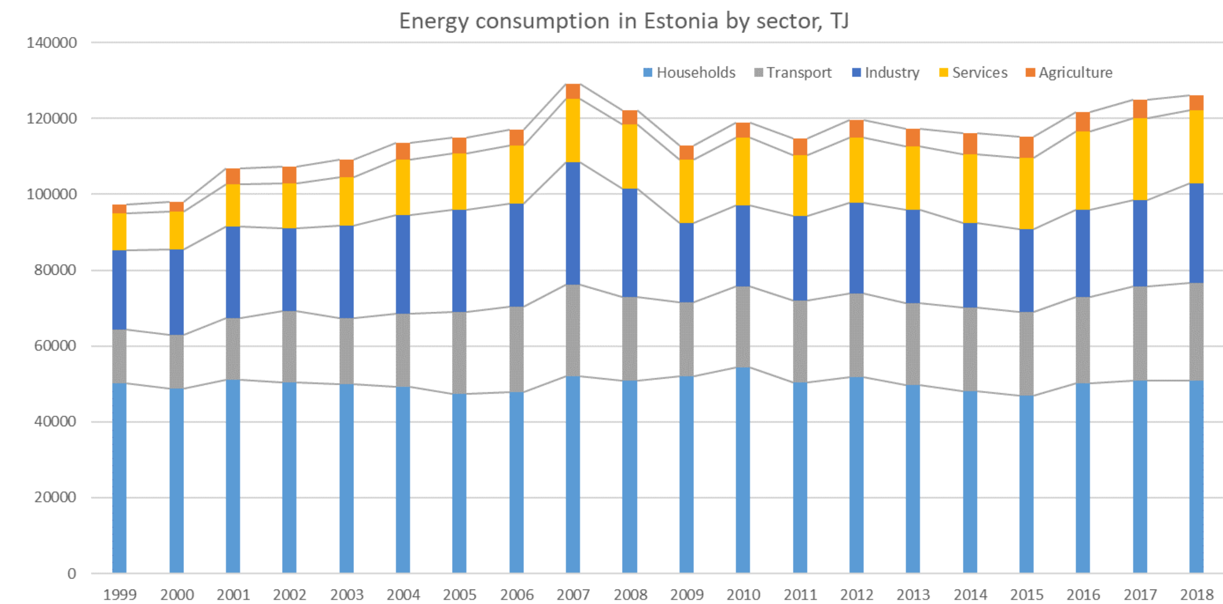

Figure 3.1 Final energy consumption in Estonia 1999 – 2018 by sector

3.1.2 Market structure: generation, distribution and retail market

Estonia is the northernmost of the three Baltic States. Between World War II and 1991, Estonia was occupied by the Union of Soviet Socialist Republics (USSR) and was fully integrated into the Soviet political and economic systems. The period was characterised by rapid urbanisation and industrialisation, which forced Estonia to become highly dependent on raw materials and energy from other parts of the USSR (Martinot et al., 1995). As part of the sovietization, workers from other areas of the USSR were moved to Estonia, to fill the new jobs created by industrialisation. From 1945-1989 the population of non-Estonians grew from 23 000 to 602 000. Today, Estonia is home to approximately 1.3 million people, of which roughly one-quarter are categorised as ethnic Russians2 After independence in 1991, the socialist system was quickly replaced by a market-based economy. State subsidies to enterprises were phased out and consumer prices were deregulated. These reforms meant that energy prices increased dramatically and energy use decreased drastically, as enterprises and citizens had to bear the costs (Martinot et al., 1995). Estonia experienced an economic downturn, including high unemployment and the collapse of the social security system. In 2004, Estonia became a member of the EU and was thus obliged to comply with environmental directives, including requirements increasing its share of renewable energy sources and complying with the Kyoto protocol (Miskinis et al., 2006). This posed particular challenges to the Estonian energy system, which is built around domestic fossil fuel oil shale. During the EU accession negotiations in 2003 Estonia agreed to deregulate its electricity market according to the EU directives. After a few years, in 2009, Estonia opened 35% of the market; large consumers that use more than 2 GWh of electricity per year gained the right to buy electricity from the open market. However, as the regulated tariffs were lower than the market prices, no consumers chose to exercise this right. Only in 2010 some competition started in the market when the electricity market law was amended so that large consumers had not only a right but also an obligation to buy electricity from the open market. In January 2013, Estonia opened the electricity market for all consumers.

The development of the Estonian electricity market has been closely linked to the advancements in the EU energy policy. The first law regulating the Estonian electricity market, the Energy Act, followed the direction of the First Energy Package of the EU and was passed in June 1997 and came into force in 1998. The document administered the fuel and energy sector (including electricity) and the supervision of these markets. In addition, the act established the Energy Market Inspectorate that was responsible in the electricity sector for issuing market licenses for import, export and sale of electricity, and for approving electricity prices for different market participants. Although the Energy Act was modeled according to the EU legislation the provisions were considered too general and not thorough enough according to a report “Electricity Sector Reform in the Candidate Counties, Balkan Countries and the Russian Federation” addressed to the EU (Holmgren et al., 2019). Nevertheless, due to the Energy Act the major energy producer Eesti Energia had to unite five regional electrical power networks in November 1998 and divide them into separate distribution (Eesti Energia Jaotusvõrk) and transmission (Eesti Energia Põhivõrk) units. These entities became independent economic units with their own accounting and auditing. However, they were still operating parts of Eesti Energia. In addition, in 1999 Eesti Energia separated its electricity production and sales operations by creating distinct subsidiaries (Narva Elektrijaamad) for electricity generation.

After the Second Energy Package of the EU was passed in June 2003, Estonia adopted the Electricity Market Act later that year, governing the generation, transmission, sale, export, import and transit of electricity and the economic and technical management of the power system. The document focused on the principles of the operation of the electricity market based on the need to ensure an effective supply of electricity at reasonable prices and meeting environmental requirements and the needs of consumers, and on the balanced, environmentally clean and long-term use of energy sources. For example, as the Electricity Market Act prohibited network operators from simultaneously producing, distributing and selling power, then in April 2004 Eesti Energia had to establish a new independent and autonomous subsidiary responsible for transmission networks, Eesti Energia Põhivõrk, instead of the existing structural unit (Holmgren et al., 2019).

Despite the development towards a liberalized electricity market, the CESI report (2009) mentioned that in practice, in 2007 there was no functioning Estonian electricity market as there were no independent suppliers. The market was dominated by a single state owned vertically integrated company (Eesti Energia), which had 97% of the production capacity, 88% of the retail market and controlled the whole transmission network.

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In accordance to the Third Energy Package in November 2009, the government of Estonia separated Elering (previously Eesti Energia Põhivõrk), including the assets of the transmission system, from Eesti Energia in order to ensure the independence of the transmission network operator from electricity production and sales activities.

Until today, Estonia has not privatized the state-owned electricity monopolies. The dominant electricity producer, Eesti Energia, with a market share above 90% is fully state owned. The government also controls the network operator Elering and the biggest distribution network operator Elektrilevi which is a subsidiary of Eesti Energia. The national electricity provider, Eesti Energia, is still protected by the direct and indirect subsidies and by the market regulations that is favoring the incumbent on the market.

However, the liberalization of the energy market has partially increased the diversity in the production, retail and consumer markets. In particular, the creation of a state support scheme (Feed-in tariff) that provided for the payment of 5.34 cents€/kWh for renewable electricity for 12 years after the plant is commissioned, gave impetus to electricity production based on renewable sources. Private investments have been steadily increasing as an outcome of open energy market. There are 4 new privately owned CHP plants established in last decade and several privately owned heat plants. Private investments have also been increasingly used for renovating the energy systems, heat pipelines, boiler houses etc.

Local private companies are focusing on (mostly) heat only, and (sometimes) heat and power cogeneration and only electricity production (PV-panels farms and wind farms). Sometimes the local companies are also the owners of the heat distribution network. Also a number of foreign companies been somewhat active in Estonia. Finnish Fortum Group owns several local CHP and district heating and cooling networks in Tartu and Pärnu, Adven OÜ (belongs to foreign investors) has lot of district heating networks over Estonia and Danpower Eesti AS (German company) owns two DH networks in Estonia. French DALKIA (subsidiary of EDF) has been active but now decreased their presence. For this type of actors, the market has been rather volatile and changing fast – they are rarely looking for a long term business relationship with the communities. Their activities however are supporting the energy transition with producing or providing green energy to the local market. Especially Fortum Group has been the leader of green innovation with two modern Cogeneration Plants (CHPs) taking use of primary renewable sources (woodchips) and a pilot project of green distant cooling plant – a unique and remarkable facility in the Baltic Sea Region.

3.1.3 The technological landscape

Oil shale is fossilized sedimentary rock that can be burnt to produce electricity and heat, and used to extract shale oil that can be refined to diesel or gasoline (Brandt, 2008). Oil shale can be found in many countries, but only in Estonia it plays a central role in the economy. Long before mining was initiated in 1917 by the Russian Empire, oil shale rock was used by local Estonians for heating. The industry was soon dominated by Russian control and imported Russian-speaking workers (Holmberg, 2008). Following industrial expansion in the USSR after WWII, the USSR significantly invested in Estonian oil shale mining. Between 1945 and 1953, 200 000 workers were moved from other parts of the USSR to Estonia to work in the mines. Large amounts of oil shale gas were exported to Leningrad, which received piped gas from Estonian mines long before Estonia's capital, Tallinn. The historical Soviet domination of the oil shale industry, combined with its severe negative environmental impacts, generated negativity towards the industry amongst ethnic Estonians (Auer, 1998).

Since independence, oil shale has remained critical for Estonia's electricity and heat production (Gaskov et al., 2012) and for rebuilding the economy. Although the quantities of oil shale mined have decreased since 1990, the share of oil shale in the primary energy supply has increased, from 52% in 1990 to 71 % in 2014.The oil shale industry has survived since EU membership and access to domestic oil shale resources means that Estonia, unlike other member states, is comparatively energy-independent. Shale oil production has increased markedly since independence and is an important export product in the era of high oil prices on the global market (Holmgren et al., 2019). The knowledge and technologies necessary for oil shale processing are in increasing demand around the world and the competences of Estonian engineers in oil shale research and development are esteemed (Holmberg, 2008). Approximately 90% of the total oil shale excavated is mined by Eesti Energia (Gaskov et al., 2012). Parallel to continued investments in the oil shale industry, the Estonian government is committed to achieving 25% renewable energy in gross final energy consumption by 2020 (European Parliament and Council, 2009). In 2005, the reference year for renewable energy 2020 objectives, the share of renewable energy in Estonia was already 17.5%, and since 2011 Estonia's gross energy consumption has exceeded the 2020 target of 25%, making Estonia the first country in the EU to fulfil its 2020 renewable energy target.

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In Estonian towns there are currently 8 CHP plants with DH network (Tallinn 3, Tartu, Pärnu, Kuressaare, Paide, Rakvere) in operation. All have been opened within last decade. 7 are using bio fuels (mainly wood chips), 1 is using municipal waste (solid waste). Instalment of CHPs has increased the security of the local energy supply of the three largest and three smaller cities.

There are more than 1000 grid-producing PV stations installed within the last decade, most of what are under 50 KWh approx. According to the annual report, the total capacity of the wind power plants at the end of 2018 was 591 GWh. No new wind turbines have been installed in recent years. There are 4 biogas stations in Estonia with CHPs installed and heat to DH network distributed and 13 biogas stations where only electricity is sold. Forty-seven different hydroelectric power plants and water mills connected to Estonian electricity networks. Most of them have a capacity of less than 50 kW, the largest being Linnamäe HPP with a capacity of 1.1 MW.

Most innovative development in energy sector is production of the biogas production and consumption systems that are used for generating heat, electricity and used also for fuelling the Public Transport system like in city of Tartu. Comparable innovation has been the nation-wide development of rapid charging network for electric vehicles, using green electricity as the source of energy.

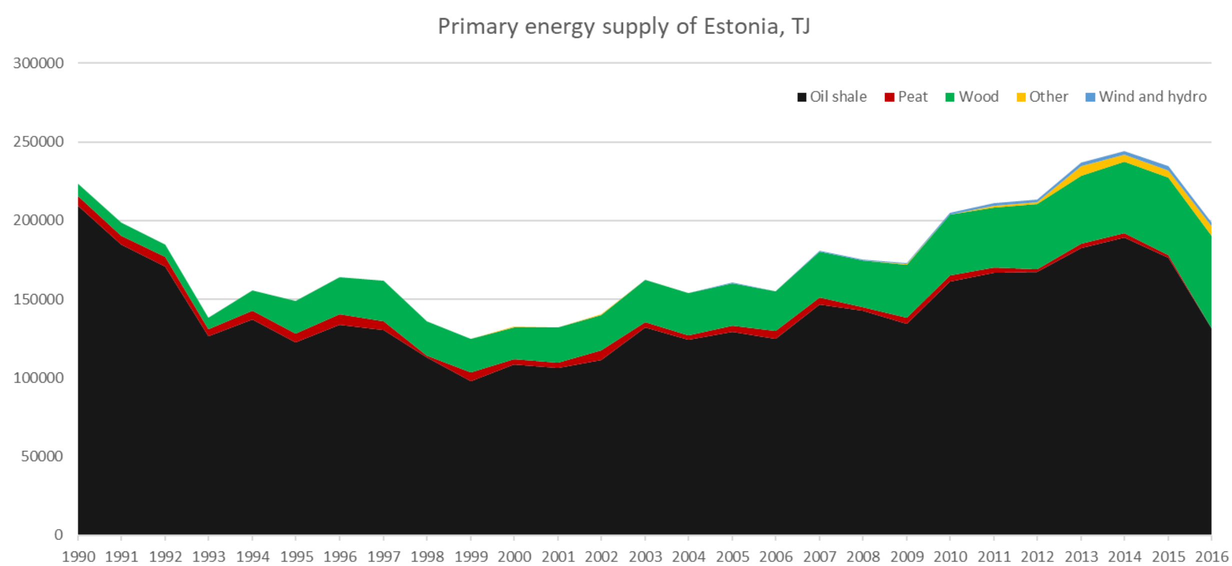

Figure 3.2 Total primary energy supply (TPES) by source, Estonia 1990-2016

3.2 **Governance**

3.2.1 National regulatory framework

Estonia's translation of EU energy policy has focused on the requirements of the European internal energy market rules providing a competitive environment for renewable energy solutions to emerge. However, there is a darker side to Estonia's energy system since its electricity demand has been materially met with a rare fossil fix. In 2015, 75% of Estonian energy production consisted of oil shale (Statistics Estonia, 2017). Because of its unique history, including a brief period of independence in the 1920s and 1930s and its role in the Soviet Union until the early 1990s, Estonian energy production consisted almost entirely of the oil shale resources mined and processed around the city of Narva in the easternmost part of the country (Holmberg, 2008). The abundant electricity production from oil shale guaranteed the nation's industrialization and energy independence, but has recently become an elephant in the climate change room due to CO2 emissions comparable to brown coal. Consequently, the design of renewable energy policies takes place in relation to oil shale's dominance in electricity production. From 2009 subsidized wood was co-fired with oil-shale in electricity production to reach national RES targets, but this particular policy approach was incongruous with EU renewable energy sustainability objectives resulting in the introduction of stricter efficiency criteria in the Estonian RE subsidy system.

National energy policies are developed under the Ministry of Economic Affairs except for the National Energy and Climate Action Plan that was established by the Ministry of Environment. Municipal governments are responsible of developing municipal energy policies and plans. The regional, sub-regional and county are not the subjects for energy policy and planning.

Moreover, the Ministry of Economic Affairs and Communication is responsible for legislative decisions, adoption of EU directives and development of regulations related to energy policy and targets. Instead, the Ministry of Environment is responsible for legislative decisions related to climate targets. The main legislation regulating the energy management is the Electricity Market Act and the Energy Management Organization Act.

At the local level, there are no regulations on energy management. Only development plans (heat sector), local level sets the rules for spatial (general and detail) planning - directly related to locations and technical conditions of PV parks and wind parks.

The Competition Authority is a governmental organization under the Ministry of Economic Affairs that is fully competent to set the rules for the tariffs, control all electricity generation prices, transmission prices and consumer prices. If there are deficiencies in the applications, the requested price will not be confirmed, but corrections must be made in the application. All regulated prices must be cost-based and transparent. Authority is also responsible for licensing, monitoring, supervision and regulating the electricity market. No environmental mission is assigned to this authority.

3.2.2 Support mechanisms

All the support mechanisms for new Renewable Energy production (including the building refurbishment) entities are at national level.

Feed-in tariffs and investment support has been used in promoting the Renewable Energy production in Estonia. Addition to the support for energy production, Renewable Energy production measures are also supported as part of building renovation under the National Renovation grant for building refurbishment. In recent years, a number of communities (apartment associations mainly, but some others also) have installed the technology and started to jointly produce and consume renewable energy, this is largely due to the national renovation scheme, which also includes the installation of RE technology. Existing support schemes have been successful on increasing the mix of Renewable Energy Sources in the final consumption. This process has been based on private initiatives utilizing investments for Renewable Energy production from individuals and companies alike. So far, these initiatives have not officially defined themselves as a separate energy cooperative or community. Nor is it required by law at the moment, as the legal entity has already been established. In principle, they can be considered as energy communities, although this is not explicitly emphasized in their legal documents. The topic of energy communities is relatively new in Estonia and has only started to get the attention of society in recent years. To this day, there is no separated market position for energy communities. There are no specific support regimes for energy communities. In fact, there are not provided any subsidies, incentives, tax exemptions or special treatment given to energy communities.

3.2.3 Planning Policies

The current legal system in Estonia conveniently and easily enables the creation of renewable energy communities and the production of renewable energy for own consumption. Under the current Commercial Code, renewable energy communities may act as a limited liability companies as well as public limited companies. The only restriction is that the renewable energy community cannot be a general partnership or a limited partnership within the meaning of the Commercial Code, since the members of these two legal entities cannot be local governments. However, local governments may form the renewable energy community under the new Renewable Energy Directive. End consumers, primarily households, retain their rights and obligations according to the statutes of the company, articles of association, etc. The current Electricity Market Act also allows the customer to be in the role of the producer as well as the customer. It is possible to consume self-generated electricity oneself as well as supply it to others and also apply for support under certain conditions.

The experience of Energy association's program that took place in the period 2014-2015 and involved ten potential energy associations (including the participation of 7 local authorities) showed that the prerequisite for creating an energy community in Estonia is a certain population density, experience with cooperative collaboration, the presence of fuel-free and other renewable sources and proper energy technologies, the capability to reconstruct buildings and the opportunity to sell energy to the network. This program resulted in only one energy association out of 10 pilot associations that participated[10].

[10] Estonian Development Fund 2015 http://basrec.net/wp-content/uploads/2014/10/EDF EnerCoop BASREC report final.pdf.

The potential and socio-economic impact of Estonian energy associations was assessed in 2015 within the context of the Energy Association Mentor Programme[11]. The greatest energy-related potential for the establishment of energy associations is in apartment buildings and public buildings that are not located in district heating regions or are located in low consumption density district heating network regions. The potential of local cooperative electricity generation with solar panels amounts to 30 GWh/year (3% of the annual electricity demand of the buildings in case the price received with investment is lower than the price of the purchased electricity). Local electricity generation for the existing local distribution grid has a positive impact by making it possible to increase network capacity by a few percent. Wood gasification with energy cogeneration of 22 GWh/year also has potential. The production potential of wind energy does not match the locations of apartment buildings and public buildings in Estonia. The share of local energy production makes up 0.33% of the final electricity consumption of all buildings. The buildings with the potential for district heating make up 8-10% of the final heating consumption of all buildings. Energy communities can primarily be implemented at the local level. More than 9,200 cities have joined the Global Covenant of Mayors for Climate and Energy, and from Estonia, Tallinn, Tartu, Rakvere, Jõgeva, Kuressaare, Rõuge and Võru have joined[12]. Under the covenant, by 2030 carbon emissions should be reduced by 40% in the territories of those towns, the towns should become carbon neutral by 2050 and tackling of the impacts of climate change should be improved. For, example, up to 100 solar electricity stations will be installed on the roofs of buildings by the end of 2020. The energy roadmap for Tallinn was prepared in 2018 and Sustainable Energy and Climate Action Plan in 2020. Tartu Regional Energy Agency has been supporting the energy community initiatives in Estonia and has helped to develop several Sustainable (Climate and) Energy Action Plans for municipalities joining Covent of Mayors. Agency is also acting as a technical expert for smart city development in Tartu and helped to develop 17 new PV stations on the rooftops of renovated apartment buildings.

3.3 **Bottom-up initiatives**

3.3.1 Legal framework

There is no specific relevant legal framework for Energy Communities and it is difficult for communal energy projects enter to the market dominated by large electricity producers. Legal framework has simplified the installation of small-scale electricity production units. However, these exceptions in legislation are not suitable for developing mid-scale production, favoured by collective investors.

[11] Estonian Development Fund 2015 Report on THE POTENTIAL AND SOCIO-ECONOMIC IMPACT OF THE ENERGY ASSOCIATIONS
https://energiatalgud.ee/img_auth.php/1/13/Eesti_Arengufond._Energia%C3%BChistute_potentsiaali_ja_sotsiaalmajandusliku_m%C3%B5ju_anal%C3%BC%C3%BCs_2015.pdf.
[12] Global Covenant of Mayors for Climate and Energy https://www.globalcovenantofmayors.org/our-cities/

There is a lack of the first active communities that go through this path first and set an example for others. The two European directives have not yet been transposed into Estonian law.

Currently, there is not a definition for Energy Communities in national legislation yet because the adoption of directives is still ongoing. The adapted law is expected to enter into force at the beginning of 2021. Probably, Estonian law will follow the definition in the European directives and will transpose them directly. It means that this definition will probably favour the usage of renewable energy sources.

All the legal structures are theoretically available but none of them is usable as the legal framework for the energy communities to offer energy services. Energy communities may operate under a public limited company, private limited company, non-profit association, etc. and in their statutes they can manifest their activities more precisely, for instance, as a renewable energy community.

There has not been an institutional or public involvement in energy communities. In fact, local authorities have no motivation nor the interest for participating of forming these. The national renovation grant and environmental grant supports the implementation of local renewable energy production units but the establishment of energy communities is not encouraged.

With reference to the authorization and legislation of energy communities, there is not a special regime for them but it applies the same regulation provided in order to manage energy activities. In this regard, the administrative burden depends on the scale of energy installation and the connection to the national electricity market. All the community initiatives of energy production are considered to be equal with other forms of energy production companies both in technical implementations and operational routines.

3.3.2 Attitudes toward the cooperative model

Financial cooperation and collective form of entrepreneurship has a deeply ambivalent connotation in Estonian culture. Cooperative activities were popular in Estonia in the 1920s and 1930s. Due to the rapid increase of economic activities after the WWI the period between two world wars was a golden era especially for rural cooperatives. However, this was not the case for energy sector that was under strict control by the State. Active period of establishing cooperatives during the 1920' and 1930s was interrupted by WW2 and Soviet occupation in 1944. However, all of that were overshadowed by the forceful, brutal, and ill-managed collectivization during the bloodiest years of soviet occupation. In this cultural context, the collective forms of entrepreneurship are linked with the traumatic memories of political terror, mass deportations, forced collectivization, and the general mismanagement of the resources by the foreign ruling power. The rapid and disruptive manner of privatization of large scale post-soviet industries during 1990s has also been linked with the (negative) experience of collective ownership that has left tens of thousands of people jobless and without many well-earned social benefits.

From a positive side: a first attempt to activate the cooperation in energy field was Energy Cooperation Mentor Programme, which was organised by Estonian Development Fund and was active from 2014 up to 2015. Ten community energy initiatives were selected and supported on their way to become an energy cooperative, for them mentor advice was provided. Unfortunately, not a single CE project started from this mentoring programme - it was too short-time (only 1 year) and legislation was not supportive at that time. Although initiatives were not established, a mentor programme developed and provided a lot of valuable analysis, research and information about conditions for Community Energy.

Due the increase of economic activities, new forms of entrepreneurship models including coops and energy coops, are finding more acceptance and interest among the general public. However, the country lacks the successful examples of the energy cooperatives and this is hindering the potential enthusiasm of the investors. The first initiatives are in the process for establishing an energy cooperative in Southern Estonia. If these will be a success, the others may follow.

3.3.3 Local activism

Historically there have been examples of energy activism on local and even on national level against intensive production of oil-shale. Because of the social and structural changes during the 1990s and 2000s the tradition of the energy activism has been weakened but with the recent movements (against the development of a large-scale cellulose production facility, against the development of pan-EU railroad project Rail Baltic, against the systematic overharvesting of the forest resources etc.) there has been a new rise of environmental and energy activism in Estonia that probably will become more influential in the years to come. By the start of 2015, climate change had again gained top priority among the issues concerning the oil shale industry because of several national and global developments and most importantly due EU energy and climate policy. On the national scale, the campaign "Our welfare lies in our national resources!", launched by the Federation of Estonian Chemical Industries against a planned rise in environmental charges and tax rates, angered many environmental activists. As a result, the Council of Environmental NGOs gave the annual "award" for the most environmentally harmful deed to the Federation of Estonian Chemical Industries.

4 Italy

4.1 **Market overview**

4.1.1 Energy Consumption trends

Italy is at 4th place (after Germany, France, and the UK) in its energy consumption in the EU. During the period 1997-2019, after a peak of 198 Mtoe gross inland energy consumption in 2005, its consumption has been decreasing with some exceptions in years 2010 and 2015-2018. In 2019 there has been a decrease of 1.3% with the respect to the previous year[13]. The sources of the primary energy consumption have significantly changed in the last 25 years, in particular, the oil contribution has decreased by more than the 20%, while the natural gas share has increased by 12% and the percentage of renewable sources has increased threefold. The latest available data reveals that predominant primary energy sources in Italy in 2019 were natural gas 36.1% and oil 34.5% whereas renewable sources accounted for 20.9%.

In the last years, Italy has returned to consumption levels equivalent to the early 1990s. There was the stable growth of all sectors until 2005, which was followed by a period of constant reduction in consumption for industry and oscillating results in other sectors. During the period 1990-2019 the only sectors that recorded positive growth rates were the civil sector (+40.7%) and the transport sector (+14.3%). Over the period 2000-2019 the energy consumption of industry, reduced by 2.2%/year, from 40.5 Mtoe in 2000 to 26.9 Mtoe in 2019.

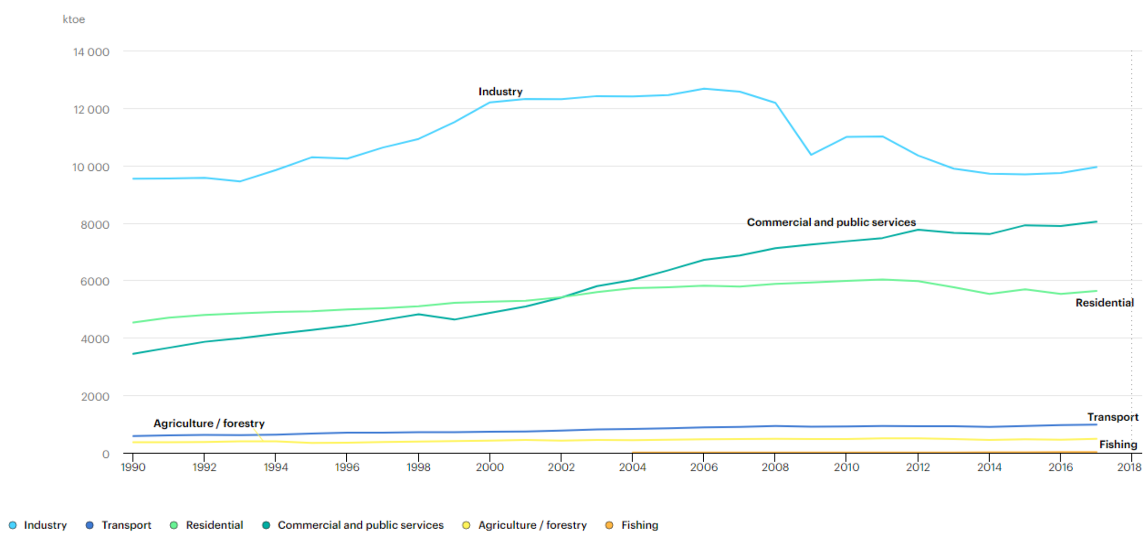

Figure 4.1 Electricity final consumption by sector, Italy 1990-2018 – IEA

The total electricity consumption in Italy increased from 302 TWh hours in 2000 to 315,8 TWh in 2018, yet the growth was not steady over time. In fact, the volume of electricity constantly increased from 2000 to 2008, when it peaked at 339 TWh hours. Thereafter, the consumption oscillated without never going back to the peak level, neither to the lowest value recorded in 2000. In 2018 electricity consumption per capita was 5.2 MWh, i.e. 10% below the EU average and lower than 11.5% in comparison with the historical peak, reached in 2006.

The consumption of electricity by selected sectors (see Figure 4.1) shows that electricity consumption in the services sector more than doubled in the period from 1990 to 2018, while

13 https://dgsaie.mise.gov.it/pub/sen/relazioni/relazione_annuale_situazione_energetica_nazionale_dati_2019.pdf

electricity consumption in the households sector increased by 24.2 % during the same period. While in 1990 electricity consumption of households was 31.72% higher than that of services, from 2002 the electricity consumption of the services sector has exceeded the electricity consumption in households.

In 2018, Italy was among the biggest European net importers of electricity in absolute values with Finland and Belgium. The net import of electricity represented 14.5% of the national electricity consumption (see figure 4.2).

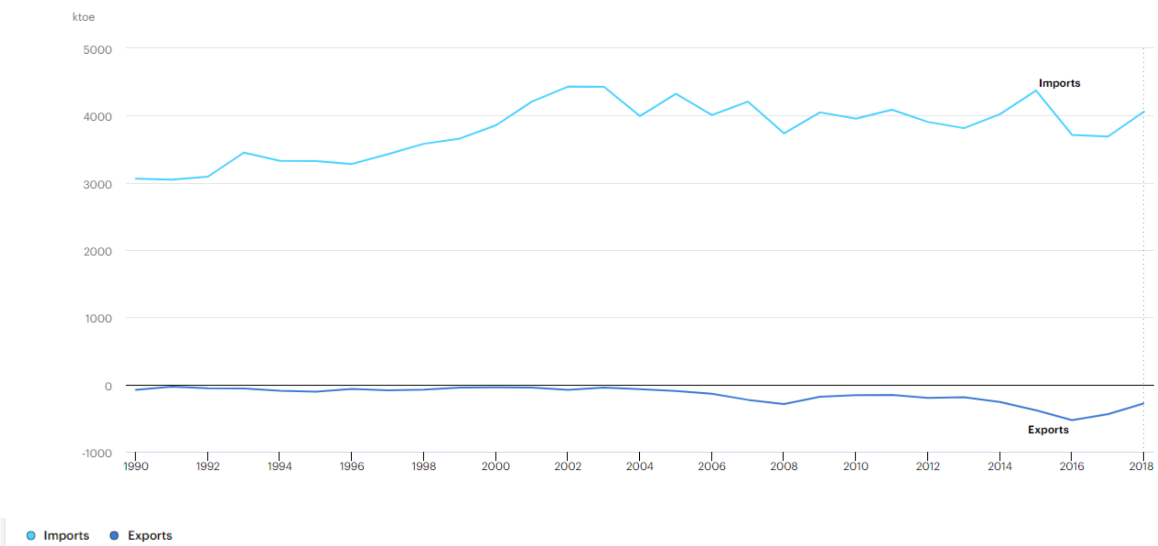

Figure 4.2 Electricity imports vs. exports, Italy 1990-2018 - IEA

4.1.2 Market structure: generation, distribution and retail market

Until 1991, the electricity sector was a public legal monopoly, with a vertically integrated structure, meaning all electricity activities were reserved to Ente Nazionale Energia Elettrica (Enel) through a sole concession. In that year, generation was opened to cogeneration and generators using renewable energy, which had to sell their output to Enel at regulated premium prices. In addition, auto generators were allowed to sell electricity directly to Enel. Enel's considerable influence in approving entrants served as a limit to this market structure. In fact, until Legislative Decree n. 79 of March 16, 1999, implementing EC Directive 96/92, was enacted, only a marginal number of generators (in terms of power capacity) were allowed to enter the market and sell electricity. The Legislative Decree 79/99, the so-called "Bersani decree", represented a milestone of reform in the Italian electricity sector. It provided specific requirements to Enel for the restructuration of the electricity sectors. The main requirements were: a) Enel had to start privatization and to unbundle its generation, distribution and sales activities; b) transmission activity in the electricity sectors must be given up to an independent body with non-discriminatory rules; c) to reduce Enel's market power upstream, no firm is allowed to have more than 50% of total installed power or to sell more than 50% of total energy, including imports. To this end, Enel formed three companies which were sold in public auctions. The transmissions activities, as dictated by EU directive, was transferred to a new, Terna, which was a part of Enel group. Later in 2003, Terna was separated from Enel and it became an independent company owned by the Italian government and private investors.

In 2014 the European Commission noted in its Italy country report[14] that despite the numerous active suppliers (about 140), the generation sector remained concentrated, as 85.4% of the total supply was provided by Enel. The free market was less concentrated with a combined share of the three main operators (Enel, Edison and Eni) at 34.3%, of which the leading operator (Enel group) accounted for 20.3%. The competition on the overall retail market was at medium level (HHI just above 1800) with only two companies having a market share greater than 5%. It also reported that despite Italy's degree of interconnection compared to other European countries, electricity prices have been higher than in the rest of Europe. Apart from the retail market, the transmission network was almost entirely owned and operated by a state-owned company, Terna and despite many small operators, Enel operated 86% of the electricity distribution network.

The Table 1 shows the ranking of the top Italian twenty groups for total sales to the final market in 2018. The dominant operator of the retail electricity market remains the Enel Group, with a share of 37.8% and always well ahead of the second group. With an overall market share of 4.9%, the Edison Group, owned by the French multinational EDF, returned to second place. In 2017, it was in third place, surpassing the Eni Group, whose market share stopped at 4.3%. With a sales volume of 11,055 GWh, the latter even fell to fourth place in 2018, overtaken by the Hera Group, a multi-utility company controlled by a number of Italian municipalities, whose sales volume was about 20 GWh higher.

[14] See https://ec.europa.eu/energy/sites/ener/files/documents/2014_countryreports_italy.pdf

GWh

GROUP	CUSTOMERS DOMESTIC	NON-DOMESTIC CUSTOMERS LV	MV	HV/VHV	TOTAL	POSITION IN 2017
Enel	40,078	28,959	21,509	5,889	96,435	1st
Edison	1,153	2,513	5,552	3,222	12,440	3rd
Hera	1,402	3,289	6,139	243	11,073	4th
Eni	3,445	1,302	5,139	1,169	11,055	2nd
Axpo Group	50	1,617	4,429	3,340	9,437	7th
A2A	1,615	2,407	4,296	701	9,019	6th
Green Network	229	1,226	3,539	2,453	7,447	12th
Iren	1,290	2,222	3,094	356	6,962	8th
Duferco	60	586	2,246	3,669	6,560	11th
E.On	345	1,513	3,001	694	5,553	9th
CVA	121	1,602	3,029	197	4,948	13th
Acea	1,874	1,450	1,394	224	4,942	10th
Metaenergia	5	620	3,231	230	4,087	5th
Repower Ag	0	1,956	1,890	63	3,908	18th
Alperia	327	1,020	2,383	74	3,804	19th
Egea	58	697	2,756	247	3,759	20th
Dolomiti Energia	614	1,337	1,562	46	3,558	15th
Eviva	77	1,716	1,664	54	3,511	14th
Sorgenia	228	1,378	1,616	46	3,268	17th
Telecom Italia	0	953	1,106	0	2,059	22nd
Other operators	4,205	15,011	18,515	3,565	41,296	-
TOTAL	57,179	73,374	98,090	26,481	255,123	-

Table 4.1 Top twenty groups by sales in the end users market in 2018 - ARERA 2019

The Enel Group keeps its position in the total market primarily due to its substantial dominance in the mass market, made up by the household sector and the non-household customers connected at low voltage: more than half of this market - 52.9%, to be precise - is in fact served by Enel, while Eni and Hera, which are substantially equal in second place, each have a share of 3.6%. Furthermore, in 2018, Enel also maintained its dominant position in the segments of non-domestic customers with medium and high/very high voltage, which it had lost in 2013 and regained in 2016. In 2018, 70.1% of the energy consumed by households was sold by the Enel group (72% in 2017); with a 6% share, the second group is Eni, while Acea, controlled by the municipality of Rome, maintained its third position with 3.3%. Overall, the top five operators (A2A and Hera together with those already mentioned) hold 84.7% of the domestic sector (86.3% in 2017). Considering sales to non-domestic customers supplied at low voltage, the Enel group's share, at 39.5% (down from 40.8% in the previous year), remains well behind the 4.5% of the second group, which was Hera (in second place in 2017 as well). This is followed by Edison with 3.4%, which in 2017 was in sixth place, A2A with 3.3% (in third place in 2017) and Iren, whose major shareholders are the Municipalities of Genoa and Turin, with 3% (in fourth place in 2017). In 2018, the Edison Group, which traditionally followed the incumbent, climbed to fifth position (it was seventh in 2017) in the mass market, which, as mentioned, is the segment consisting of households and nondomestic customers powered by low voltage; in sales to non-domestic customers connected to high and very high voltage Edison remained the fourth group (as last year) with a share of 12.2%, and for medium voltage customers it fell to third place with a share of 5.7%. In the medium voltage segment, the Hera group gained ground, rising to second place with 6.3%, from fifth place in 2017. With 5.2%, the Eni Group is in fourth position (it was third in 2017) and the swiss company Axpo Group has risen to fifth position, with its share rising from 3.6% in 2017 to 4.5%. In sales to high-voltage and very-high voltage customers, after Enel the second group is the Duferco group, a company headquartered in Luxembourg, with a share of 13.9%, followed shortly after by Axpo (12.6%) and Edison (12.2%). In 2018, the level of concentration in the retail market, as measured by the quantities of energy sold by the corporate groups, increased compared with 2017, while that measured by the number of customers decreased. Table 1 provides details of the concentration measurements, which can also be broken down by voltage level. In the first part of the table, measurements are calculated from the volumes sold by corporate groups in the retail market, while in the second part of the table, measurements are calculated on the basis of the customers (delivery points) served by the corporate groups themselves. The concentration level of the retail market, measured on the basis of quantities of energy amounts sold by corporate groups, has grown compared to 2017, while that estimated on the basis of the number of customers has decreased. Using the measurements calculated on the kWh sold, C3, the share of the first three operators (corporate groups), rose to 47% of total sales, compared to 45.9% in 2017. The HHI also rose slightly to 1,571 from 1,521 in 2017. A HHI value between 1,500 and 2,500 indicates a moderately concentrated market, while a value above 2,500 indicates a highly concentrated market (the maximum value of the index is 10,000). The number of corporate groups needed to exceed 75% of total sales, on the other hand, remained at 16, as in 2017. In 2018, the Enel group was the only one with a market share of more than 5%, as in 2017. The Edison Group, with a market share of 4.9%, and Hera with 4.3% follow suit. The top ten operators (corporate groups) account for 65.5% of total sales (compared with 63.8% in 2017).

Using the measurements calculated at the delivery points, the concentration values are higher than what is indicated by the volumes of energy sold, with the exception of those for non-domestic customers served at high and very-high voltage. However, in comparison with the data for 2017, the data confirm that in the segment of households and that of non-domestic customers connected to low voltage the concentration is decreasing, while in the segments relating to medium and high voltage customers the concentration is increasing.

4.1.3 The technological landscape

Hydroelectric production has traditionally been the most important RES in Italy in terms of installed capacity. However, its contribution has remained mostly unchanged since the 1950s , when large dams were constructed in the Alpine areas (Magnani and Osti, 2016). After the

Chernobyl nuclear disaster of 1986, the antinuclear movements gained momentum and, thanks to a national referendum that took place in the next year, the Italian population opposed the development of nuclear power plants in the national territory. Therefore, the government ordered the complete shutdown of any working nuclear plant, stopped the construction of new ones and restrained Italian companies from investing in any foreign project related to nuclear energy.

After the end of the Italian experience with nuclear energy, a National Energy Plan (Piano Energetico Nazionale - PEN) was proposed in 1988 and introduced in 1991. In the PEN, the government urged the necessity to substitute the production of electricity from nuclear power with the production from natural gas.

As a consequence of the gas emergency of 2006 and the 2007 financial crisis that hit particularly hard the Italian economy, the Government Berlusconi, through the Legislative Decree 112/2008, decided to revive the nuclear experience in the Italian territory in order to increase employment and decrease the price of electricity. Nonetheless, this experience did not have a long life since, after the Fukushima Daiichi nuclear accident of 2011, through a national referendum the Italian population decided once again to abandon nuclear power. In addition, the year 2011 marks the establishment by the European Commission of the project Roadmap 2050, which sets the goal for the EU to reduce greenhouse gas emissions by 80% by 2050 compared to the 1990 levels (European Commission, 2011). It was in 2013 that a proper new National Energy Strategy (NES) 2013 was proposed by the Government Monti, which incentivized the exploitation of fossil fuels present in the national territory in order to decrease the dependence of the electricity system on foreign fossil fuels[15].

Eventually, the increasing awareness among the population concerning climate change and the participation of Italy to treaties and agreements that fostered the transition to low-carbon economies (Paris Agreement 2015) pressured the Italian government to review and rework on the National Energy Strategy. Indeed, Government Gentiloni in 2017 proposed a new version of the National Energy Strategy (NES 2017), which favoured natural gas and renewable energy sources for electricity production and set a path to the decarbonisation of the Italian economy.

The strategy set the following goals for the Italian energy system in 2030: strengthen the energy supply security and reduce the electricity and gas price gap with European average; phase-out of coal by 2025; 28% of total energy consumption derived from renewable sources of energy; and 55% of total electricity consumption derived from RES[16].

Beginning in 2009, the significant rise in installed capacity of renewable energy was driven by the rapid growth of photovoltaic production. This was the result of the introduction in 2005 of a very generous feed-in tariff scheme, together with a net-metering sys-tem, for solar electricity (called "Conto energia"). Because of this policy development, Italy's installed photovoltaic capacity rose rapidly from 87 MW in 2007 to 18,450 in 2014, making the country the second largest photovoltaic

[15] https://www.mise.gov.it/images/stories/documenti/SEN_EN_marzo2013.pdf.
[16] https://www.mise.gov.it/images/stories/documenti/Testo-integrale-SEN-2017.pdf.

market in Europe after Germany. Less important increases have concerned other RES, which have also benefited from national subsidies of different kinds. This is particularly the case of biogas-power plants and wind farms. For the former, a generous all-inclusive tariff was introduced in 2007. The latter enjoyed both a special sale price and a system of green certificates. Indeed, as highlighted by Brondi et al. (2014), Italy is one of the countries with the strongest policy support for green energy production. As stressed by these authors, this has mainly been the result of a strategic political choice, rather than of environmental concerns, given that Italy is the biggest importer of energy in the EU. The combination of the generous incentive system for renewable energy and the liberalization of the electricity market in the late 1990s produced new land-use tensions that exhibited a spatially differentiated pattern. In particular, land-use conflicts mainly concerned large biogas facilities in northern agriculture-oriented lowland areas, and large wind and on-land solar PV plants in south-ern regions. From 2011 onwards, energy-related conflicts have become the most frequent kind of local environmental controversy in Italy (Osti, 2012)

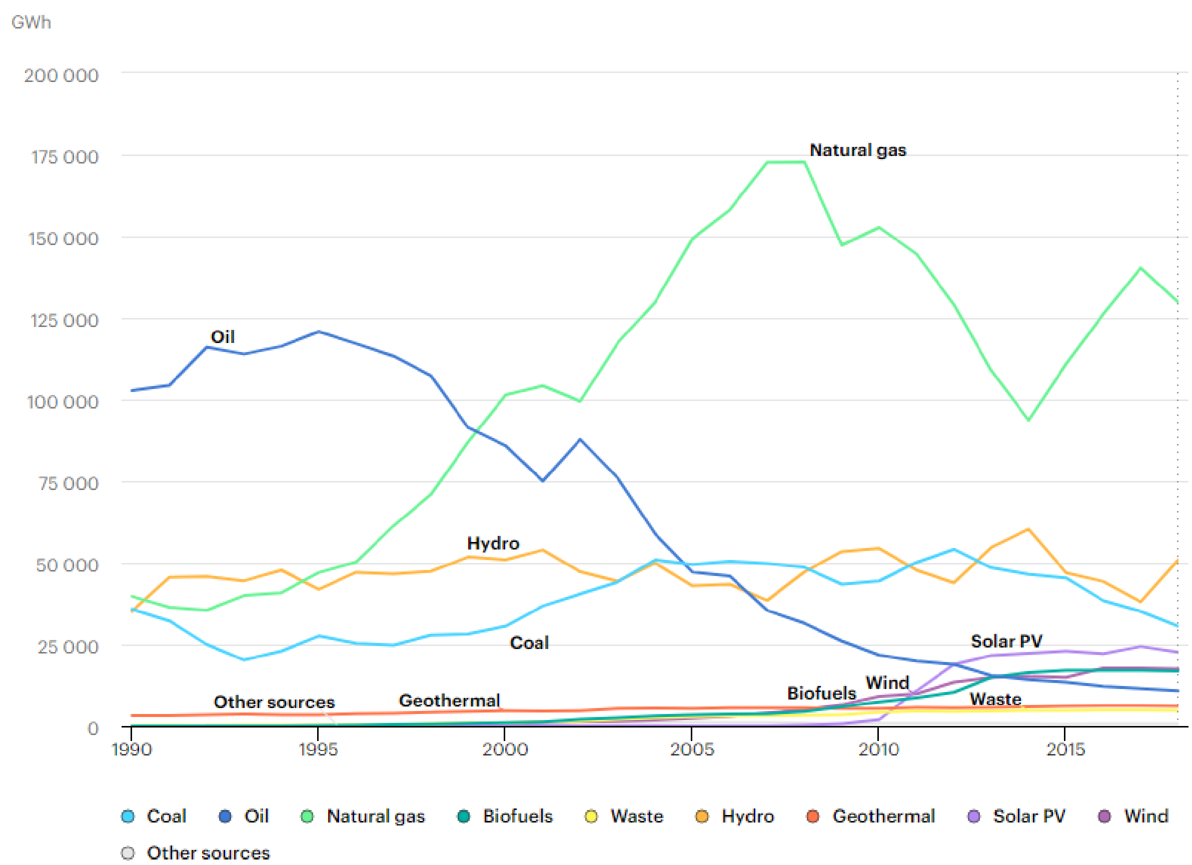

Figure 4.3 Electricity generation by source, Italy 1990-2018 – IEA

The share of renewable energy production capacity, excluding hydropower, rose dramatically between 2008 and 2012 (see Figure 1). The growth can be attributed primarily due to an upsurge of investments in solar and wind capacity. Wind and biomass capacities doubled over this period and that of solar PV has grown many-fold. In 2011 alone, solar PV capacity more than tripled, from under 4 GW to over 12 GW due to the generous *Conto energia* schemes and falling unit costs. However, on July 6, 2013 some of the incentives to solar farms on agricultural land were revoked leading to a slowdown in solar PV investments.

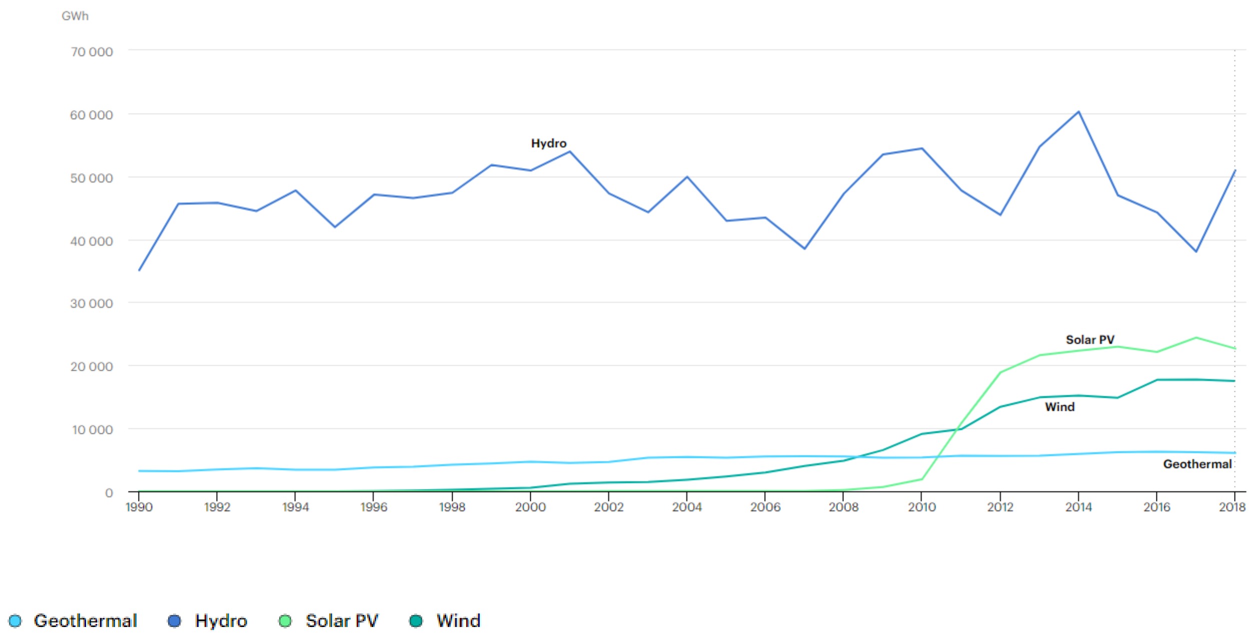

Figure 4.4. Trends in Italian electricity generation and installed capacity by technology, 1990-2018 – IEA

In 2018, 40% of gross electricity generation was produced from renewable sources, while 60% was achieved with thermoelectric plants; among these, natural gas provided 45% of overall gross generation (Figure 3), a slight drop compared to 47% in the previous year.

4.2 Governance

4.2.1 National regulatory framework

The Italian regulatory framework provides for the involvement of various public authorities in comply with the principles of subsidiarity and adequacy.

The Ministry of Economic Development (MISE) is competent to adopt the Italian National Energy Strategy (SEN), which is a ten–year plan that the Italian government drew up to anticipate and manage the change of the national energy system. The SEN 2017 is the first national document explicitly mentioning energy communities.

Subsequently, fundamental functions were assigned to the Italian Regulatory Authority for Energy, Networks and Environment (ARERA) and MISE, which are responsible for adopting the detailed discipline mandated by the legislator with reference to the application of art. 42-bis of Legislative

Decree December 30, 2019, n. 162 converted with Law February 28, 2020, n. 8. This provision allows small-scale collective self-consumption of renewable energy plants below 200 kW for customers linked to the same low voltage distribution sub-grid.

It is an experimental and transitory regulation in view of the complete transposition of Articles 21 and 22 of the Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources. To date, this directive and the other directive that takes into consideration energy communities – that is Directive (EU) 2019/944 of the European Parliament and of the Council of 5 June 2019 on common rules for the internal market for electricity – have not yet been implemented by the Italian legislator.

In particular, the aforementioned Article 42-bis defines the methods and conditions for activating collective self-consumption from renewable sources and for the creation of renewable energy communities.

The current definition by Italian regulatory context is the same as Renewable Energy Community introduced by Directive EU 2018/2001. There is not a regulatory definition of Citizen Energy Community within the Italian legal system, but only Directive EU EU 2019/944 provides for it.

In this context, MISE must define specific incentive tools, which will be granted by GSE, a public company entirely controlled by the Ministry of economy and finance (MEF), while ARERA, which is the independent administration in the energy sector, is required to regulate the economic accounts relating to electricity.

In addition, some regions adopted a specific discipline on the subject. For instance, Piedmont adopted the L.R. August 3, 2018, n. 12 in order to promote the establishment of energy communities. From the point of view of the administrative bodies involved, some functions are assigned to the Regional Council and others to a permanent technical table for the coordination between the Region and the Energy Communities.

The subsidiarity principle plays a fundamental role in the exercise of administrative functions. This principle is established by art. 118 of the Constitution and is applied in relation to public authorities, especially territorial (so-called vertical subsidiarity) but also in relation to the involvement of private entities in the exercise of administrative functions (so-called horizontal subsidiarity).

Citizens are a fundamental player in the energy communities' activities even if some initiatives are organized by public authorities or by economic operators in the sector.

With specific reference to the authorization of energy activities, the competences are shared between the State and the other public authorities depending on the size of the installation that is intended to be built. The local authorities are also the owners of the administrative functions in the building and landscape field on the location of the plants in comply with the general regulations.

4.2.2 Support mechanisms

There have been five waves of feed-in tariff (FIT) schemes called "Conto Energia", which fix incentives for photovoltaic plants over 20 years. Initial FIT schemes were providing higher levels of support, as tariffs offered to photovoltaic installation have been progressively reduced over time to account for cost reduction of photovoltaic system prices on the market. The last version, *Conto Energia V*, which entered into force in August 2012 guaranteed FiT and premium support for a period of 20 years. This legislation introduced cuts in the incentive 43% and 39% for ground-mounted and rooftop PV installations respectively, relative to pre-2012 levels. An annual expenditure cap of €6.7 billion was also introduced as a part of the revised measures. The Conto Energia program ended in June 2013, but a residual quota of plants admitted to the fifth FIT scheme was installed from July 2013 to 2016. As a result of the Conto Energia program, domestic PV cumulative capacity increased from 25 MW (0.025 GW) at the end of 2005 to about 16.4 GW at the end of 2012 (an increase by a factor of 650). With Conto Energia, annual installations grew from 6.5 MW (0.0065 GW) in 2006 to 3.64 GW in 2012, with a compound annual growth rate (CAGR) of 120%. Over the same 2005-12 time frame, global PV cumulative capacity grew by a factor of 23 (from 4.2 GW to about 99 GW), whereas global annual installations grew by a CAGR of 53% (from 1.4 GW in 2005 to about 29 GW in 2012). This pace of growth in domestic installations made the Italian PV market one of the main drivers of global PV demand. In 2011, Italy had the highest annual installations in the world (9.4 GW), while the Italian market accounted for about 17% of cumulative global PV demand between 2006 and 2012. This sustained market deployment was accompanied by a significant reduction in PV system prices, particularly from 2008 onwards (Politecnico di Milano, 2014)

Unsurprisingly, Italian energy communities have been mostly developed since 2008 and up to 2013, when FIT were implemented to support deployment and cost reduction of photovoltaic systems. The strong policy support, combined with remarkable reductions in photovoltaic modules and installation costs since 2010, has made photovoltaic investments quite profitable and relatively low risk in the wider context of the Italian energy sector. These favourable conditions have been a major driver for the development of Italian energy community sector, opening a window of opportunity for the development of PV systems by proponents generally not equipped to deal with large, complex, and high-risk project development in the energy sector. With the reduction of FiT support in 2013 the Italian PV market has shrunk (moving from 3.5 GW/year of installed PV between 2008 and 2013 to 385 MW/year in the period between 2013 and 2018, as shown in Figure 1) and the Italian CE sector with it. (Candelise and Ruggieri, 2020).

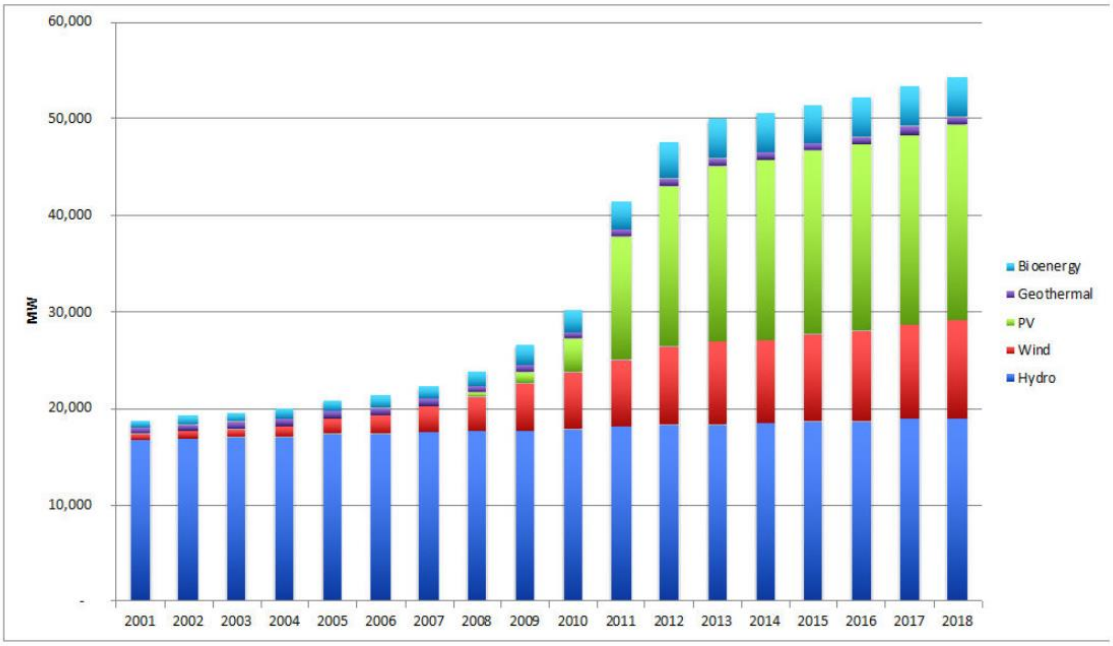

Fig. 4.5 Renewable cumulative installed capacity in Italy (MW), 2001–2018 - Gestore dei Servizi Energetici

Moreover, up to 2013, the Italian community energy sector has been mainly characterized by the development of rather small, 'ad hoc' initiatives with a strong local focus. While PV systems installed vary in size and application, the majority are small/medium size projects, more easily developed and financed by actors with lower experience in the energy sector. The focus on smaller, roof mounted PV plants has also been reported by some representatives interviewed as a consequence of a deliberate choice of community or municipality led projects to focus activities on investments perceived more sustainable and with lower impact on the local environment than large ground mounted plants (Candelise and Ruggieri, 2020). The largest projects (ground mounted PV systems in the megawatt range and a wind farm) have been developed by the initiatives led by commercial actors, either company or municipal utility. They developed larger projects thanks to their higher internal technical knowledge and expertise which made the founding and development process easier; they were also more connected with economic networks which allow them to get access to capital more easily, making them able to develop more complex projects and bear higher risks (e.g., the risk of not raising enough capital among citizens to finance the investment). Only a few CE initiatives have been developing renewable energy plants after the cancellation of the FiT in 2013, the larger ones and with a national scope in their activities or promoted by commercial actors. Moreover, those still operating after 2013 have rarely developed new renewable energy plants and mostly focused their activity on acquiring operating PV plants on the secondary market, which are still benefiting from the FiT support (Candelise and Ruggieri, 2020).

The Regional Law Piedmont n. 12/2018 provides for public funding aimed at promoting the establishment of the energy communities, which are granted by the Region following an evaluation of the proposal. Tax incentives linked to the nature of an innovative start-up company are also envisaged: if the energy community takes this form, then the investment entitles you to the 30% tax credit by keeping the participation for at least three years. There are also tax deductions the construction of plants instrumental to energy communities.

4.2.3 Planning Policies

The aforementioned art. 42-bis provides for a support mechanism for energy communities that is being defined by the MISE through the adoption of a specific act. This mechanism is special compared to those envisaged in general for renewable energy. These incentives must not be an additional cost for the State because they will not be added but will replace an existing facilitation, the so-called "scambio sul posto". The idea is to define an incentive rate for the remuneration of the plants, provided by the GSE as an alternative to the "scambio sul posto" mechanism.

The new mechanism will be implemented taking into account the overall balance of charges in the bill. It is provided the prohibition of cumulation of this facilitation with the incentives provided by the Ministerial Decree of 4th July 2019. On the other hand, the tax deductions in force on renewable energy plants remain cumulative. There are not quantitative targets to obtain in order to a minimum percentage of energy to produce by energy communities within the next few years.

4.3 **Bottom-up initiatives**

4.3.1 Legal framework

ARERA defines "renewable energy community" as a legal entity that is based on open and voluntary participation, is autonomous and is actually controlled by shareholders or members who are located in the vicinity of production plants owned by the renewable energy community. According to ARERA's definition, shareholders or members are natural persons, small and medium-sized enterprises, local authorities or local authorities, including administrations, municipal. With reference to private companies, the participation in the renewable energy community does not constitute commercial activity and / or main industrial. Moreover, its main objective is to provide environmental, economic or benefits community level to its shareholders or members or to local areas in which it operates, rather than financial profits.

The historical initiatives are cooperatives and are based on direct and local participation. Regarding the new wave of energy communities in Italy, part of them are cooperatives based on the principle "one head, one vote". Others are partnerships limited by shares through the start-up model (Cusa, 2020). Some energy communities have a top-down approach, meaning that the municipality or another private company promotes the initiative and involves the participation (and the financing) of citizens. Others have a bottom-up approach, and citizen themselves organize and finance the energy communities (Candelise and Ruggieri, 2020).

With specific reference to the administrative burdens that must be carried out for the purposes of operating the energy communities, there is no specific regime. In fact, energy communities do not need to obtain a specific authorization but they have to follow the administrative paths fixed for the exercise of energy activities.

Article 42-bis of the decree-law 162/19 provides that ARERA identifies ways to encourage the direct participation of Municipalities and Public Administrations in renewable energy communities. If there are no other interested parties, in fact, Municipalities and Public Administrations can create energy communities consisting also of their own users and production plants, provided that the requirements set out in the aforementioned Article 42-bis are respected (with particular reference to the geographical requirement)..

In addition, municipalities and public administrations can take advantage of an assistance service such as that which the GSE already operates with regard to access to the incentive tools referred to in the interministerial decree of 16 February 2016 (so-called Conto Termico).

Finally, with regard to consumer protection, ARERA provides that consumers can withdraw from the energy communities at any time, without providing for specific information obligations, which are therefore left to private autonomy.

4.3.2 Attitudes toward the cooperative model

Civil society involvement in renewable energy production and management is not new in Italy. However, it has been mostly limited to a specific geographical area of the country. Indeed, 'historical hydroelectric cooperatives' emerged as early as the first half of the twentieth century in the northern Alpine area of the country. Their purpose was to foster the economic and social well-being of mountain populations through the production and distribution of electricity from medium hydroelectric plants. Since the nationalization of the electricity grid, these cooperatives have enjoyed a special legal status which allows them to maintain ownership of the local grid. About thirty of these hydroelectric cooperatives are still to be found in the Trentino and South Tyrol autonomous regions. Since the beginning of the twentieth century they have grown into large economic organizations selling the energy that they produce to thousands of customers connected to their grid. This area of the country, and especially the German speaking autonomous province of South-Tyrol, has also traditionally been characterized by community projects focused on wood biomasses for heat production, leading in some cases to the creation of district heating systems. The large number of community projects in this area can be explained by a deep-rooted tradition of cooperativism and by the connected presence of historically 'institutionalized networks' (Magnani and Osti, 2016). However, the diffusion of renewable energy and the forms that it has taken in this geographically circumscribed and ethnically distinctive territory represent something of an exception in Italy. They are very specific and currently not replicable cases, functioning as a group of special legal status that in particular allow them to own and manage the local distribution network.

In the rest of the country, community projects linking renewable energy consumption and production have emerged only since the late 2000s, mainly as a response to the national incentive policy. They are mostly initiatives focused on development of renewable energy production facilities and, most of all, differentiate themselves from Italian historical cooperatives as they do not benefit from their special legal status and cannot own local distribution networks. The number of them in Italy, as in Southern European countries in general, is still small compared with Northern and Central European countries, where hundreds of renewable energy cooperatives can be counted (Huybrecht and Mertens, 2016). The large majority of them are based on shareholding in solar PV installations for the production and consumption of electricity. Compared with the situation in other European countries, the number of members of Italian solar cooperatives is usually small, rarely reaching one hundred. The creation of a cooperative is a means to reduce the costs of technology, but also to maximize the economic output deriving from sale of the electricity to the grid. The ultimate goal of these cooperatives is to reduce the cost of electricity for individual families but also to invest at least part of the profit in local development projects. Moreover, there is often also a concern to promote energy-saving behaviour.

Regarding the recent wave of CEs in Italy, part of them are cooperatives based on the principle "one head, one vote". Others are partnerships limited by shares through the start-up model (Cusa, 2020). Some energy communities have a top-down approach, meaning that the municipality or another private company promote the initiative and involve the participation (and the financing) of citizens. Others have a bottom-up approach, and citizen themselves organize and finance the energy communities (Candelise and Ruggieri, 2020).

4.3.3 Local activism

At the origins of the recent wake of energy community projects in Italy are new types of entrepreneur. In some cases, they have links with the environmental movement of the1970s or with the social economy. In other cases, they are new figures who have acquired technical knowledge and environmental sensitivity by working in the emerging green economy sector (Magnani and Osti, 2016; Candelise and Ruggieri, 2020). An example of the former case is the SoLe cooperative, which has developed in a small mountain valley located in the province of Trento (North-East Italy). The initiator was an ecopreneur who had previously been a militant in the environmental movement and who had worked for several years as environmental councilor of a nearby urban municipality. He also worked as director of a cooperative enterprise installing small renewable energy facilities for the private market. From the encounter between this entrepreneur and some locals interested in renewable energy technology there emerged the idea of creating a cooperative working on solar PV installations and making solar technology the basis for new relationships of local mutuality and new development opportunities. Eventually, as part of the project, it was also decided to build one or more community PV plants. The collective solar project would per-form two functions: solve the problems of people who wanted to become members of the cooperative but could not install a solar PV panel on the roofs of their houses for architectural reasons (practical function); strengthen social ties around the project of building an environmentally sustainable community (symbolic function). Initially, a collective plant was constructed on the local fire station, and then another one on the roof of a private sawmill. The total installed kW amounted to about 98 kW. The local cooperative bank was involved. The local citizens who wanted to participate as shareholders were not asked to invest a sum of money; rather, they were asked to sign a bank surety. In order to maximize participation by local residents, 3 kW was set as the maximum share for both of the plants, since it was estimated that this amount would cover the average need of a family (Candelise - Ruggieri, 2020)..

However, we have to stress also that, with the liberalization of the energy system, new land-use tensions arose between agricultural biogas facilities, wind parks, and solar photovoltaic plants. As civil society becomes more mobilized in the energy transition, land-use is becoming the most frequent type of environmental controversy within Italy (Magnani and Osti, 2016).

5 The Netherlands

5.1 Market overview

5.1.1 Energy Consumption trends

Natural gas and electricity are main sources of energy in the Netherlands. Natural gas has been a dominant source of energy for the residential sector. Yet, gas extraction has more than halved over the last years. Government decided to reduce extraction in the main gas producing area in the Groningen province and to stop it entirely in 2022, because of the earthquake resulting from the gas exploitation. Because consumption remained the same, export was scaled back and natural gas imports saw a sharp rise. In 2018, gas import exceeded export (see figure 5.1).

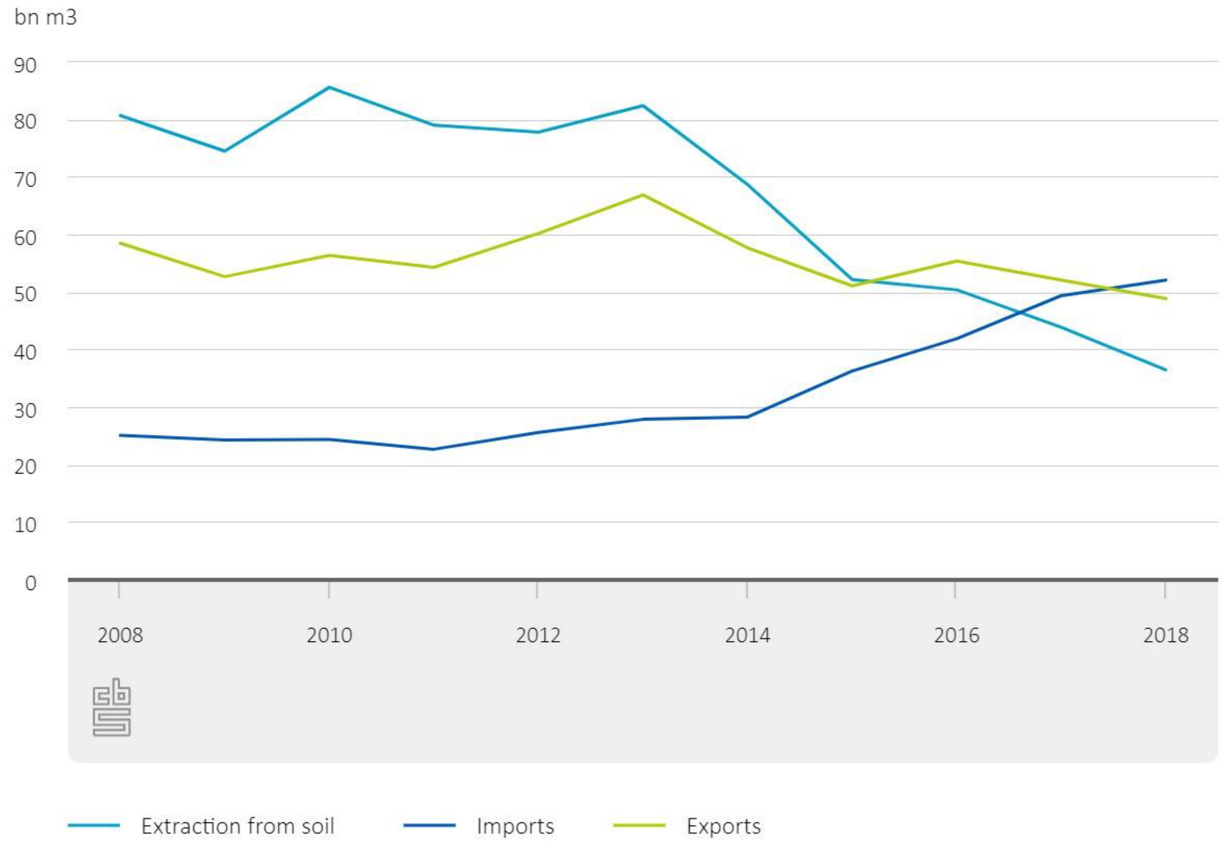

Figure 5.1. Development of extraction, import and export of natural gas between 2008 and 2018 (CBS, 2019).

During the last years electricity consumption and export remained more or less the same, while import rose (see figure 5.2). The volume of locally generated electricity increased, for instance by hydropower, solar and wind installations.

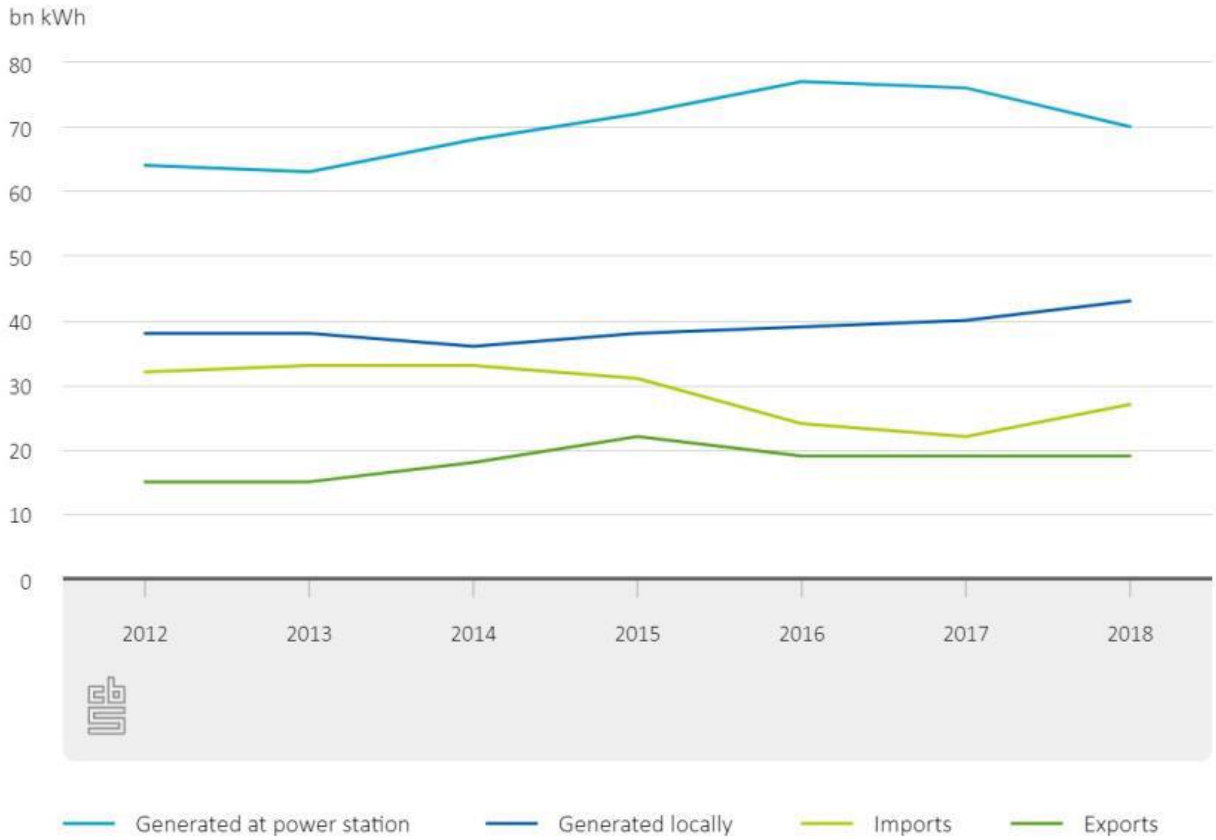

Figure 5.2 Development of production, import and export of electricity 2012-2018 (CBS, 2019).

Total energy consumption in the Netherlands rose from 2856 PJ in 1990 to 3100 PJ in 2018. Most energy was consumed by industry (42%), followed by households (13-17%) traffic and transport 13-15%) and energy (12-14%) (see Figure 5.3).

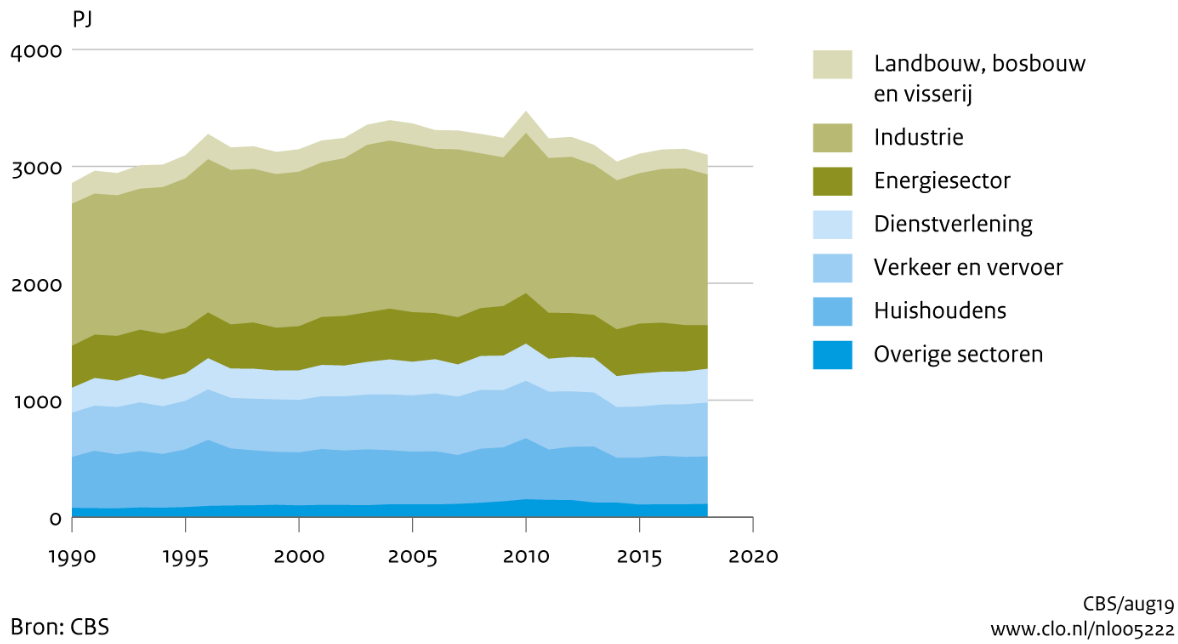

Figure 5.3 Energy consumption per sector in the Netherlands 1990-2018 (CLO, 2019).

Legend: Landbouw, bosbouw en visserij = agriculture, forestry and fishery; industrie = industry; energiesector = energy sector; dienstverlening = services; verkeer en vervoer = traffic and transport; huishoudens = households; overige sectoren= other sectors.

5.1.2 Market structure: generation, distribution and retail market

To comply with European policy and legislation, the Netherlands started to liberalize and restructure its electricity sector in the 1990s, when the Electricity Act 1998 was enacted. In terms of liberalization, this turned out to be successful: the Dutch electricity system is considered as one of most liberalized ones (Tanrisever, Derinkuyu, & Heeren, 2013). The new policy resulted in a radical unbundling of the system: no utility can be responsible for the whole supply chain any more, but various independent parties have responsibility for parts of the chain. The Dutch government decided to split commercial activities regarding electricity and natural gas from network operations. Generation companies have no shares in network operators, while network operators do not hold shares of generation companies or suppliers. During this unbundling process, competition was introduced. First for large consumers such as companies, in 1998, and in 2004 for the whole demand side of the energy market (Tanrisever, Derinkuyu, & Jongen, 2015)

The deregulation and unbundling, which started in 1998, resulted in a new supply chain of electricity (and gas), consisting of six links, for generating, trading, transmission, distribution, metering and supplying. (see figure 5.4).

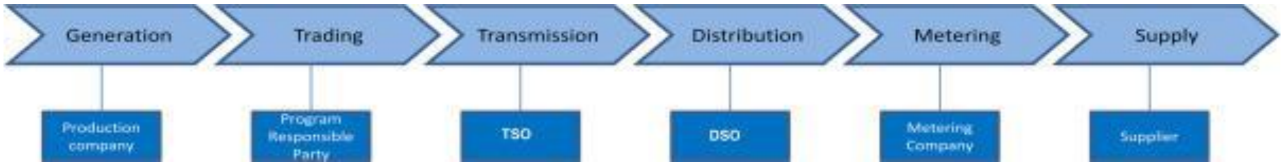

Figure 5.4 Electricity supply chain in the Netherlands (Tanrisever et al., 2013).

Compared to 1990s the landscape of electricity companies has changed drastically. At that time, municipalities or provinces owned all electricity companies (about 50) and they integrated production, distribution and delivery of energy, often both electricity and gas. They were also responsible for information supply, and sometimes other activities such as services and import of coal, as well as non-energy related tasks, such as cable connections for radio and tv. A dynamic process of merging, differentiation and reorganization resulted in a few large energy-generating companies, about 50 suppliers, 9 transmission and distribution companies and many other institutions.

In addition to the Electricity Act 1998 and Gas Act (2000), the so-called Wet Onafhankelijk Netbeheer (WON), informally called 'Splitting Act', came into force in 2006. Originally, the integrated energy companies had to split before January 1, 2011. Companies Delta, Essent and Eneco feared that without a distribution part of their company a large foreign company would swallow them. However, after strong resistance of the companies Delta and Eneco, including several lawsuits, the split of companies was delayed to 2017 (Rechtennieuws.nl, 2016).

In 2019, the most important electricity generating companies in the Netherlands were Delta, EON, Eneco, Engie, Essent and Nuon (Netbeheer Nederland, 2019). Most of them originated from government owned companies. Nineteen municipalities and three provinces, for instance, are the controlling shareholders of Delta that produces and delivers natural gas, electricity and digital services. In 2008, grid activities became the responsibility of a special company, which changed its name after some time to Endures. In 2019, Swedish Vattenfall became the owner of the energy part of Delta (Delta Energie, 2020).

- Eneco resulted from several municipal energy companies and was in 2020 still owned by 44 Dutch municipalities. Despite strong resistance against the division of the company, in 2017 the split became a fact. Then this new network organization, called Stedin, was founded. In 2020, a Japanese syndicate which comprised Mitsubishi Corporation (80%) and Chubu Electric Power Co. (20%) became the owner of ENECO (Eneco, 2020).
- Essent resulted from a merge of several provincial energy companies. Because of the ‘Splitting Act’ Essent Network was founded as an independent company in 2009, later called Enexis (Essent, 2020). It became part of German companies RWE (2016) and EON (2020).
- Nuon has the same type of historical background. Some provincial and regional energy companies merged in 1994 to Nuon. In 2008 a special company was founded for

distribution, called Liander (Liander, 2020). In 2009 Vattenfal became owner of Nuon. The name Nuon will disappear from the Dutch market.

- Engie Energie Nederland is part of Engie, a French company. In 2001 Electrabel, part of Engie, took over de Dutch electricity producer EPON, at that time the biggest electricity company of the Netherlands, which was owned by some provinces and municipalities (NRC, 1999).
- EON is a German energy company. EON took over the electricity company of the province of Zuid-Holland in 2000.

In addition to these large players, after the liberalization, new, mostly small producers developed, such as farmers, citizens, cooperatives and small companies.

The supplying company ultimately supplies the electricity to the consumer, and is responsible for purchasing this electricity. It is also responsible for customer services. The supplier always buys the electricity from a program responsible party (PRP). Often suppliers (Essent, Vattenfall, Eneco), energy generators and PRPs are owned by the same group. Here again, however, we see dynamic tendencies. EON, for instance, sold its supplier part to Eneco.

In the Netherlands, both companies and individuals have a choice between different suppliers. In the Netherlands about 50 suppliers exist. The larger are Essent, Eneco, Nuon (Vattenfall), NLE and BudgetEnergie. Others are Greenchoice and UnitedConsumers. Some suppliers exclusively sell green electricity. In addition, several energy cooperatives have an own supplying company.

A supplier decides which PRP to use. The consumer therefore has no choice here. The supplier makes money because it sells the electricity more expensively than he buys. In principle, the sellerr does not run a price risk because its purchase price and sales price are fixed.

According to the Heat Act, Gas Act and Electricity Act 1998, Transmission System Operators and Distribution System operators are owned, directly or indirectly, by the Dutch state, provinces, municipalities or other public bodies. Tennet, the state-owned Dutch Electricity TSO, is responsible for all electricity transactions in the Netherlands. The Netherlands Authority for Consumers and Markets (ACM) has certified Tennet to confirm their compliance with the unbundling requirements from EU directives, i.e. Directive 2009/72/EC (electricity).

Tennet manages the 110 kV, 150 kV, 220 kV and 380 kV grids, and its network connects all regional electricity grids and the national grid with the European ones. Through Tennet, the Dutch government can steer the electricity market. The regional electricity distribution is in the hands of regional government-owned distribution system operators (DSOs). DSOs are responsible for the distribution of electricity to the customers. They construct, develop, maintain and manage the distribution networks, between the high voltage grid and the customers. The Dutch government regulates their tariffs. ACM evaluates the performance of DSOs. In the Netherlands, 7 regional DSO's exist: Coteq Enduris Enexis Liander RENDO Stedin Westland Infra. The regional network operators all work in their own region. They have no competition within these regions, because it would be too expensive to run multiple energy grids next to each other.

According to the Electricity Act 998, Program Responsible Parties (PRPs) are needed to plan supply, transport and demand of electricity. They are responsible for what is called program responsibility, i.e. for forecasting and measuring supply and demands passing through the grid, and for the quantity of energy that is transported. They have to submit the information to TSO Tennet. Tennet has the authority to grant program responsibility. PRPs are responsible for permits and costs related to balancing the grid.

Two types of responsibility exist. If a PRP has full responsibility, it is responsible for grid connection and trade. In case of the trade responsibility, it is only about trade. Tennet gave full responsibility to more than 50 parties, and only trade responsibility to about 40 parties (Tennet, 2020). On the list, we find generating companies such as ENGIE, Eneco, Essent, RWE and Vattenfall and also oil company SHELL.

The Netherlands Authority for Consumers and Markets (ACM) has an important regulatory function on the energy market. The board members are appointed by the Ministry of Economic Affairs and Climate Policy, but they are independent in their decision-making. Its energy department ensures that the free Dutch energy market works properly: everyone should have access to the energy grids, the market should be transparent and the consumer should be sufficiently protected against possible abuse of power by energy providers. ACM sets rules for the energy markets with the aim of guaranteeing the affordability, quality and availability of energy products and services. ACM enforces and monitors compliance with the laws for energy, i.e. the Gas Act, the Heat Act and the Electricity Act 1998, as well as EU-regulations. The ACM has the competence to give fines and penalties. In addition, the ACM has the power to resolve conflicts, between DSO's and customers. ACM is also authorized to determine rules for rates, to determine procedures and technical codes and to indicate how information is exchanged between DSOs (ACM, n.d.).

In conclusion, Dutch state adopted EU legislation concerning market liberalization, despite serious resistance of some utilities. As a result, governments are less able to steer electricity markets and energy markets in general, and private companies became more important. Most municipalities and provinces were willing to sell their share, because of the revenues. Instead of a large number of government-owned integrated utilities, a few large players dominate the Dutch energy market, most of them rooted in other countries, Germany, Sweden, France and Japan. TSOs, DSOs and ACM are crucial to control the electricity market.

5.1.3 The technological landscape

Next to natural gas, oil is the most important source of energy, of which most is imported. The third most important source is coal, which is all imported. Renewables and nuclear are no main sources of energy (see Table 5.1).

Source	%
Natural gas	41
Oil	39
Coal	12
Renewables	6
Nuclear	1
Others	1

Table 5.1 Share of different sources of energy in the Netherlands in 2019 (EBN, n.d.).

Renewables are expected to increase their share. Biomass is most important, but also wind energy is becoming more important (see Figure 5.5).

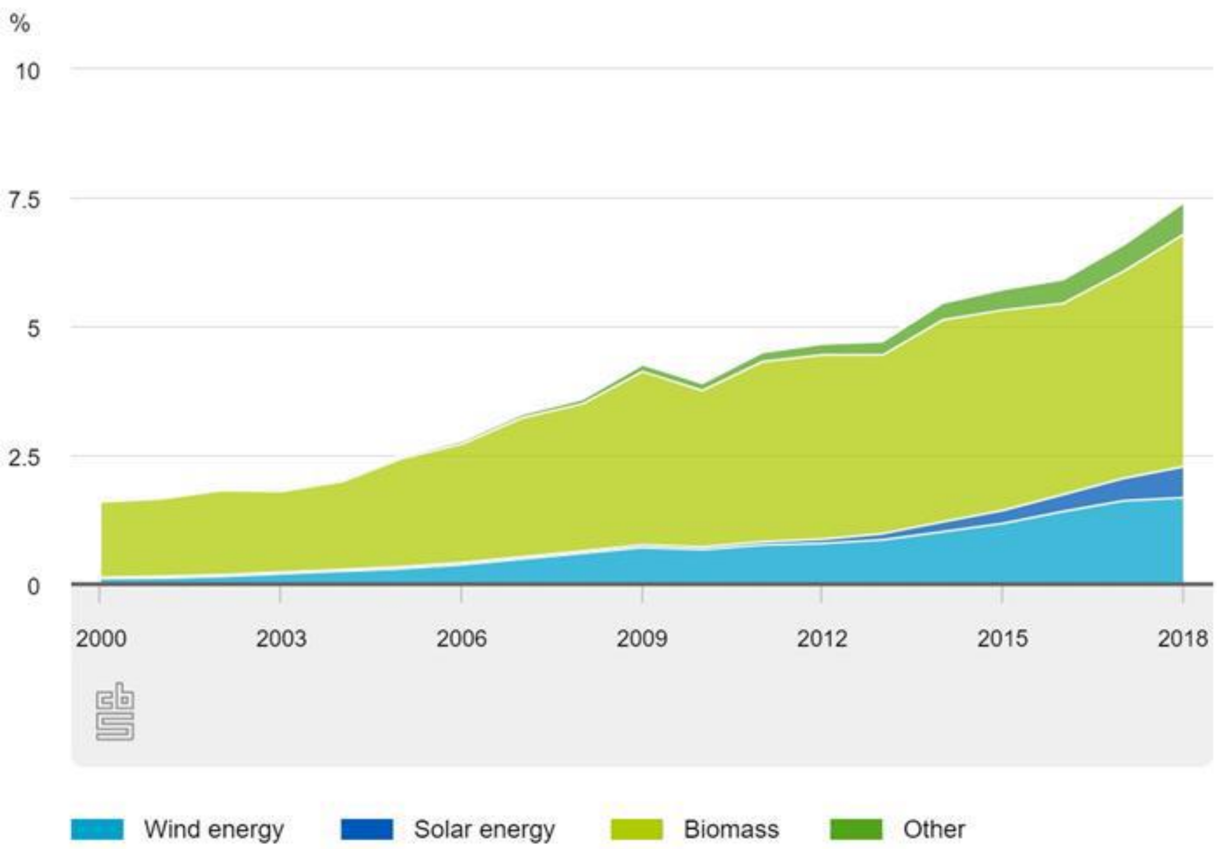

Figure 5.5 Renewables in the Netherlands 2000-2018 (CBS, 2020).

The total Dutch consumption of renewable amounted to 158 petajoules (PJ) in 2018, 13 percent up on the previous year. In conclusion, the role of natural gas in the energy sector is decreasing, but is still important. The Netherlands will become an energy import country instead of an export country because the closing of the gas field in Groningen. Industry is the most energy consuming sector, and total energy consumption slightly increased during the last 30 years. Although rising, the share of renewables is pretty low.

A series of Dutch running private-public innovation programs, a number of technologies could contribute to reduction of emissions or energy transition in general. (RVO, n.d.; Topsector Energie, n.d.):

1. Wind energy: large scale offshore wind parks have been and will be developed on the North Sea;
2. New gas: State owned natural gas company Gasunie and partners try to develop and improve biogas and other types of (green) gas. Gas is supposed to play a key role during the transition process;
3. Urban energy: attempt to develop new integrated systems for urban areas, such as PV, saving of energy, heat-cold systems and smart grids;
4. Industry and energy: attempt to introduce new systems which reduce emissions;
5. Biobased economy: the aim is to use biomass for the chemical industry to replace fossil resources, part of biomass will be used for energy generation;
6. System integration: better integration of flows of energy, balancing and involvement of relevant actors to build new systems are the goals within this theme;
7. Digitalization: ICT is expected to play a crucial role in saving energy, for instance smart grids; at present DSOs are able to monitor energy consumption;
8. Hydrogen: recently investments, research and pilots started to explore the role of hydrogen in the energy transition; it is already applied in some cases;
9. Electric cars: it is investigated how to design a system of charging points;
10. Carbon Capture and Storage (CCS): CCS should play a substantial role to reduce emissions of industry.

Most of these technologies are in a development stage. To stimulate energy transition, the central government started several research and innovation programs, often together with large companies. Innovation programs are not only open for companies, however, to a certain extent, also to energy cooperatives.

5.2 **Governance**

5.2.1 National regulatory framework

Several ministries are important for energy sustainability policy. Since 2017, energy and climate policy is part of Ministry of Economic Affairs, which then changed its name into Ministry of Economic Affairs and Climate Policy. Other relevant ministries are Ministry of the Interior and Kingdom Relations for energy in the build environment and Ministry of Infrastructure and Water Management in order to the mobility.

A new Energy Act is on the planning. This act should integrate the Electricity, Heat and Gas Acts, but in 2019 a Climate Act already came into force. By this Climate Act, the objectives of the climate policy for 2030 and 2050 are anchored in law. In particular, the Netherlands must have reduced greenhouse gas emissions by 95% by 2050 compared to 1990 and 49% greenhouse gas reduction in 2030. Moreover, electricity production will be 100% CO2 neutral by 2050.

In addition to legislation, communication and interaction are seen as important means. Also, provinces and municipalities have responsibilities regarding the energy transition. Provinces are responsible for spatial planning, so they can plan or forbid construction of wind parks or solar parks. They can also stimulate cooperation among municipalities or companies to make certain industrial areas or neighborhoods more sustainable. Just as provinces they can decide on spatial planning issues, such as developing wind parks within their borders. Because they have close contacts with housing associations, they can stimulate them to make their houses more energy efficient. Municipalities are supposed to develop energy plans. Some municipalities set up energy panels with all local stakeholders to discuss plans for energy transition. Other municipalities organize project teams, together with energy cooperatives to develop district heating projects. Both provinces and municipalities can stimulate sustainable mobility by constructing cycle paths or restricting car mobility. Provinces and municipalities have to make so-called Regional Energy Strategy (RES) for regions, together with all relevant stakeholders. Energy cooperatives often participate in the RES-working groups. Lower governments are free to formulate more ambitious energy plans than central government in accordance with the subsidiary principle.

Furthermore, the government signed agreements with different sectors to reduce emissions, and use of energy. These agreements also have an impact on the discipline of energy communities. One of crucial agreements is the so-called Climate agreement: more than 70 Dutch organization, among them universities, trade unions, insurance companies, energy producers, environmental organizations, discussed in several rounds and so-called 'climate tables' about key themes related to the energy transitions, such as mobility, land use, industry etc.

The Climate Act and Climate Agreement are leading frameworks, and probably at the local levels the Regional Energy Strategy plans. By subsidy schemes for renewable and sectoral agreements and largescale interaction procedures, the government tries to make energy transition socially accepted and inclusive. Citizen energy initiatives and their energy projects are supported by the postcoderoosregeling, SDE subsidy and direct support from governments. They participate in regional energy sessions.

In conclusion, the most important governmental institution in energy transition is the Dutch state, while provinces and municipalities play a crucial role in implementation, as well as different societal sectors.

5.2.2 Support mechanisms

Provinces do not have specific means to subsidize energy transition projects, but some provinces support small-scale sustainable energy projects and parties, such as energy cooperatives with advice or staff hours, and sometimes also financially. In Groningen, for instance, each organized citizen group can ask 10.000 euros to develop a sustainable energy plan for their village or city. Some provinces subsidize sustainable energy or environmental organizations, which organize knowledge exchange meetings and train energy coaches.

In general, one of the important subsidy schemes to stimulate production of renewable energy, of which the first version started in 2003, is the Renewable Energy Production Subsidy Scheme (SDE) (Zonnestroom Nederland, n.d.). This scheme compensates energy producers (heat, gas and electricity) for differences between the cost price of renewable energy they produce and the market value of the energy supplied (Simonetti et al., 2019).

Another important policy is the postcoderoos (zip code area) scheme that makes it possible for citizens to work together on an energy project within a certain postcode (zip code). Via this scheme energy tax can be deducted from the energy bill via net metering. For this, citizens should be organized as a cooperative.

5.2.3 Planning Policies

The Dutch law provides that concrete measures will be making 200,000 houses sustainable each year, closure of all coal-fired power stations at the latest in 2030, CO_2 storage, replacement of the obligation to connect homes to the gas grid. In new housing projects a gas network is no longer being constructed.

In 2030, only emission-free cars are allowed to drive on the road (Ministerie van Economische Zaken en Klimaat, 2019).

The Ministry of the Interior and Kingdom Relations started a project in order to stimulate municipalities to develop natural gas-free heat systems for villages or neighborhoods (Ministerie van Binnenlandse Zaken en Koninkrijksrelaties, ministerie van Economische Zaken en Klimaat, Interprovinciaal Overleg, Unie van Waterschappen, & Vereniging van Nederlandse Gemeenten, n.d.)

5.3 **Bottom-up initiatives**

5.3.1 Legal framework

The recent European directives have not been implemented: it can be important because it might create space for energy cooperatives and other partnerships of citizens in the energy transition, and strengthens their position in relation to market parties. The Dutch government is working on the transposition into the national legislation.

Most of the energy communities are organized as a cooperative, some as a foundation, society, working group or BV (limited liability company). More specifically, the vast majority of citizens' initiatives in the energy sector chooses the cooperative association as legal form, with exclusion of liability (U.A.) (HIER Opgewekt, 2019). Most citizens' initiatives feel the need to incorporate as soon as money comes into play, they have to sign contracts for contracts, subsidies or projects and people want to invest together.

A cooperative association or cooperative often turns out to be a favorite because it is a form of enterprise that members themselves manage and finance based on a shared objective. The energy cooperatives are not for profit, but they do make a profit that serves the shared objectives. The members decide on the objectives, policy, business operations and profit appropriation. Most of the initiatives have a broad scope, including other environmental or social issues, such as energy poverty. In principle, all members have the same say: each member has one vote. A number of local initiatives opt for a foundation, usually as an additional entity to initiate new projects and activities. Production projects are sometimes housed in project cooperatives or project BVs.

With specific reference to energy communities, the major challenge is in the implementation of the section of the Climate Agreement on local involvement. According to this section, citizens must be able to participate in the energy transition. This has been translated into conditions for the participation of the local stakeholders in the realization of wind and sun on land, and in particular in the pursuit of 50% ownership of the local environment. In the heat transition, participation means a neighborhood-oriented approach.

Another challenge is the revision of the zip code scheme and the net metering scheme. According to the 2014 zip code scheme, there is a lower energy tax on electricity in the case of collective generation by a cooperative within a certain postcode area. Many collective solar projects are realized using this scheme.

5.3.2 Attitudes toward the cooperative model

Already at the start of the 20th century, some Dutch citizens started to organize in energy cooperatives (Van der Waal & Van der Windt, in prep). The aim of these over 80 cooperatives was to bring electricity to the countryside, to be part of the new technological development and to share profits. At the same time, other types of cooperatives arose, cooperatives of farmers and employees, sometimes related to socialist or anarchist movements, but often very practical, to share machines, capital and labor, to organize production and retail. Some insurance companies, large banks, large agricultural companies and retail organizations are still organized as a cooperative. However, the energy (i.e. electricity) cooperatives disappeared when the national government decided that electricity provision should become a task of the provincial government and the existing cooperatives could not remain profitable in their own municipality due to technological developments that encouraged upscaling, while they were not allowed to supply outside the own municipality anymore.

In 2019, the Netherlands counts about 600 energy cooperatives (HIER Opgewekt, 2019a). Most of them (80%) develop solar projects, 24% wind projects and an increasing number is involved in heat, mobility and other innovative projects. In addition, there is a lot attention to energy savings.

Almost 6% of onshore wind power is in the hands of these cooperatives (193 MW). This concerns 'real' ownership, in the sense of economic and legal ownership or shared ownership of a cooperative. Most members of a cooperative live in the area of their projects. Cooperatives often work together with commercial partners. Around 11% of the total Dutch wind power was realized in wind farms with shared ownership (HIER Opgewekt, 2019a). The average citizen ownership in these co-owned wind farms is approximately 50%. Now, about 50% of all solar panels are installed on private homes, often supported by cooperatives that organized collective purchasing actions. Currently 2% of the total solar energy is realized in cooperative ownership. Sometimes citizens invest in solar energy through a crowdfunding platform.

The vast majority of citizens' initiatives in the energy sector chooses the cooperative association as legal form, with exclusion of liability (U.A.) (HIER Opgewekt, 2019a). Most citizens' initiatives feel the need to incorporate as soon as money comes into play, they have to sign contracts for contracts, subsidies or projects and people want to invest together. A cooperative association or cooperative often turns out to be a favorite because it is a form of enterprise that members themselves manage and finance based on a shared objective. The energy cooperatives are not for profit, but they do make a profit that serves the shared objectives. The members decide on the objectives, policy, business operations and profit appropriation. In principle, all members have the same say: each member has one vote. A number of local initiatives opt for a foundation, usually as an additional entity to initiate new projects and activities. Production projects are sometimes housed in project cooperatives or project BVs.

In conclusion, in the Netherlands there is a large and diverse group of citizens initiatives. Although energy cooperatives functioned in the 1920s and 1980s, the big wave took place after 2010. Most of them are organized as a cooperative, some as a foundation, society, working group or BV (limited liability company). Most of them are customer-owned cooperatives. Most of the initiatives have a broad scope, including other environmental or social issues, such as energy poverty. It is not well known if other social aspects, such as global justice, are part of the discourse.

Although the citizen energy movement is growing, the impact on the energy mix is small. Initiatives play a substantial role in engaging people and experimenting with new social and technological configurations. Governments and DSOs, and sometimes commercial actors recognize the role of citizen initiatives, to a certain extent and are looking for a niche for them. However, it is uncertain what these parties expect from cooperatives in the future.

5.3.3 Local activism

In the 1980s, some anti-nuclear activists together with others started to organize energy cooperatives, mostly wind energy cooperatives. This resulted in some large wind cooperatives, which have now several wind parks and many customers (Oteman, Kooij, & Wiering, 2017). The energy movement only really started to grow around 2010 (see figure 5.6) At least the following factors are relevant for this rise: the liberalization of the energy market, supportive financial RE schemes, the decreasing prize of PV panels and the rising awareness on climate change.

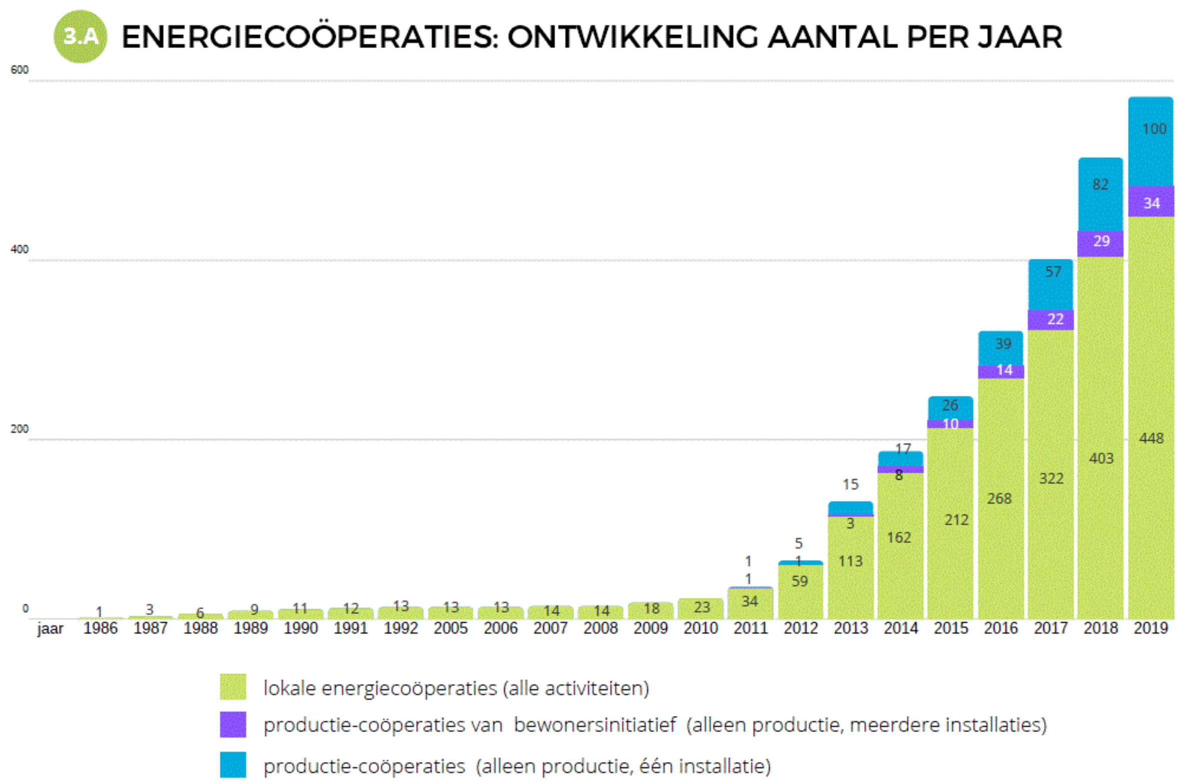

Figure 5.6 Growth of energy cooperatives in the Netherland 1986-2019 HIER Opgewekt, 2019a

Green: general energy cooperatives, purple: large production cooperatives, blue: small energy cooperatives

Many Dutch local energy cooperatives have a broad objective: making the local environment and the local community more sustainable. Stimulating the energy transition is one of the aims, but they also pursue social goals such as strengthening the community and local economy.

Some energy initiatives, such as Spijkerkwartier, Zonnedorpen, ZutphenEnergie put energy poverty on the agenda, and are looking for solutions to avoid that. Knowledge platform HIER Opgewekt made a so-called knowledge dossier for this theme (HIER Opgewekt, 2019b). Almost all cooperatives regard affordability as one of the constraints if they develop energy transition projects.

Energy cooperatives are engaged in energy savings, are experimenting with new technologies, and are developing complete wind farms or solar parks and more. About half of the cooperatives develop into production cooperatives, setting up a production installation, usually a sunroof, only concerned with energy generation. Half of the production cooperatives are founded by new type of initiators, such as resident groups, associations of owners, companies or project developers (HIER Opgewekt, 2019a). Often cooperatives work together with the municipality, in the context of the project 'aardgasvrije wijken' of the Ministry of the Interior and Kingdom Relations. In addition, cooperatives start to pay more attention to mobility, such as electric shared cars and charging stations, to green (landfill gas, biogas from manure and seaweed), circular economy, integrated hydrogen gas production, smart grids with storage, flexibility services and new market models (HIER Opgewekt, 2019a).

Despite the growth of local energy production and the cooperative movement, there are – still - a number of obstacles and challenges. A major challenge for the cooperatives in the implementation of the section of the Climate Agreement on local involvement. According to this section, citizens must be able to participate in the energy transition. This has been translated into conditions for the participation of the local stakeholders in the realization of wind and solar on land, and in particular in the pursuit of 50% ownership of the local environment. In the heat transition, participation means a neighbourhood-oriented approach. Energy cooperatives believe that the Climate Agreement reinforces the importance of their activities and can provide an important new impulse (HIER Opgewekt, 2019a).

Another challenge is the revision of the zip code scheme and the net metering scheme. According to the 2014 zip code scheme, there is a lower energy tax on electricity in the case of collective generation by a cooperative within a certain postcode area. Many collective solar projects are realized using this scheme. The uncertainty about the new zip code scheme puts a brake on solar projects. Cooperatives indicate that it becomes more difficult to recruit participants as long as there is no clarity about this (HIER Opgewekt, 2019a)

Another problem is the rise of commercial companies that try to dominate the sustainable energy market, often claiming that they are 'for the people'. Surveys reveal that two thirds of the Dutch population is positive about joint production of sustainable energy in the living environment, and that at least 30% is willing to participate in an energy cooperative or wind collective (HIER Opgewekt, 2019a).

6 Poland

6.1 Market overview

6.1.1 Energy Consumption trends

The average yearly electricity demand for Poland increased by 32.5% in comparison to 1990 and reached 165.6 TWh in 2018. At the same time, the electricity production increased by only 14.8%.

During this period, the available average power reserves were satisfactory (excluding economic crisis in 2008), until 2014 when the first positive import/export balance appeared and 2.2 TWh was imported from foreign countries. The industry sector is the largest electricity consuming sector, accounting for over 38% of total consumption in 2018, followed by services with 32% and households with 19% (see Figure 6.1).

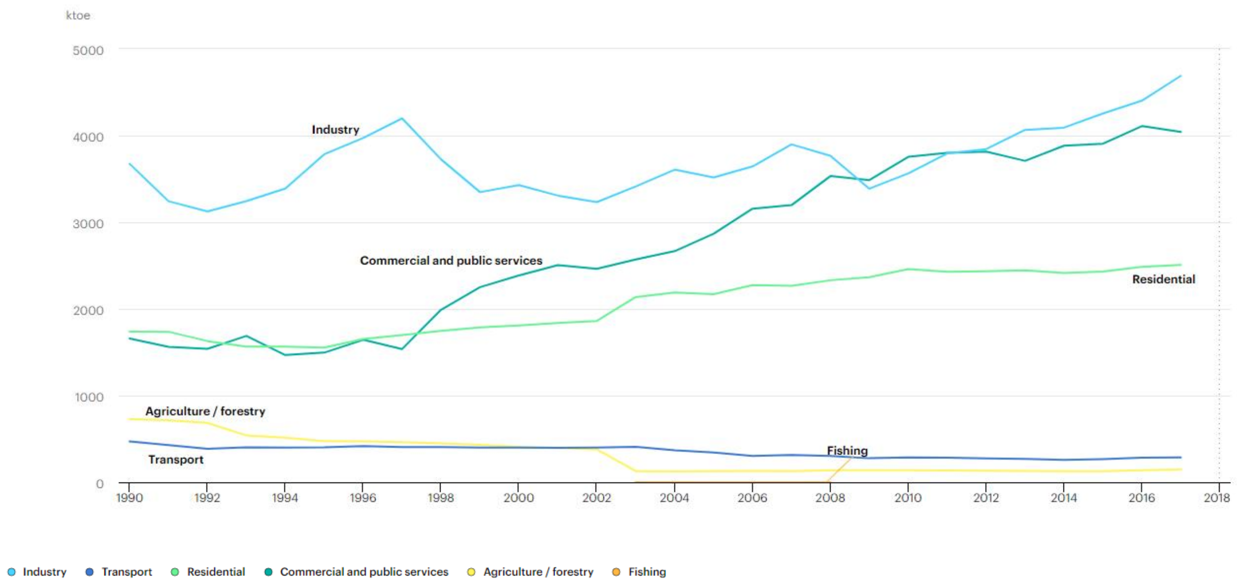

Figure 6.1 Electricity final consumption by sector, Poland 1990-2018 – IEA

6.1.2 Market structure: generation, distribution and retail market

In Poland there are five main distribution companies which, while legally unbundled, are in fact part of large parent companies with significant generation and distribution assets, as well as a significant share of the retail market. The exceptions are Energa, which has less generation assets than the other Polish parent companies, and Innogy, which focuses primarily on retail supply and network operation in Warsaw. The consolidation of Polish power companies into four vertically integrated companies (PGE, Tauron, Energa, and Enea), three of them majority state owned and the fourth with a state-owned controlling share, is the result of a policy adopted in 2006, the Programme for the Electric Power Sector. This strategic document, adopted by the Council of Ministers, laid down a path for the development of the power market in Poland. The programme called for the consolidation of energy companies into four vertically integrated energy groups holding generation and distribution assets, which would be owned by the State Treasury. Today, three out of four of the largest distribution companies remain majority-owned by the State Treasury.

Sector	Leading Companies	Market Share	Remaining Companies
Transmission	PSE Operator	100 %	None
Distribution[4]	Tauron Dystrybucja	37 %	164 vertically integrated DSOs
	PGE Dystrybucja	26 %	
	Energa-Operator	17 %	
	Enea Operator	14 %	
	Innogy Stoen Operator	6 %	
Generation[5]	PGE	37 %	ENGIE 6 %, ENERGA 3 % Remaining 20 % (mainly small independent companies)
	TAURON	11 %	
	EDF	8 %	
	Enea	9 %	
	ZE PAK	7 %	
Retail[6]	Tauron Polska Energia	29 %	More than 100 active suppliers in 2015
	PGE	31 %	
	Energa	13 %	
	Enea	14 %	
	Other	13 %	

Table 6.1 Market Share of Polish Electricity Companies - https://www.agora-energiewende.de/fileadmin2/Projekte/2018/CP-Polen/Agora-Energiewende_report_on_the_Polish_power_system_WEB.pdf

PGE holds the largest share of power production, followed by Tauron Polska, Enea, and Électricité de France (EDF). Together, these companies account for 65 per cent of total electricity production in Poland. In 2015 there were more than 100 active alternative retail suppliers on the electricity market, though the top four suppliers accounted for 87 per cent of the retail market. There were also 164 vertically integrated entities providing both distribution and supply services to customers.

Most of the Polish power companies continue to be owned by the State Treasury. The Treasury wholly owns PSE (the transmission system operator, or TSO), and holds a majority share in PGE, Energa, and Enea. Tauron is the only one of the four energy main companies not majority-owned by the Treasury, though the Treasury continues to hold a 30 per cent stake in the company. RWE Polska is wholly owned by RWE. Since the end of 2016, RWE Polska was re-branded and changed its name to Innogy.

Companies	Ownership
PSE Operator	100 % owned by the State Treasury.
PGE	57.39 % State Treasury; 42.61 % other shareholders.[8]
Tauron	30.06 % State Treasury; 10.39 % KGHM Polska Miedź; 5.06 % ING Retirement Fund; 54.49 % other individual and institutional investors.[9]
Energa	51.52 % State Treasury; 48.48 % remaining shareholders.[10]
Enea	51.5 % State Treasury; 10 % PZU TFI ; 38.4 % others.[11]
Innogy	Innogy Polska is wholly owned by RWE East, which in turn is wholly owned by RWE AG, which is 86 % owned by institutional investors, 13 % by private shareholders, and 1 % by employees.[12]

Figure 6.2 - Ownership Structure of Polish Energy Companies – https://www.agora-energiewende.de/fileadmin2/Projekte/2018/CP-Polen/Agora-Energiewende_report_on_the_Polish_power_system_WEB.pdf

Distribution of electricity is based on a transmission grid owned and operated by in Poland by a state owned company PSE. PSE S.A. activity is to provide the services of electricity transmission in compliance with the required criteria of the security of the Polish Power System operation. As a result of the liberalization of the electricity market in Poland, institutional clients obtained the right to change the seller of electricity from July 1, 2004. Individual customers have obtained this opportunity since July 1, 2007. That was the result of the implementation of the TPA (Third Party Access) principle[17]. It enabled the use of the distribution network to other entities trading electricity. At present, as many as nearly 17 million customers (households and enterprises) on the market have the right to choose their electricity supplier freely[18].

According to the data from President of the Energy Regulatory Office,[19] there was a long-term downward trend in HHI indicators in Poland, measured by installed capacity and by the volume of energy fed into the network (taking into account the amount of energy supplied by manufacturers directly to final recipients). This trend changed significantly in 2017. The high level of both concentration indicators recorded in 2017 slightly changed in 2018, according to installed capacity it fell by 3.1%, and according to the energy fed into the network, it remained at the level from 2017. At the end of 2018, concentration in production in Poland reached about 70%.

6.1.3 The technological landscape

[17] The TPA (Third Party Access) principle has been in force in Poland since 2007. It means that the local distribution network operator (monopolist) is required to make available its electricity transmission network purchased by the customer from a freely chosen seller. Distribution networks are therefore still the property of companies, but smaller sellers have equal access to them.

[18] https://www.politykainsight.pl/en/_resource/multimedium/20182100

[19] https://www.ure.gov.pl/pl/urzad/informacje-ogolne/publikacje/podsumowanie-kadencji-p/8263,Dbamy-o-rownowage-Podsumowanie-Kadencji-Prezesa-URE-Wybrane-aspekty-rynkow-energ.html

At the end of 2019, the Polish energy-mix was based on brown coal (lignite) and hard coal (70%), followed by renewable sources (20.1%) and natural gas (5.7%). The most important renewables were wind, biomass, water and biogas according to data gathered by ARE (Agencja Rynku Energetyki) Agency of Energy Market and Transformacja Energetyczna think tank.

The falling amount of electricity produced from coal according to the “Forum Energii” think tank is an outcome of rising electricity import from abroad. It is worth noting that the amount of electricity produced from natural gas was possible due to the new Gazoport (gas terminal) in Świnoujście and import of this resource from Qatar.

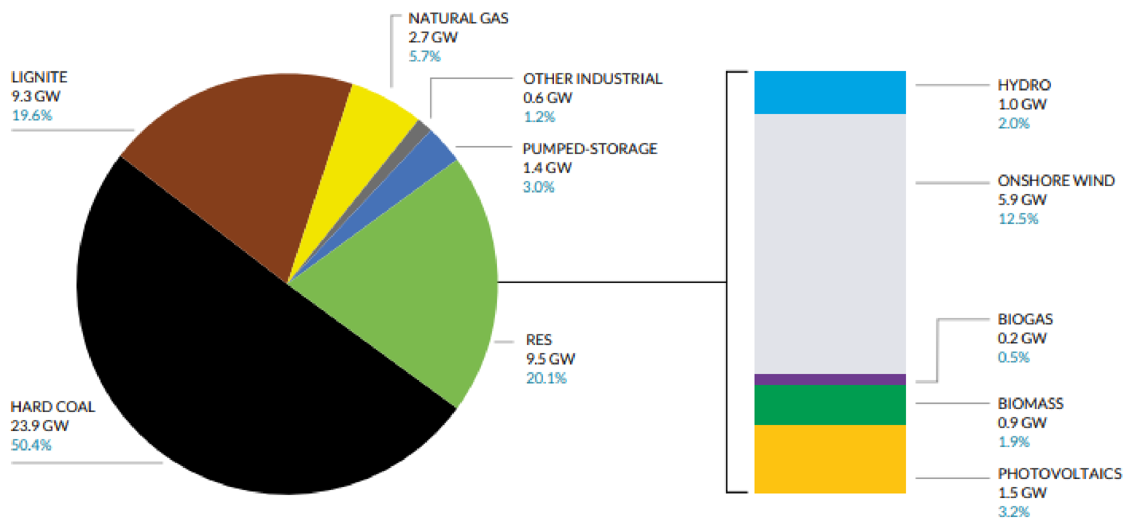

Figure 6.3 Installed generation capacity, Poland 2019 - [*https://forum-energii.eu/public/upload/files/Energy%20transition%20in%20Poland.%202020%20Edition.pdf*](https://forum-energii.eu/public/upload/files/Energy%20transition%20in%20Poland.%202020%20Edition.pdf)

Over the last decade, the level of capacity installed in the system has systematically increased. Between 2011 and 2015, RES installations were developed. After 2016 it has been mainly conventional units. In 2019, there has been a significant increase in the installed capacity for hard coal because of the completion of construction of two new 900 MW units, both in city of Opole. At the end of 2019, 9.5 GW were installed in RES, of which 1.5 GW in photovoltaic installations. The development of RES in the last years is mainly due to investments in prosumer installations

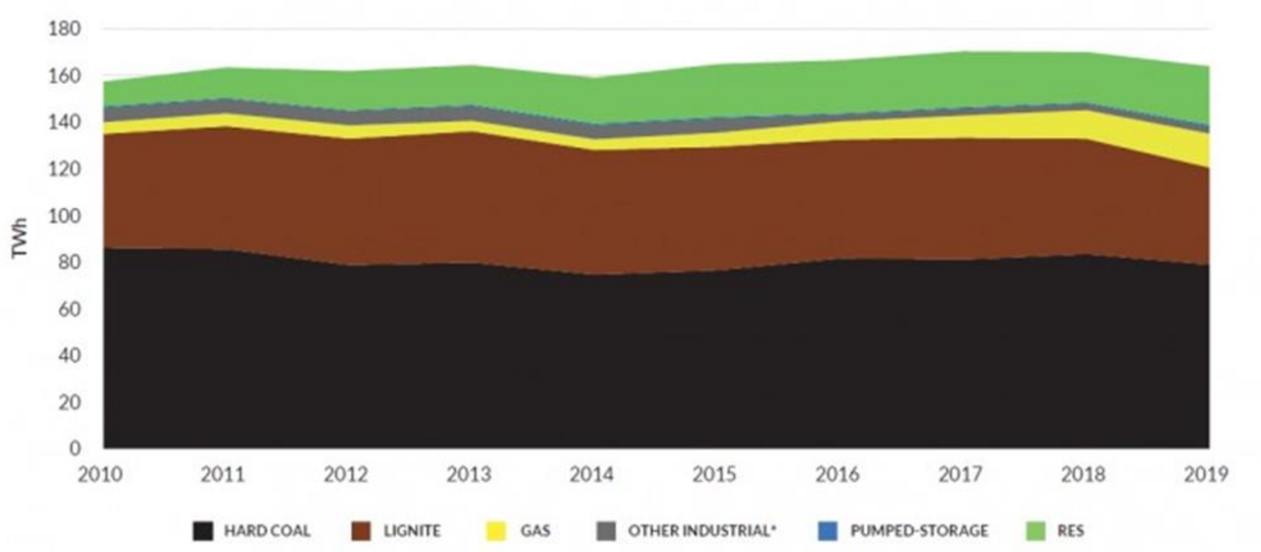

Figure 6.4 - Change in generation capacity, Poland 2010-2019 - https://forum-energii.eu/public/upload/files/Energy%20transition%20in%20Poland.%202020%20Edition.pdf

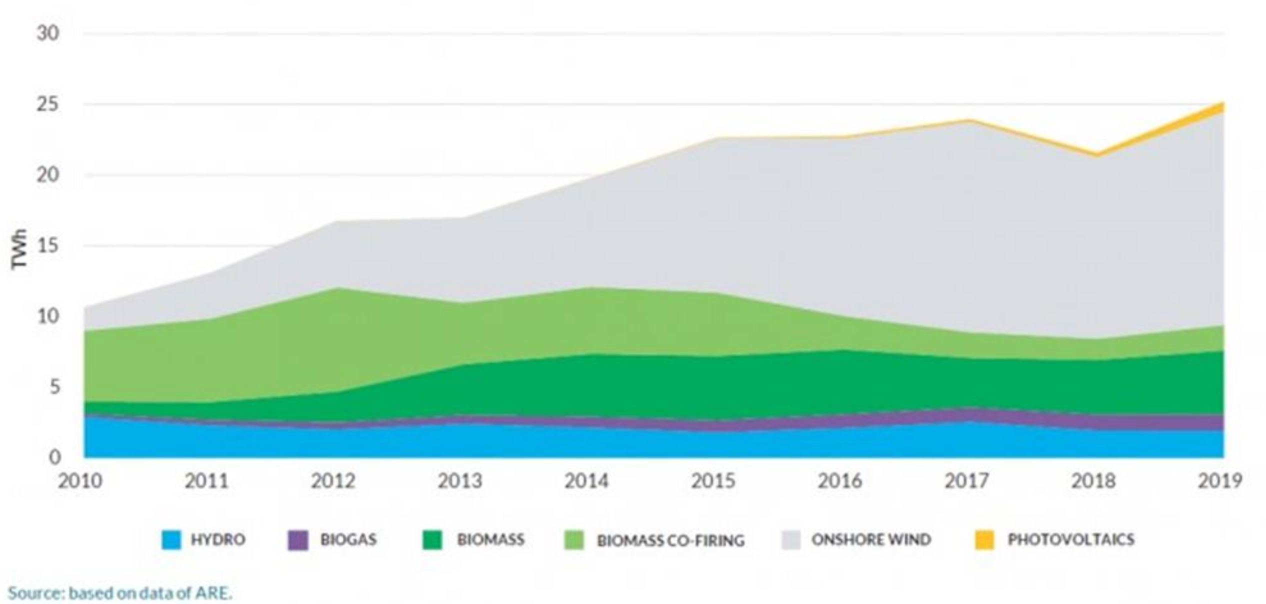

Figure 6.5 Changes in installed RES capacity, Poland 2010-2019 - https://forum-energii.eu/public/upload/files/Energy%20transition%20in%20Poland.%202020%20Edition.pdf

Although important improvements have been made to modernise Polish energy infrastructure, significant investments are still needed to ensure a sustainable supply of energy, reduce the share of carbon-intensive plants and increase the exploitation of renewable energy sources.

6.2 **Governance**

6.2.1 National regulatory framework

The two European Union directives supporting the development of Collective Action Initiative in energy have not yet been transposed into Polish law. Currently, in the absence of transposition of these directives, the emergence of energy communities is limited to the level of trust and citizens engagement (Błażejowska & Gostomczyk, 2018).

There is no specific discipline of energy communities; therefore, the description of governance will deal with the energy issue from a general point of view.

One of the most important agencies that control the Polish energy market is Urząd Rregulacji Energetyki (Energy Regulatory Office - URE), whose duties and competences are related to the state policy in the field of energy (for instance, the regulation of economic activity of energy enterprises, the concept and development of energy market in comply with recommendations given by European Union, the regulation of renewable energy market, etc.).

The President of URE is a central body of state administration nominated on the basis of the Energy Law Act of 10 April 1997. It regulates activities of energy enterprises aiming to balance interests of energy companies and customers. More specifically, it is competent to grant and withdraw licenses, approve and control application of tariffs, determine the period of application of these tariffs and their correction factors, determine the justified amount of return on capital for energy enterprises which are obliged to submit tariffs for the approval, etc.

The Energy Regulatory Office is not the sole competent authority in the energy sector.

In the last two years, there were changes in the governmental control over the energy market. The Ministry of Energy was transformed into the Ministry of State Actives who now controls all state-owned mines and energy companies. At the same time, the Ministry of Climate was cleaved off from the Ministry of Environment. This ministry is important for the supporting of renewable energy development and production. The Ministry of Environment supervises programmes like "Czyste Powietrze" (Clean Air), supporting households in changing their heating systems into cleaner and even renewable solutions. The Ministry of Environment is also responsible for the overall preparation of the future energy market in Poland, including adaptation to climate change policies.

The local authorities have not specific competencies in this field despite the principle of subsidiarity enshrined in the constitution. Moreover, there is no strategy in Poland, which defines the participation of prosumer, civic or collective energy production. In fact, energy communities' membership is not actively encouraged.

6.2.2 Support mechanisms

In general, central government supports the creation and establishment of energy clusters by subsidizing and granting loans for investment into development of grids, new renewable instantiation, and thermal efficiency improvement.

With reference to the support mechanisms, the production of electricity from renewable energy sources is supported by the FIT (feed-in-tariff) guaranteed tariff system and the FIP (feed-in premium) market price subsidy system. As said above, the operating principles of the system are set by the URE.

Moreover, the Ministry of Environment supervises programmes like Clean Air, supporting households in changing their heating systems into cleaner and even renewable solutions. It is also currently running a project named My energy, that it provides a subsidy (about 1200 EUR for each household) in order to implement new PV installations. However, there is no income criterion.

6.2.3 Planning Policies

In the project "National Plan for Energy and Climate for 2021-2030" published by the Ministry of Energy there is a government forecast of the increase in the share of renewable energy in the national energy mix by 2030. The plan assumes achieving by 2030 a 21% share of renewable energy in final (gross) consumption of energy - including heating and cooling, as well as for transport purposes.

With reference to administrative burdens, works are underway to amend the RES Act and include implementations resulting from the RED II directive. A kind of advantage seems to be the exclusion of the obligation to hold a license for the production and trade of electricity for the collective prosumer when the total installed electrical capacity of renewable energy installations in the cooperative's area does not exceed a certain level.

According to press information, the new regulation, apart from the definition of energy commnunity, will also include definition of collective prosumer and virtually operated power plants.

Bottom-up initiatives

6.2.4 Legal framework

As above said, the two European Union directives supporting the development of Collective Action Initiative in energy will be implemented into Polish law in the next years. Now, there is no concept of energy cooperative in Polish legislation. Most initiators must therefore use other regulations: energy production is possible based on the same principles as the production of other goods by energy cooperatives.

Pursuant to the Act of 16 September 1982, a cooperative "*is a voluntary association of an unlimited number of persons, with variable composition and variable share fund, which in the interest of its members conducts joint economic activity*".

If the energy cooperative would like to be officially registered as Energy Cooperative, it must meet the following conditions provided by the Polish law. Firstly, it cannot have more than 1000 members. Moreover, the total installed electrical capacity of all renewable energy installations has to cover at least 70 % of its member's needs and the total capacity of electricity production of all members cannot exceed 10 MW.

6.2.5 Attitudes toward the cooperative model

The history of cooperatives in Poland is quite long and goes back to the second half of the nineteenth century. Various cooperatives were also important during the formation of the state after 1918 (independence of the country). However, the experience of real socialism destroyed the ideas of cooperative activity. The experience of involuntary associations meant that Poles are reluctant to participate in collective actions. One of the lower levels of social trust (European Social Survey) in EU countries is also a problem.

The first energy cooperative established in Poland was Nasza Energia. It is a private and local government initiative, which aim is to build a complex of 12 biogas power plants in the four communes of Zamość county. It consists of three agricultural biogas plants with capacities from 0.5 to 1 MW connected by cable bridges. Individual power nodes will also be interconnected, thus creating a unique energy production system supplying homes and public buildings (Unia Producentów i Pracodawców Przemysłu Biogazowego, 2019).

While analysing collective action initiatives in renewables, we have to take into consideration energy cooperatives, energy clusters and small energy sharing initiatives (not even formalised). For example, the Wirtualna zielona energia energy cluster will be located in a small village of Ochotnica Dolna and will connect not only local government and its institutions but also local entrepreneurs and prosumers. It is also worth noting some of the renewable energy plants, as for example the one in Sieńsk, where Remigiusz Darmach (an owner of the cow-farm) shares the heat produced by his small biogas plant with other village residents.

The importance of cooperatives on the energy market is still marginal. At the moment, the dominant forms of energy community initiatives are: a) agricultural cooperatives producing biogas; b) housing communities investing in PV installations; c) energy clusters arising from local government initiatives.

6.2.6 Local activism

With worsening air quality and the acute problem of acid rain caused by industrial and energy sector emissions, “alternative energy sources” were explored as an option in Poland already in the early 1990s, given that nuclear energy was out of the question in the aftermath of earlier societal protests (Szulecki et al. 2015). The Polish wind farm market has steadily grown from 1989 until 2016, when as a result of the record oversupply of green certificates, change of the auctions support system, and new tax regulations the profitability of existing wind farms were significantly reduced. At the same time, the government introduced location restrictions (the so-called "10H" principle). “10H” principle was a law that established a minimum distance between a wind turbine installation and buildings or protected areas. A wind farm could not be built closer than 10 times of turbine height. According to the Polish Wind Energy Association, in practice it excluded about 99 % of the Polish territory from such investments. That led to the creation of an investment gap and caused major difficulties in obtaining the European and Paris climate goals.

7 Spain

7.1 Market overview

7.1.1 Energy Consumption trends

The final energy consumption grew continuously in Spain between the 1990 and 2008, when the economic crisis strongly affected the consumption of energy and has been reducing since. This reduction in consumption has been more relevant in the case of coal and petroleum-based products, whereas there has been an increase in the consumption of electricity and RES and waste-based energy.

AÑO	Carbón y derivados		P. Petrolíferos		Gas		Electricidad		Energías renovables y residuos		TOTAL
	Ktep.	(%)	Ktep.	(%)	Ktep.	(%)	Ktep.	(%)	Ktep.	(%)	Ktep.
1990	4.089	7,0%	34.989	59,9%	4.603	7,9%	10.819	18,5%	3.913	6,7%	58.413
1991	4.396	6,7%	41.172	63,0%	5.063	7,7%	11.063	16,9%	3.671	5,6%	65.364
1992	4.122	6,2%	42.092	63,6%	5.425	8,2%	11.246	17,0%	3.345	5,1%	66.231
1993	3.349	5,2%	41.411	63,8%	5.561	8,6%	11.239	17,3%	3.354	5,2%	64.915
1994	3.079	4,5%	44.533	65,1%	5.606	8,2%	11.779	17,2%	3.387	5,0%	68.384
1995	2.581	3,6%	46.723	65,3%	6.874	9,6%	12.118	16,9%	3.256	4,6%	71.553
1996	2.322	3,2%	46.351	64,3%	7.440	10,3%	12.658	17,6%	3.276	4,5%	72.047
1997	2.367	3,1%	48.606	63,8%	8.298	10,9%	13.676	17,9%	3.288	4,3%	76.237
1998	2.145	2,6%	52.036	64,2%	9.236	11,4%	14.205	17,5%	3.428	4,2%	81.050
1999	1.928	2,3%	52.587	63,1%	10.091	12,1%	15.244	18,3%	3.448	4,1%	83.298
2000	1.959	2,2%	54.893	61,7%	12.377	13,9%	16.207	18,2%	3.469	3,9%	88.906
2001	2.276	2,4%	56.611	60,8%	13.511	14,5%	17.282	18,5%	3.486	3,7%	93.166
2002	2.273	2,4%	56.656	60,0%	14.172	15,0%	17.674	18,7%	3.593	3,8%	94.367
2003	2.257	2,3%	59.080	59,3%	15.824	15,9%	18.739	18,8%	3.654	3,7%	99.555
2004	2.277	2,2%	60.627	58,7%	16.847	16,3%	19.838	19,2%	3.685	3,6%	103.274
2005	2.116	2,0%	61.071	57,6%	18.171	17,1%	20.831	19,7%	3.790	3,6%	105.979
2006	2.038	2,0%	60.483	58,5%	15.635	15,1%	21.167	20,5%	4.005	3,9%	103.328
2007	2.193	2,1%	61.708	58,2%	16.222	15,3%	21.568	20,4%	4.279	4,0%	105.970
2008	2.015	2,0%	58.727	57,5%	15.112	14,8%	21.938	21,5%	4.409	4,3%	102.200
2009	1.410	1,5%	54.317	57,3%	13.418	14,2%	20.621	21,8%	5.005	5,3%	94.771
2010	1.603	1,7%	53.171	55,4%	14.848	15,5%	21.053	21,9%	5.367	5,6%	96.042
2011	1.915	2,1%	50.119	53,7%	14.486	15,5%	20.942	22,5%	5.815	6,2%	93.277
2012	1.507	1,7%	45.543	51,2%	14.987	16,8%	20.661	23,2%	6.297	7,1%	88.995
2013	1.752	2,0%	43.603	50,8%	15.254	17,8%	19.953	23,2%	5.293	6,2%	85.855
2014	1.367	1,6%	42.264	50,9%	14.778	17,8%	19.513	23,5%	5.109	6,2%	83.031
2015	1.503	1,8%	44.588	52,5%	13.576	16,0%	19.952	23,5%	5.294	6,2%	84.913
2016	1.652	1,9%	46.639	53,2%	13.890	15,8%	19.993	22,8%	5.522	6,3%	87.697
2017	1.891	2,1%	47.409	53,2%	13.946	15,6%	20.169	22,6%	5.747	6,4%	89.162

Figure 7.1 Evolution of the final energy consumption in Spain - Spanish Ministry for Ecological Transition and Demographic Challenge (MITECO)

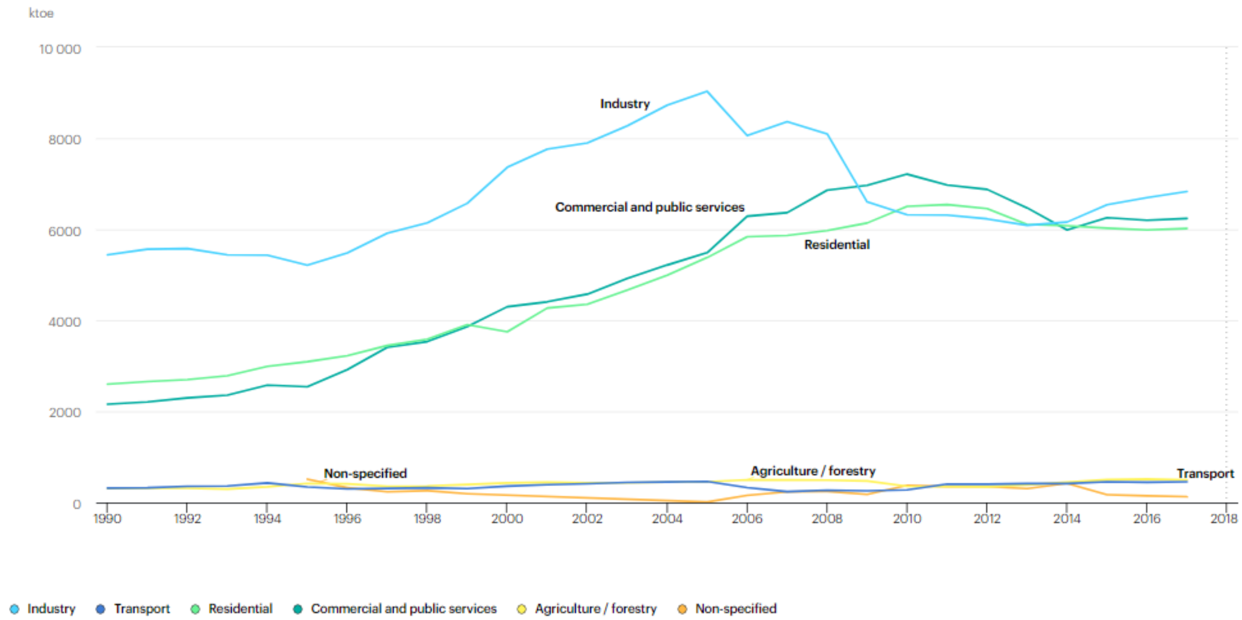

Figure 7.2 Electricity consumption by sector in Spain 1990-2018 Source: IEA

Since 2005, the indicator of the energy consumption in the Spanish manufacturing sector followed a decreasing trend that continued after the crisis in 2008 and subsequent economic recovery started in 2014. Virtually all branches of manufacturing industry registered an increase of production that reflected in an improvement of added value. This increased activity entailed an increase in energy demand in all branches, except for textile, mineral industries non-metallic and machinery.

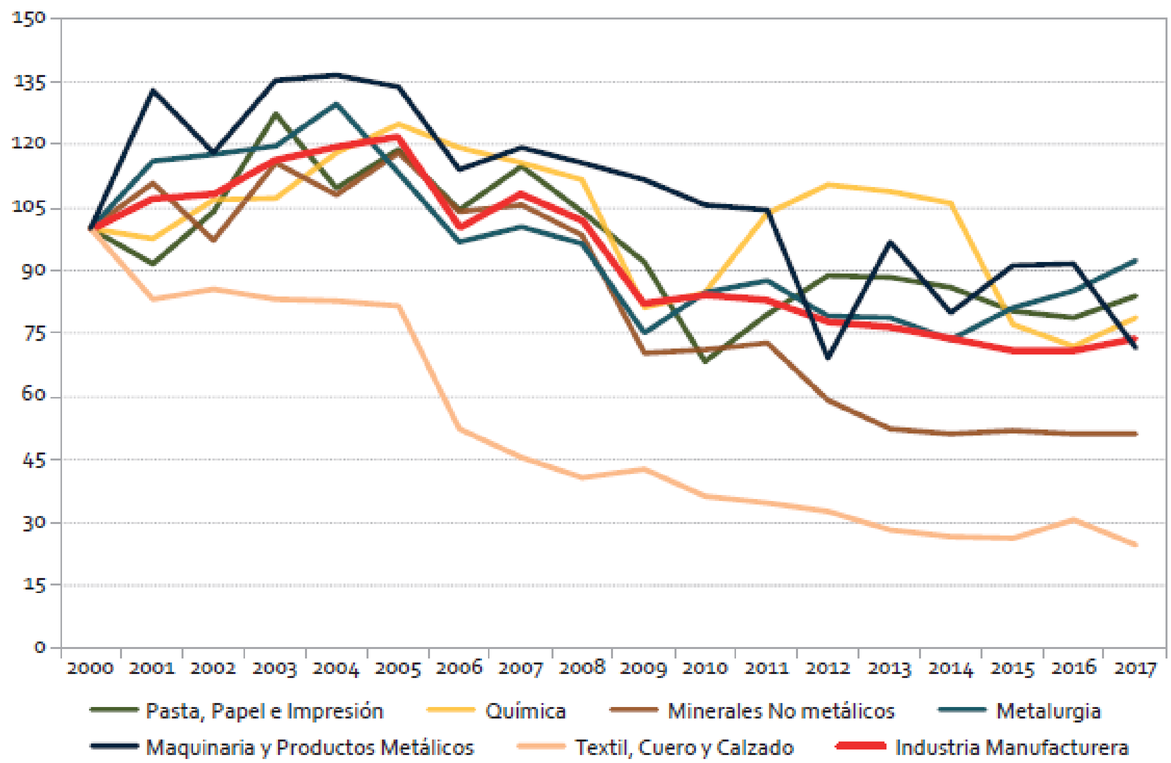

Figure 7.3 Energy consumption in the manufacturing sector in Spain 2000-2017 - MITECO, IDEA and INE

7.1.2 Market structure: generation, distribution and retail market

The liberalization of the Spanish electricity sector materializes with the approval of Law 54/1997 of November 27 of the Electric Sector (LSE) and with the privatization of electricity companies that were still at that time in the hands of the State. This liberalization entailed dismantling the existing vertically integrated monopolies when competition entered in the generation and retail segments. Currently, there are around 2,000 different agents in the electricity supply[20], among which there are producers in ordinary and specialised regime, retailers as well as representatives of sales agents. There are also electricity distributors, carriers, system operators (system operator and market operator).

The existing vertically integrated companies must have a clearly differentiated management and economic flows of the transmission and distribution activities and the generation and retail activities. Electricity companies maintain a "high concentration" of the market in the domestic segment despite the push from small retailers, according to the latest data published by the National Commission on Markets and Competition (*CNMC*)[21].

[20] OMIE (2020). Lista de agentes. Retrieved from: https://www.omie.es/es/listado-de-agentes

[21] Comisión Nacional de los Mercados y de la Competencia-CNMC (2019) Informe de supervisión del mercado minorista de electricidad. Retrieved from www.cnmc.es

However, electricity transport and distribution were still regulated activities. Therefore, there was a separation of activities: electricity generation and retail were non-regulated activities while transport and distribution were still regulated activities.

The implementation of this market model gave rise to the creation of a new institutional framework, in accordance with European regulations. The liberalization of the electricity generation provoked the creation of a wholesale electricity market. Consequently, its functioning and organizational model was established, which was managed by a new entity, the Electricity Market Operator (*OMEL* or *Operador del Mercado Eléctrico*). The Law 54/1997 also established the procedures for remuneration for regulated activities, transportation and distribution. In addition, an electric System Operator and transport manager was established (*Red Eléctrica de España* or *REE*), which was an independent entity within the electric sector. The System Operator was controlled by the State and hold the propriety of most of the Transmission Network.

The possibility of eligibility of all consumers was set from January 1, 2003. This eligibility was understood as the right of consumers to choose how to contract electricity, with two choices: to contract electricity supply with the distribution company of one's choice or to continue "at rate" (price set by the Government) . With this measure, the full liberalisation of the market was achieved, both in terms of generation and consumption. In retail, this liberalisation was progressively established, and the industrial consumers were the first to access to the liberalised market before 2003.

However, the regulated price of electricity for domestic final consumers (Tarifa Eléctrica Integral) poses some barriers to the liberalised price and did not allow the desired degree of competition until its disappearance in 2009. This tariff was fixed administratively and included both the cost of access to networks and the cost of energy acquisition. The latter was not calculated using market references, but administratively and it was thus subject to errors of estimates or to policy decisions taken with non-maker criteria. The disappearance of this tariff in 2009 supposed an increase of competition in the free market.

To solve the problem associated with to the coexistence of integral tariffs and a competitive market the Tarifa de Último Recurso (TU) or "Last Resort Tariff" was established. The TUR was defined as the price that some electricity retailers designated as "Last Resort Providers" (Suministradores de Último Recurso or SUR) could charge. All consumers who would not exceed a certain contracted power, typically domestic consumers, could take advantage of the TUR. In 2014, the "Voluntary Price for Small Consumers" (Precio Voluntario Pequeño Consumidor or PVPC) was introduced, which replaced the TUR. With the new method, the consumer pays for his/her consumption during a billing period the resulting price in the electricity market.

By replacing the Tarifa Eléctrica Integral with a rate determined through a competitive process (provided first by the TUR and later by the PVPC), it is intended that the existence of a regulated price of last resort does not hinder the operation of the liberalised retail market, as the competitive mechanism ensures the generation of an efficient and cost-representative price. Red Eléctrica de España is the organism in charge of calculating and publishing the PVPC.

In terms of generation, coal and nuclear plants have received government's subsidies (fossil generation) that has posed barriers for renewables to compete in the generation. Spain established a temporary suspension (moratorium) of the development of policies for the construction and commissioning of atomic fission power plants (nuclear power plants). Due to this moratorium, in Spain the electricity bill included between 1996 and 2015 a fee or surcharge for large electricity companies in compensation for the enormous expenses they incurred to start building nuclear power plants that were not completed after the State's termination of the unilaterally permits.

From 1989 to 2014, Spain devoted different types of public aid to boost and restructure coal mining and to generate electricity. Most of these funds were allocated to some of the big electricity players in Spain. In fact, some of these funds were investigated by the European Commission for the alleged granting of illegal state aid to a sector of the economy[22].

Renewable energy generation has also received, and still receives, public funding from diverse public institutions in Spain. Both national government and regional governments offer different type of grants and subsidies in order to promote the generation of renewable energy.

The Spanish electricity sector has around 26 million clients[23], of which around 94% have a contracted power of less than 10 kW. Among those, approximately 40% use the above-mentioned *PVPC.* The fact that the five big electric companies in Spain are obliged to offer this regulated tariff and the difficulty of finding better offers in the liberalized market than the *PVPC* is, according to Díaz Mendoza et al (2015), a clear sign that said tariff constitutes a barrier to effective market liberalization, hindering the development of competition. A possible increase in competition could be represented by the direct investments of foreign multinationals. All the major European groups acquired subsidiary companies in Spain. EdP acquired Hidrocantabrico, while E.ON bought Electra de Viesgo in 2008. In addition, most of them have diversified their markets in Spain by acquiring gas, water and electricity companies in Spain. In addition, Spanish companies acquired energy companies in other countries, such as in the United States, in order to diversify their markets.

[22] https://www.elmundo.es/economia/2017/11/27/5a1c0d7dca4741b6468b4570.html
[23] Comisión Nacional de los Mercados y de la Competencia-CNMC (2020). Boletín de indicadores eléctricos de mayo de 2020. Madrid: Retrieved from www.cnmc.es

AÑO	ENDESA	IBERDROLA	NATURGY	EDP	VIESGO	FORTIA	ENERGYA VM	AXPO	ACCIONA	NEXUS	OTROS	HHI
2008	33%	26%	16%	20%	1%	2%	0%	0%	0%	0%	2%	2.369
2009	34%	25%	14%	18%	2%	4%	1%	0%	0%	0%	2%	2.219
2010	34%	25%	14%	15%	2%	4%	1%	0%	0%	0%	5%	2.268
2011	35%	26%	14%	14%	2%	4%	1%	0%	0%	1%	3%	2.333
2012	33%	24%	13%	17%	2%	3%	1%	0%	1%	1%	5%	2.153
2013	32%	23%	13%	17%	3%	4%	1%	1%	2%	0%	4%	2.012
2014	32%	21%	13%	16%	3%	3%	1%	1%	1%	1%	8%	1.929
2015	31%	21%	13%	14%	3%	4%	2%	2%	1%	1%	8%	1.816
2016	30%	22%	13%	15%	2%	3%	2%	1%	2%	1%	9%	1.844
2017	30%	23%	12%	13%	1%	4%	2%	1%	2%	1%	11%	1.824
2018	29%	23%	12%	13%	1%	4%	1%	1%	2%	1%	13%	1.748

Figure 7.4 Evolution of the shares of energy supplied in the free market by marketing group. Domestic segment - CNMC 2019

Outstanding in 2017 is the higher HHI index in the industrial segment than in the SME segment, indicative of the effort made by retailers not belonging to traditional energy groups to enter the latter.

	ENDESA	IBERDROLA	NATURGY	EDP	VIESGO	UNIELECTRICA	FENIE	VM	AUDAX	NEXUS	ALCANZIA	FACTOR	ALDRO	AXPO	CLIDOM	ACCIONA	GESTERNOVA	OTROS	HHI
2009	35%	30%	20%	7%	3%	0%	0%	1%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	2.626
2010	36%	28%	19%	7%	3%	0%	0%	1%	0%	3%	0%	2%	0%	0%	0%	0%	0%	1%	2.501
2011	37%	25%	19%	7%	4%	0%	0%	1%	1%	2%	0%	2%	0%	0%	0%	0%	0%	2%	2.462
2012	38%	23%	18%	7%	4%	0%	0%	2%	1%	2%	0%	2%	0%	0%	0%	0%	0%	2%	2.414
2013	35%	21%	19%	7%	4%	0%	1%	3%	2%	2%	0%	2%	0%	0%	0%	0%	0%	3%	2.134
2014	31%	21%	18%	5%	4%	1%	1%	4%	4%	2%	0%	2%	0%	1%	0%	0%	0%	5%	1.778
2015	31%	20%	17%	5%	3%	1%	2%	4%	3%	2%	0%	2%	0%	0%	0%	1%	0%	7%	1.747
2016	30%	21%	16%	5%	3%	2%	2%	4%	3%	2%	0%	2%	1%	1%	0%	0%	1%	8%	1.648
2017	28%	21%	18%	4%	3%	3%	2%	2%	2%	2%	1%	1%	1%	1%	1%	1%	1%	10%	1.570

Figure 7.5 Evolution of the shares of energy supplied in the free market by marketing group. SME segment. Source: CNMC 2019

	ENDESA	IBERDROLA	NATURGY	FORTIA	EDP	ACCIONA	AXPO	VM	FENIE	ENGIE	VIESGO	CEPSA	NEXUS	DLR	OTROS	HHI
2009	36%	16%	14%	12%	12%	0%	0%	1%	0%	0%	1%	0%	0%	0%	8%	2.097
2010	38%	15%	12%	11%	12%	1%	2%	2%	0%	0%	1%	0%	1%	0%	5%	2.083
2011	37%	15%	10%	10%	11%	3%	3%	2%	0%	0%	2%	1%	1%	0%	6%	1.940
2012	35%	12%	11%	9%	11%	5%	5%	3%	0%	2%	3%	1%	1%	0%	2%	1.770
2013	36%	10%	12%	8%	12%	4%	4%	3%	0%	3%	4%	1%	1%	1%	2%	1.794
2014	33%	14%	11%	9%	10%	3%	6%	3%	0%	2%	4%	1%	1%	1%	3%	1.650
2015	35%	14%	12%	9%	12%	4%	3%	3%	0%	2%	2%	1%	1%	1%	3%	1.795
2016	35%	18%	12%	8%	9%	4%	3%	3%	0%	2%	1%	1%	1%	1%	3%	1.888
2017	33%	18%	11%	9%	7%	5%	3%	2%	2%	2%	1%	1%	1%	1%	4%	1.757

Figure 7.6 Evolution of the shares of energy supplied in the free market by marketing group. Industrial segment - CNMC 2019

According to some authors (Capellán-Pérez et al, 2018), the power of traditional utilities has not been challenged despite the increase in RES capacity in Spain in the period 1997-2012. However, the energy cooperatives have increased since their first steps in 2010. The authors argue that the current structure of the market (five companies concentrate around 80% of the final customers), the economic crisis of 2008, the possibility of trading electricity since 2010, and the influence of political movements such as the 15-M and legislative curb to renewable energies since 2012 spurred the development of these initiatives.

In addition, renewable energy organisations such as the Spanish Association of Renewable Energy Companies (Asociación de Empresas de Energías Renovables, APPA) currently represents a “de facto power” that did not exist before.

7.1.3 The technological landscape

During the first years of the 2000s, there was a surge of in the installed capacity of gas combined cycle (GCC) in parallel to the promotion of RES technologies. This surge was caused by the installation of GCC by traditional electricity companies in Spain. The large amount of installed capacity leads to a situation of overcapacity in the Spanish electric system. Since 2008 the installation of GCC has been stable, with no additional installed capacity.

With the promotion of renewable resources in the wind technologies started to rise and still growing in installed capacity. In addition, hydraulic energy suffered an increase in installed capacity in 2014 and 2015, maintaining stable since then. Solar photovoltaic technologies had a first surge in 2006 and 2007, and then slowed down their development for almost ten years until 2018 when their installed capacity started to grow substantially again.

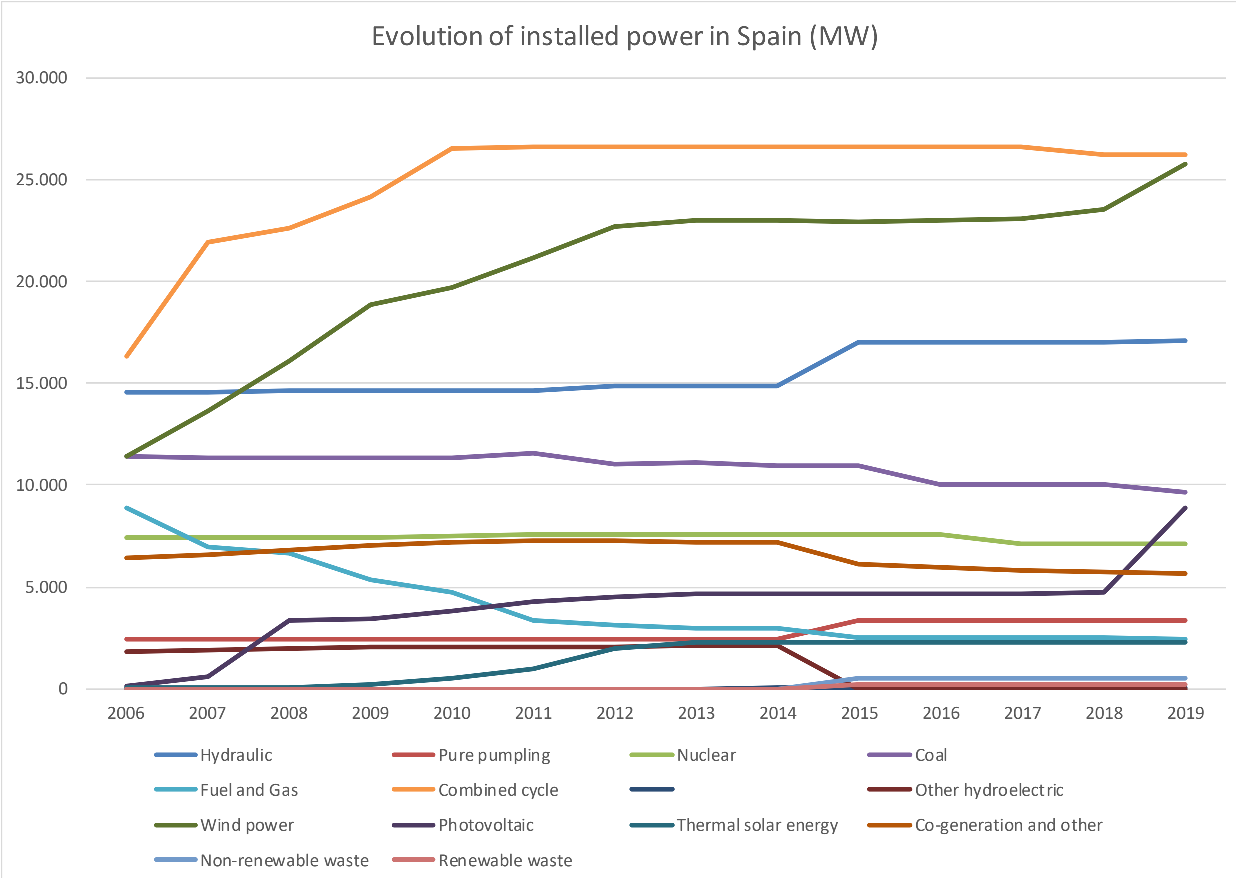

Figure 7.7 Evolution of installed power in Spain 2006-2019 - REE dataset

7.2 Governance

7.2.1 National regulatory framework

The two European Union directives supporting the development of Collective Action Initiative in energy have not yet been transposed into Spanish law.

With reference to the energy governance, the General State Administration, through the Ministry responsible for energy (currently the Ministry for Ecological Transition and Demographic Challenge), has the main regulatory responsibilities.

The Spanish Government created in 1998 the Comisión Nacional de Energía (National Energy Commission) to ensure effective competition in the energy systems and to look after their objectivity and transparency in their operation, in order to benefit all the actors operating in the systems, as well as consumers. This commission was subsequently integrated in the National Market and Competition Commission (CNMC), which is currently attached to the Ministry of Economic Affairs and Digital Transformation and it has its own legal personality and full public and private capacity. It is a public body with its own legal personality, independent from the

Government and subject to parliamentary and judicial control. It is financed through the General State Budgets. CNMC has four different sections: Competition, Energy, Telecommunications and Audiovisual sector, and Transport and Postal sector.

With reference to the energy sector, CNMC supervises the operation and degree of competition in the electricity market, both the wholesale and retail markets, as well as the operation of the system. It manages the system of origin guarantees and labelling of electricity from renewable sources. It also oversees the integrity and transparency of the wholesale energy markets.

Moreover, the Electricity Wholesale Market is managed by Market Operator (OMIE), and the technical and safety corresponds to the System Operator (REE). The latter is responsible for ensuring the correct operation of the electricity supply system and guarantee the continuity and security of the electricity supply. REE manages the entire electrical energy transmission network (high voltage) but does not carry out electrical energy distribution (low voltage). Instead, OMIE manages the daily and intraday wholesale electricity market (intraday auctions and continuous intraday auctions) for Spain and Portugal.

In addition to CNMC, the Ministry for Ecological Transition and Demographic Challenge has among its competencies the establishment of the basic regulation of the generation, transportation and marketing of electrical energy in Spain. It is also in charge of regulating the structure of prices, the rate and the amount corresponding to the use of transport networks and distribution (network access tolls), as well as setting the minimum requirements for quality and safety that must govern the supply of electrical energy that caters to both small and large consumers.

The subsidiary principle applies because regional and local authorities have energy-policy making competences.

In particular, the Autonomous Communities (CCAA) are not a body or an energy institution itself, but they are important, since they have assigned competences in energy and environmental matters. They have a limited margin of action, on occasions, from the regulatory and normative point of view, and they are not able to go beyond exercising a certain capacity for influence, promoting proposals for review and adaptation of the regulatory framework defined by the General State Administration. In addition, CCAA can hold renewable energy tenders, not linked to standardized remuneration or State objectives; or develop environmental taxes different to each other, among others. They can also promote renewable energies and energy efficiency measures through subsidies and grants.

For their part, the municipalities can impose conditions of installation of facilities and infrastructures in relation to licenses, areas of passage, permits, burial, etc. Besides, they can elaborate energy efficiency or mobility plans.

7.2.2 Support mechanisms

Since the liberalisation of the electricity sector in Spain until 2012 there were different financial incentives at national level for producing electricity from renewable sources, waste and co-generation. These regulations contributed to the fast increase in the installed capacity from co-generation and RES.

Firstly, the Royal Decree 2818/1998 provided an incentive model based on feed-in premiums (FiP), and then the Royal Decree 436/2004 established that the producers could choose between Feed-in tariffs (FiT) or feed-in premiums (FiP). Lastly, the Royal Decree 661/2007 introduced the priority access to the grid and a cap-and-floor system for those facilities that fell under the FiP option.

Since 2012, new regulations came into force which eliminated the incentives for new installations and established new taxes for power generation plants. In addition, the Royal Decree 413/2014, which regulates the electricity produced by renewable sources, waste and co-generation, establishes cuts in incentives with retrospective effect. These changes in the regime meant that many private, small RES owners could not have enough revenues to cover their investments and were headed to lack of profitability and bankruptcy. It also entailed that many cooperatives could not produce their own energy because without those incentives, they could not be profitable.

7.2.3 Planning Policies

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The Institute for the Diversification and Saving of Energy (IDEA), which is the main energy-related agency of the national government, has undertaken a line of work to promote Local Energy

Communities, by preparing a guide with the steps to follow for its constitution and the possibility of financing pilot projects.

There are no quantitative targets to obtain in order to the development of energy communities.

7.3 **Bottom-up initiatives**

7.3.1 Legal framework

As above mentioned the two European Union directives have not yet been transposed into Spanish law. Therefore, national law does not yet provide the definition of energy community.

However, IDAE defines "local energy communities" in the same way as the Directive (EU) 2018/2001, that is, as "a legal entity of voluntary and open participation controlled by shareholders or members who are natural or legal persons and also local, regional or national administrations". The definition goes on to state that "the main social objective is to offer energy benefits (from which also environmental, economic or social benefits are derived) to its members or to the community where the activity is carried out, rather than generating financial profitability". With specific reference to the social benefit, there are some general mechanisms to tackle energy poverty, such as the Bono Social de Electricidad, which is a discount rate for vulnerable consumers. The activities to be carried out are, amongst others, "*the generation of energy mainly from renewable sources, distribution, supply, consumption, aggregation, energy storage, the provision of energy efficiency services, the provision of recharge services for electric vehicles or other energy services*".

Most of the energy communities marketing renewable electricity are cooperatives, where each member has one vote and all members of the cooperative can participate in the decision-making process. In the case of renewable generation plants, the most common ownership model is of partnership limited by shares. This is the case of wind parks or solar photovoltaic plants.

Energy communities that are retailers need to obtain an authorization of Ministry of Industry, Commerce and Tourism, which will inform the National Commission on Markets and Competition. They are supposed to prove their legal, technical and economic capacity. To prove their economic capacity, they must present to the System Operator (REE) and to the Market Operator (OMIE) the guarantees that are required for the acquisition of energy in the electricity production market in the Technical Operation Procedures and in the corresponding Market Operation and Liquidation Rules, respectively. They also have to pay network access tolls and charges.

Likewise, when the activity is to be carried out exclusively in the territorial area of a single autonomous community, the launch of the activity must be communicated to the competent body in the field of energy of the autonomous community that will transfer it to the General Directorate of Energy Policy and Mines of the Ministry of Industry, Tourism and Commerce accompanied by the responsible declaration and the documentation presented by the interested party. In addition, the energy communities with the legal structure of a cooperative must fulfil the corresponding national or regional Cooperative's Law.

According to Capellán-Perez et al. (2018), the main barrier to access to market for new RES cooperatives is the regulation, which complicates their entrance and operation in the market. In fact, they have big entry barriers to access to the public energy purchase markets because the public bidding process require technical solvency and financial guarantees. This entails a barrier that excludes cooperatives from the process, as they cannot fulfil those requirements.

Guarantee of Origin Certification's objective is to provide information to the consumer, so that they know in detail the origin of the energy received and the associated environmental impact, so that they can make more informed decisions about purchasing electricity. CNMC is responsible to offering the renewable energy producers that request it, the certification of "Guarantee of Origin" of the kWh generated from renewable sources. These certificates can be transferred to the retailers who can thus prove the "green" nature of the electricity they sell.

7.3.2 Attitudes toward the cooperative model

Two important periods can be identified in Spain's recent history related to energy cooperatives. The first wave of cooperatives was between the end of the 19th and beginning of the 20th centuries, when people from peripheral regions collaborated to supply electricity to their businesses and homes, due the fact that there was no interest from the State nor from private investors to connect those areas to the grid. Among those energy cooperatives, there were many RES cooperatives, based on hydroelectric power (Heras-Saizarbitoria et al., 2018). The second wave of energy cooperatives has been from 2010 onwards, when different organizations focusing mainly on the retailing of electricity from RES have been created. While the first wave cooperatives were born out of necessity, the creation of the second wave organizations has been motivated by environmental and social concerns following other European examples (Capellán-Pérez et al. 2018). Even though some experiences of small organizations aiming to promote RES in Spain can be found during the last decades of the 20th century, the emergence of the second wave of RES cooperatives coincided with the impact of the global financial crisis in the country, the increasing social awareness around energy issues and the modification of the regulation in 2010 that allowed cooperatives to retail electricity. The latter favored the beginning of the operation of RES cooperatives in the country, which required significantly lower initial investments than other RES-related activities, such as the construction of power plants. In this line, it is worth noting that, unlike other European countries, no cooperative focusing on RES generation has been created in Spain during the period favorable to RES deployment before 2012 in the country (Capellán-Pérez et al. 2018).

7.3.3 Local activism

The anti-nuclear movement has been strong in some parts of Spain. In the Basque Country important citizen protests against the planned nuclear plants in the Basque Country (Lemoniz and two other possible locations) happened. The protests had started in 1976 with the first massive and legally authorized demonstration in the Basque Country during the "transition" from dictatorship to democracy. Nuclear power is still questioned in the Basque region, as the recent discussion about and the social mobilization against the prolongation of the old plant in Garoña (province of Burgos, close to the Basque region) has demonstrated. Although the anti-nuclear movement was relevant in Spain, it did not lead to the emergence of RES cooperatives as in other European countries (Capellán-Pérez et al. 2018).

In recent years, the supply of electricity in Spain is an issue that has generated and generates a notable public controversy, where the agents of the system itself (traditional or renewable generators, marketers, consumer associations, market or system operators), citizen associations (business, environmental and other) and political parties hold often antagonistic positions.

Wind power plants received very different reactions. While these plants represented hope for change when they were first introduced in Spain, other saw them as a danger because of the environmental impact of wind turbines in landscape and wildlife.

Due to its important side effects, hydropower also receives some opposition. The challenge that hydropower poses for the social challenge of safe water and the burden of the threat of flooding nearby villages to construct new dams are also barriers for the social acceptance of hydropower.

8 Conclusions

Even though there is no straightforward explanation for addressing the differences in the level of development of energy community initiatives in different countries, this report has sought to show the role played by some explanatory factors. We have focused on the historical evolution of the electricity market structure, the technological trends in electricity generation, the changes in the national regulatory framework, the support instruments for renewables, the planning policies, the attitudes toward the cooperative model and the influence of the ecologist and anti-nuclear movements in shaping local energy activism. Table 8.1 presents a synthetic view of the comparative analysis.

The first challenging question is if liberalization of the electricity sector has facilitated or hindered energy transition. The different degree of liberalization in each country had a strong impact on market structure and contributed to determine the opportunity of energy communities to distribute renewable electricity. The liberalization of electricity markets exposes incumbent utilities to competition from new entrants. A high concentration of market actors will quite conceivably reduce the likelihood of renewable energy policy adoption. Furthermore, in markets with a higher level of concentration, incumbent electric utilities are more likely to dominate renewable energy markets, whereas in deregulated power markets independent companies and owners of small-scale distributed generation are more likely to hold significant shares in renewable energy capacity. This is the case of the Netherlands, where the liberalization process resulted in a radical unbundling of the system and many new, mostly small, producers developed, such as farmers, citizens, cooperatives and small companies. On the other side, we have Estonia and Poland. In Estonia the market is still dominated by a single state owned vertically integrated company, which had 97% of the production capacity, 88% of the retail market and controlled the whole transmission network. In Poland four vertically integrated companies, three of them majority state owned and the fourth with a state-owned controlling share, account for 65% of total electricity production and 87% of the Polish retail market. Belgium, Italy and Spain represent a third cluster that is characterized by a higher degree of liberalization in comparison to Estonia and Poland but the market power of historical incumbents has not been significantly challenged.

However, an energy transition process in which incumbent utilities are supplanted mostly by large privately owned generators is different from a transition in which utilities are supplanted mostly by smaller-scale community initiatives. We found that, to survive as serious actor in the energy system, the role of energy communities initiatives need to be explicitly embedded in legislation. For that reason, the implementation of EU and national legislation on participation and ownership is crucial. To this date, the EU Directives 2018/2001 and 2020/944 have been transposed only by Italy, however, only in part and on an experimental basis, with legislation that is temporarily effective and destined to be superseded at the time of full implementation. Indeed, the other countries examined by this report have not yet adopted specific regulatory measures in this direction, limiting themselves to developing energy communities based on the current general regulatory context.

As the analysis of support instruments and planning policies shows, there is also the tendency, started after the Great Recession of 2008-2012, toward a more hostile environment for community initiatives. The increase in community energy projects and in renewable energy capacity installation was significant in Europe during the period 2000-2010, because of the implementation of renewable energy support measures (Feed-in tariffs, installation subsidies) implemented in many EU countries to support the increase of RES. These measures had a typical duration of 10-13 years after which they have been replaced with less intense support. However, the market power of traditional utilities in almost all the countries analyzed was not challenged. As a result, when the electric demand decreased due to the crisis and the conflict of interest arose, a systematic protection of the traditional utilities was carried out at expenses of renewable sources.

This has been particular clear in the case of Belgium, Estonia, Italy, Poland and Spain. On the one side, Estonia and Poland suffer from a very strong economic-political lock-in due to the dependence on domestic sources of fossil fuels - oil shale in Estonia and coal in Poland – that put the renewable sector at economic and political disadvantage. In particular, the design of the support mechanism for renewables in Poland determined the main winners and losers of the shifts in the energy sector. Incumbent energy companies received “green certificates” for energy produced in their decades old hydro-power plants and for burning biomass in coal-fired power plants, and so they constituted the main beneficiaries of the support mechanism. On the other side, low-risk investment conditions created by fixed Feed-in tariffs (FiT) contributed significantly to the development of energy communities in Italy and Spain. The fixed Feed-in tariffs regime was abandoned in both countries after the 2012, resulting in a higher exposure to volatile electricity market prices and creating a major obstacle for the occurrence of new initiatives and the survival of existing ones. In Belgium, the introduction in 2001 of a quota system based on trade of green certificates has favored incumbent players to the detriment of small-scale initiatives. After 2011, the green certificate systems have undergone deep changes, both in Flanders and in Wallonia, which resulted in a steep decrease in the value of certificates. These changes have had important consequences for RE producers, including cooperatives, whose income declined steadily. The Duct case represents an outlier due to the introduction in 2014 of a new support mechanism: the zip code scheme, a lower energy tax on electricity in the case of collective generation by a cooperative within a certain postcode area.

From the perspective of policymaking, our analysis shows a number of policies that stimulated the emergence and development of energy communities projects. These can be direct and indirect support instruments. Direct instruments include, for example, specific loans or guarantees schemes, technical assistance and capacity building, partnerships with government agencies. Indirect instruments include the promotion of renewable energy, the eco-social requisites in public tenders, etc. In addition, in Belgium, Spain and the Netherlands, the policies and incentives developed at regional/local level are playing a fundamental role in shaping an energy transition based on democratic, sustainable and decentralized production. Estonia is characterized by unfavorable planning conditions for small-scale and participatory projects. There is no an institutional or public involvement in creating energy communities. In Poland, the main barrier to access to market for new RES initiatives is represented by the significant administrative, which complicates their entrance and operation in the market. However, we have to stress that the set of governance policies – support mechanisms and planning policies – adopted by a country at some point in time seems to be often, at least partly, the outcome of the political equilibrium reached at that moment.

The most diffuse legal form for the establishment of energy communities is the cooperative. In the Italian and Spanish case, the reason is probably to be found in past experience characterized by the spread of these subjects, especially in the most disadvantaged areas of the nation where the central administration encountered difficulties in distributing the electricity produced by conventional plants. In general, all the countries examined require energy cooperatives to comply with the "one head, one vote" principle, establishing in some cases internal shares of benefits. In addition to cooperatives, the examination has shown how the other legal forms adopted for the establishment of energy communities are also associations and limited liability companies. The latter subject is likely to find widespread diffusion, especially with reference to the energy communities of citizens, whose organization seems more complex than the renewable energy communities in light of European directives.

We can confirm that the extent to which a society is familiar with the cooperative model plays a role in the diffusion of community energy initiatives. In countries where the cooperative movement has an old and well-established tradition, people know about this legal structure and are aware of its benefits. In countries where the general public and other actors are less familiar with this model, this low awareness may potentially constitute a "cognitive barrier" (Huybrechts and Mertens, 2014). In this perspective, the historical experience of state socialism followed by a quick transition to market economies in the 1990s partially explain the negative view of collective ownership in Estonia and Poland, particular the widespread mistrust of the cooperative institutional structure, born out of its misuse by the establishment during the socialist era.

	Belgium	Estonia	Italy	The Netherlands	Poland	Spain
Market and Technology						
Electricity consumption	Energy consumption is stable. In 2019 net imports of electricity turned negative for the first time since 2009.	In the period of 1999-2018, the energy consumption in Estonia has increased by 30%	Electricity consumption decreased by 7,5% from 2008 to 2018. In 2018 the net import of electricity represented 14.5% of the national electricity consumption.	During the last years, electricity consumption and export remained stable, while import rose.	Between 1990 and 2018 the Polish electricity consumption Poland increased by 32.5%. At the same time, the electricity production increased by only 14.8%.	Between 1990 and 2018 electricity consumption almost doubled.
Market development	Electricity generation in Belgium is still clearly dominated by Electrabel, the incumbent company and former state monopoly. A similar situation prevails on the electricity supply market.	The dominant electricity producer, Eesti Energia (market share above 90%), is state owned and it is still protected by the direct and indirect subsidies and by the market regulations.	The Enel Group keeps its dominant position in the electricity market primarily due to its substantial dominance in the mass market.	The Dutch electricity system is one of most liberalized.	**After 2006**: consolidation of Polish electricity sector into four vertically integrated companies, three of them majority state owned and the fourth with a state-owned controlling share.	Electricity companies maintain a "high concentration" of the market in the domestic segment despite the push from small retailers.
Electricity mix	Nuclear generation still represents 50% of the total electricity produced. Over the past 10 years there is a notable increase in the production capacity of renewable electricity in Belgium, mainly solar and wind energy (30% of the total installed electrical capacity in 2018)	The share of oil shale in the primary energy supply has increased, from 52% in 1990 to 71 % in 2014. The main renewable source is wood.	In 2018, 40% of gross electricity generation was produced from renewable sources, while 60% was achieved with thermoelectric plants; among these, natural gas provided 45% of overall gross generation. Hydroelectric production has traditionally been the most important RES in Italy in terms of installed capacity.	Next to natural gas, oil is the most important source of energy, of which most is imported. The third most important source is coal, which is all imported. Renewables represented 6% of the Dutch energy mix in 2019: biomass is the most important RES.	At the end of 2019, the Polish energy-mix was based on brown coal (lignite) and hard coal (70%), followed by renewable sources (20.1%) and natural gas (5.7%). The most important renewables were wind, biomass, water and biogas.	Combined cycle, with 21.9% of the total national generation, has been the technology that most contributed to the Spanish generation mix in 2019, followed by nuclear (21.2%), wind (20.6%), cogeneration (11.4%) and hydro (9%). Behind these is coal, with 5% of the total national generation.

Energy sector governance

Support mechanisms	**2001**: quota system based on trade of green certificates: it tends to favor incumbent players to the detriment of small-scale initiatives	Feed-in tariffs and investment support has been used in promoting renewable energy.	**2005-2013**: low risk investment conditions for photovoltaic plants due to fixed Feed-in tariffs	**From 2003**: introduction of a subsidy scheme that compensates energy producers for differences between the cost price of renewable energy and the market value of the energy supplied	**1999**: introduction of a quota system that guaranteed an identical price for all renewable sources of energy.	**1998**: first law that allowed for the Feed-in of RES.
	After 2010: saturation of the green certificates market and decrease in income for RE producers		**From 2019**: tax incentives linked to the nature of an innovative start-up company. If the energy community takes this form, then the investment entitles it to the 30% tax credit by keeping the participation for at least three years.	**2014**: introduction of a zip code scheme (lower energy tax on electricity in the case of collective generation by a cooperative within a certain postcode area)	**2005**: creation of a green certificates market. Under the "green certificates", energy coming from biomass burnt in old coal-fired power plants and decades-old large hydro-power plants was rewarded in the same way as wind and solar energy. **After 2016**: as a result of the record oversupply of green certificates, change of the auctions support system, and new tax regulations the profitability of existing RE producers were significantly reduced	**2012-14:** new regulations came into force which eliminated the incentives for new installations and established new taxes for power generation plants
Planning policies	**2013**: in Wallonia, obligation for developers to open capital of new projects for citizen and municipalities participation	Unfavorable planning conditions for small-scale and participatory projects. There is no an institutional or public involvement in creating energy communities.	**2019**: it is allowed the small-scale collective self-consumption of renewable energy plants below 200 kW for customers linked to the same low voltage distribution sub-grid.	Incentives for the participation of the local stakeholders in the realization of wind and sun on land, and in particular in the pursuit of 50% ownership of the local communities.	A partial advantage is the exclusion of the obligation to hold a license for the production and trade of electricity for the collective prosumer when the total installed electrical capacity of renewable energy installations in the area does not exceed a certain level.	Historically, coal and nuclear plants have received government's subsidies that has posed barriers for renewables to compete in the generation.
	2019 : Wallonia adopted a decree that explicitly favor the development of renewable energy communities	Currently, there is not a definition for energy communities in national legislation.				The main barrier to access to market for new RES initiatives is the regulation, which complicates their entrance and operation in the market.

Bottom-up initiatives						
Attitudes toward the cooperative model	Long historical cooperative tradition but co-existence of “true” and “false” cooperatives (creation of "top-down" cooperatives by incumbent companies).	Negative historical experience of collective ownership. Renewable energy communities may act as a limited liability companies as well as public limited companies	Long cooperative tradition. Hydroelectric cooperatives emerged as early as the first half of the twentieth century in the Alpine area of the country.	Long cooperative tradition. Already at the start of the 20th century, some Dutch citizens started to organize in energy cooperatives.	The experience of real socialism destroyed the ideas of cooperative activity. The importance of cooperatives on the energy market is marginal.	Long historical cooperative tradition, including in the electricity sector
	2013: REScoop Belgium was created to promote the cooperative ideal.		Some energy communities are cooperatives based on the principle “one head, one vote”. Others are partnerships limited by shares through the start-up model.	In 2019, the Netherlands counted about 600 energy cooperatives.		
Local energy activism	Weak anti-nuclear movement but some cooperative rooted in local protests against nuclear wastes.	Historical examples of energy activism on local and even on national level against intensive production of oil-shale	Strong anti-nuclear movement. Some founders of energy communities have links with the environmental movement of the1970s.	Strong anti-nuclear movement, but cannot explain the new wave of energy cooperatives after 2010. Important role played by profitability expectations.	Strong anti-nuclear movement.	Strong anti-nuclear movement in some parts of Spain.
	Since 2011, onshore wind projects in Wallonia are recurrently blocked, as the population shows resistance to projects developed by big companies.	Barriers for the social acceptance of wind power		Half of the production cooperatives are founded by new type of initiators, such as resident groups, associations of owners, companies or project developers.		Barriers for the social acceptance of hydropower.

Table 8.1 Synthetic table

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