# Energy Governance in Portugal

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## Abstract

Portugal is in the middle of a major transformation of its energy supply, which has been shaped by internal resource constraints, growing environmental concerns, and the dynamics of European integration. Portugal's past choices – the investment in hydro power and the refusal of nuclear energy – and the lack of an endowment of resources have constrained the Portuguese energy policy. With the accession to the European Union in 1986, environmental concerns moved up the Portuguese policy agenda. The EU's push for a common electricity market influenced a set of policies oriented towards the liberalization of the energy market, which was centralized, monopolistic, and public-owned. The investment in renewable energy gained momentum in the 2000s, led by the Portuguese government and EDP, the (then) publicly-owned energy company, supported by a public discourse on climate change and energy policy imbued with economic rationality. The financial crisis that hit Portugal in 2010 led to a temporary stall in the promotion of the use of energy from renewable energy sources (RES), but new market-based support schemes, such as photovoltaic solar auctions, have fostered the recent new investment in renewables.

**Keywords:** Portugal; energy governance; renewable energy; energy transition; energy policy; climate policy; feed-in tariffs; solar auctions

## 1. Introduction

Portugal is in the middle of a major transformation of its energy supply. The Portuguese Energy and Climate Plan projects a significant shift towards renewable energy combined with a decommissioning of coal power plants, improved energy efficiency, investment in technologies that substitute oil in the transportation sector, and better interconnections with Spain (and, indirectly, with France and Europe) to achieve the goals of the European Energy Union (European Commission 2020). The commitment to ratify the Paris Agreement is a key driver, and a National Plan for turning the economy carbon neutral by 2050 was approved in 2019 (República Portuguesa 2019a). In 2018, Portugal's gross inland energy consumption of renewables reached 30,3%, while the EU average stood at 18.9% (Eurostat, 2020)

This chapter maps the evolution of the Portuguese energy governance, focuses on the development of renewable energy that has been at the core of the Portuguese energy transition, and identifies the drivers and major actors that have been relevant in shaping this policy. The Portuguese transition has been driven by internal resource constraints, growing environmental concerns, and European integration. Early Portuguese energy policies took a pragmatic approach to energy efficiency and independence with an investment in coal and oil, as well as hydro power (Madureira 2002), which was the most accessible endogenous energy resource in the country, but refrained from including nuclear energy in the national energy mix (Barca and Delicado 2016: 504). These choices shaped the Portuguese investment in renewable energy and the evolution of the Portuguese energy mix in the 1990s and 2000s.

With the accession to the European Union in 1986, environmental concerns moved up the Portuguese policy agenda, and more coherent environmental policies were developed (Araújo and Coelho 2013: 147-148). Since then, successive governments have prioritized energy security, energy efficiency, and sustainable development. The European Union's push for a common electricity market and the recommendations and directives aimed at the liberalization of national energy markets influenced the Portuguese policies. In the late 1990s, Portugal initiated the liberalization of its energy market which previously was centralized, monopolistic, and public-owned. Since then, all public companies – including the transportation and the distribution companies that have high stakes in energy supply and security – have been privatized, the retail markets have been deregulated for industrial and household consumers, and an Iberian energy market has been created, which facilitated the import and export of energy (although limited by network capacity).

In the 2000s, investment in renewable energy gained momentum. The main actors were the Portuguese government, pushing forward the renewable agenda in tandem with the EU, and EDP, the (then) publicly-owned energy company. The energy mix changed as the share of renewable energy sources (RES) in electricity generation increased and fossil fuel consumption declined. By 2010, the economy had significantly reduced its energy intensity (Guevara and Domingos 2017) and Portugal

had become a forerunner in RES deployment. The Portuguese energy transition became palpable.

Public discourses on climate and energy policy were strongly influenced by notions of economic rationality (Carvalho et al. 2014). The media and government emphasized the idea of ecological modernization, explaining the need for climate change mitigation and the benefits of a green economy. However, despite high levels of environmental concern, centralized processes of decision-making hindered civic participation in the definition of environmental and renewable energy policies (Delicado 2015b). This has changed more recently, as both policy makers and private actors seek to include other stakeholders in policy debates.

The financial crisis that hit Portugal in 2010 led to a temporary stall in RES promotion. However, unlike its neighbor Spain, Portugal never abandoned its commitment to renewable energy support. Instead, renewable energy support schemes were revised to become more cost-efficient and the push for energy market liberalization increased (see below). New market-based support schemes, such as photovoltaic solar auctions, were introduced (Jörgens 2020) and investment in renewables resumed with less public incentives and more private commitment. The Portuguese milestones for 2030 are ambitious: the rate of electrification shall rise to in all sectors and the overall penetration of renewables shall reach 47%, with 80% in the final consumption of electricity, 38% in heating and cooling, and 20% in transports (República Portuguesa 2019b).

## 2. General conditions of Energy Governance in Portugal

### 2.1. Legacies of Energy Governance

In the first half of the twentieth century agriculture was the most important pillar of the Portuguese economy (Araújo and Coelho 2013). While coal was the main source of energy, hydro power constituted the most accessible endogenous energy resource (Law 2002 of 1944), and the need to electrify energy consumption led to a significant investment in hydroelectricity. By the end of the 1960s hydro power was responsible for more than 90% of total electricity production (Madureira 2002). Together with coal, these were the two main energy sources up to the 1970s. Oil became increasingly used in industry and transportation in the 1970s and exposed the Portuguese economy to the oil shocks of 1973 and 1979 (Araújo and Coelho 2013).

After the revolution of 1974, the Portuguese power sector was nationalized. All existing public and private electricity producers were merged into the new energy company Electricidade de Portugal (EDP) (Decree Law 502/76), which became responsible for the production, transmission, distribution and retailing of electricity. A first feed-in tariff scheme was approved already in 1981 (Decree Law 20/81) with the goal of reducing oil imports and in 1984 the National Energy Plan (Plano Energético Nacional) diagnosed that Portugal needed to increase energy efficiency and develop alternative energy sources. The plan triggered a national debate about the adoption of nuclear power (Araújo 2013), an option that was never realized and was ultimately abandoned in 1986 (Barca and Delicado 2016: 504). This renunciation of nuclear energy differentiated Portugal from its two closest neighbors – Spain (the first nuclear power plants were installed in the 70s, and nuclear energy has developed since then) and France (nuclear power plants were installed in the 60s, and have dominated French electricity production since the 80s) – and aligned Portugal with smaller EU countries which had similarly rejected the nuclear option (e.g. Denmark and Ireland).

After Portugal's adhesion to the EU, the country stabilized politically and economically. In the next ten years, the Portuguese economy averaged an annual growth rate of 3.81% (PORDATA), and the increase in energy consumption was matched with investments in coal and gas power plants. This reduced the Portuguese oil dependence in electricity generation, but not its overall dependence, as oil consumption increased from 6 Mtoe in 1990 to more than 10 Mtoe in the early 2000s (European Commission 2020). In 1987, already within the EU context, environmental concerns became part of the Portuguese policy agenda (Araújo 2013) and general environmental laws were approved (Lei de Bases do Ambiente, Lei das Associações de Defesa do Ambiente). The government plan of 1987-1991 referred explicitly to the use of endogenous, renewable energy sources for electricity generation. Since then, all governments have included this point on their policy agenda (Araújo and Coelho 2013). Despite the existence of domestic coal reserves, coal mining had not been competitive since the 1970s. Environmental groups, which perceived coal mining as degrading the natural landscape and the environment, together with weak stakeholders in this industry (Caetano 1998), led to the decay of coal mining in the

early 1990s (Miguel et al. 2018: 6). Portugal now depends on imported coal (Miguel et al. 2018; Pinho and Hunter 2019), with national coal production having ceased in 1994.

In 1988, the year when the first small-scale pilots for wind energy production were installed in the Azores (Santa Maria) and Madeira, the regulatory framework that governed the energy sector since 1977 changed. Private business activity in the energy sector (Decree Law 449/88) was explicitly allowed in all stages of the value chain – production, transportation, distribution, and retailing. Energy producers and energy distributers could apply for operation licenses to the National Electricity Transmission Grid (RNT), a public company created in 1991 (Decree Law 99/91) to manage the electricity transportation network for high voltages. And in 1993, the integration of natural gas in the Portuguese market was regulated (Decree Law 274-C/93).

The 1994 Energy Program (Decree Law 195/94) established as a priority the replacement of fossil fuel consumption. Within this program investments in the development or installation of technology that used either natural gas or renewable energy sources would be eligible for public subsidies leveraged by European funds. In 1995, the Portuguese electrical system was divided into two interdependent systems (Decree Law 182/95) – the public system (SEP) and the independent system (SEI), subject to different regulations. Both cogeneration plants and RES became part of the SEI, and a RES-specific incentive, which guaranteed support for up to 50% of the investment needed to develop or install a RES technology, was approved (Legislative order 11-B/95). Compensation contracts were given to incumbent energy producers guaranteeing returns for the next fifteen years. A Regulatory Authority for Energy Services – Entidade Reguladora dos Serviços Energéticos (ERSE) – was also created.

By 1995, all the institutions required for further liberalization of the sector were in place. Hydro power had been the renewable energy most consistently promoted, while oil and coal dominated the primary energy sources. In the 1990s, Portuguese energy import dependency averaged 83.7% – which rose to 84.3% in the 2000s and declined to 75.3% in the 2010s (European Commission 2020).

### 2.2. Composition of the Energy Mix

In the first half of the 20th century, coal was the main source of energy, followed by hydro power. Only from the 1960s did petrol use increase in Portugal's energy mix. While in 1995 residential and industrial energy needs were covered almost completely by oil and coal, in 2010 renewables produced the largest share of electricity available to consumers (Guevara and Domingos 2017: 134).

Oil still is the primary energy supply in Portugal (see figure 1). Portugal imports its oil from a range of suppliers to cover about 50% of its energy needs (IEA 2016). However,

after peaking in the 2000s, the importance of oil in the Portuguese energy mix is declining.

<Energy Governance in Portugal, fig1.jpg>

**Figure 1:** Total energy supply. **Source**: EU Commission (2020).

Coal has been a relevant primary energy supply in the 1980s and 1990s. Since the 2000s, its consumption is declining, with natural gas partially replacing coal (see figure 1; note: in figures 1 and 2 coal is included in the category “solid fossil fuels”). Coal is used for electricity generation in the two coal-fired power plants in Sines (1250MW) and Pego (620 MW) that serve as a backup system for periods of low renewable energy production, or in draught periods when hydro power output is lowest (Miguel et al. 2018). Currently, the coal power plants are being phased out and should be fully decommissioned by 2023 (PNEC 2019: 36). Biofuels have been used in industrial production processes and residential and commercial heating. Since the 2000s, a small but increasing fraction of transportation runs on biofuels.

The share of renewables in final energy consumption is increasing (see figure 2). Solar thermal is used mainly for warm water and biofuels are used for heating (the green stripe in the graphic). 50% of the final consumption of electricity (the yellow stripe in figure 2) is also made from renewables and the share of renewables in electricity generation is continuously increasing (see figure 4). The overall increase in electricity consumption – observed in the industry, the residential, and the commercial segments – further consolidates the role renewables have in final consumption. On the other hand, the final consumption of oil, mostly used in transportation, is declining.

<Energy Governance in Portugal, fig2.jpg>

**Figure 2:** Final energy consumption. **Source**: EU Commission (2020).

The boom of wind and, to a lesser extent, solar power has been the main driver of the increasing domestic energy production in Portugal (IEA 2016: 16) – wind generation now accounts for about one-fifth of energy production (see figure 3). Portugal produces only renewable energy: the largest share belongs to solid biofuels, followed by wind and hydro. These account for more than 90% of national energy production.

<Energy Governance in Portugal, fig3.jpg>

**Figure 3:** National energy production. **Source**: EU Commission (2020).

The Portuguese energy transition becomes most visible with regard to electricity generation (see figure 4). Renewables are now responsible for generating about 50% of Portugal's electricity needs. This success in greening electricity generation has turned the further electrification of industry, transport, and household consumption into one of the primary goals of the Portuguese energy transition. Overall, electricity and biofuels today account for about 40% of final energy consumption, and this share is continuously increasing, while fossil fuel consumption is declining.

<Energy Governance in Portugal, fig4.jpg>

**Figure 4:** Gross electricity generation, by fuel. **Source**: EU Commission (2020).

In 2019, renewable energy sources were responsible for 51% of electricity consumption (slightly below the 52% of the previous year). Wind turbines produced 26% of the overall consumption, followed by hydro (17%) and solar power (2.1%). Coal was responsible for 10% of consumption and natural gas for 32% (REN 2019).

### 2.3. Discourse on energy issues

Media discourse analyses suggest that the social construction of climate change in Portugal has been strongly influenced by policymakers, with the media often reproducing official discourses of administrative and economic rationality, and rarely adopting critical stances. Mitigation of climate change is regarded as solvable by state and expert-led policies and ecological modernization – that is, policies that promote technological solutions to increase the eco-efficiency of products, production processes and services (Jänicke 2009) – can be a driver of economic growth (Carvalho et al. 2014; Delicado 2015b; Horta and Carvalho 2017). While the media focuses mainly on economic issues, citizens are concerned with environmental degradation and global warming and consider the investment in renewable energies an adequate response to the risks associated with climate change (Delicado 2015b: 136).

Overall, the Portuguese show high levels of concern regarding the environment, viewing climate change as a serious personal and global threat (Carvalho et al. 2014). According to the 2019 Parlemeter (European Parliament 2019), climate change and the environment rank fifth after social exclusion and poverty, employment, health, and economic growth. Portuguese citizens view climate change as the most pressing environmental concern, followed by pollution, water, and forest-related concerns, and only then energy issues (eighth position). However, a 2009 Eurobarometer survey shows that the Portuguese feel poorly informed not only about the causes but also about the consequences and ways to combat climate change. Thus, the high levels of

concern among Portuguese citizens go along with relatively low levels of knowledge about climate change (Carvalho et al. 2014: 208).

According to a survey led by Ribeiro et al. (2014), solar and wind power lead the preferences of the Portuguese towards renewable energy, with hydro power ranking last (but still with a 77% acceptance rate). Moreover, the economic outcomes of renewable energy projects rather than their positive environmental impact are the fundamental drivers for the population's acceptance of renewable energy (Ribeiro et al. 2014: 48).

Levels of civic participation are quite low, as the Portuguese tend to have limited trust in public officials (Carvalho et al. 2014). Government initiatives engaging civil society have been scarce, with a preference for top-down approaches and centralized forms of decision-making, with no real fora for active participation or feedback from civil society representatives (Carvalho et al. 2014; Delicado et al. 2014; Jörgens 2020). Companies from the energy sector tend to organize themselves to lobby for greater investment in renewables, but the state is seen as unavailable to listen to other stakeholders (Delicado 2015a). Environmental non-governmental organizations (ENGOs), on the other hand, tend to have an ambivalent discourse, due to the "green on green" dilemma: they tend to support the development of renewable energies, while also showing concerns for its negative social and territorial impacts. Overall, Portuguese ENGOs support energy generation on a smaller scale, with less local environmental impacts, criticize incoherent planning in renewable energy deployment, and accuse the government of favoring the big energy companies (Delicado 2015a: 91).

Due to the weak tradition of environmental politics and values, Portugal's governmental climate change policies have been shaped and applied under a strong influence of the EU (Carvalho et al. 2014: 199). Until the first decade of the 21st century, renewable energy policy was relatively unaffected by changes of government. The main political parties – the social democrats on the center-right and the socialists on the center-left – have had divergences that resulted in complementary policies: the center-right pushed for liberalization, while the center-left pushed for state incentives for renewables.

However, after the strong investment by the governments led by socialist prime minister José Sócrates (2005-2011), and in the context of the financial crisis, the center-right government elected in 2011 adopted a more reluctant stance toward investments in renewable energy, giving greater priority to financial stability (Araújo & Coelho 2013; Boemi & Papadopoulos 2013; Delicado 2015a; Andreas et al. 2019). Ecological arguments lost importance, and economic factors became more dominant in the political discourse (Soares & Silva 2014; Delicado 2015a). Parties on the center-right criticize the feed-in tariffs that create additional costs for domestic and industrial consumers while opposition parties on the left criticize government policies for favoring big companies instead of consumers (Delicado 2015a).

Even though the Portuguese show a strong concern for the environment, this has not affected the emphasis given by mainstream political parties during elections (Volkens et al. 2020). Aside from the two green parties – PEV and PAN – environmental concerns are not given particular attention by most Portuguese parties in their political manifestos. Nonetheless, there was an increase in party attention after Portugal joined the EU. By contrast, during the 2008 economic crisis, all parties lowered the emphasis given to environmental topics.

### 2.4. Political institutions and actors

*Government*

The Ministry of Industry and Energy was created in 1980 and existed until 1995 (with a brief interruption from 1985 to 1987). From 1995 to 2013 energy policies were conducted by secretaries of state under the Ministry of the Economy. However, from 2005 to 2009, prime minister José Socrates – who previously had been Minister of the Environment from 1999 to 2002 – assumed the responsibility for energy policy, focusing on the promotion of renewable energy (Resolution of the Council of Ministers 169/2005). In 2013, the Ministry of Environment, Territory and Energy was created and existed until 2015. In 2018 the Ministry of Environment and Energy Transition was created, which is responsible for climate policy and for achieving a competitive, resilient and low-carbon economy. In 2019 its name was changed to Ministry of Environment and Climate Action.

*Administrative actors*

Within the Ministry for Environment and Climate Action, the Directorate-General for Energy and Geology (DGEG) is responsible for the development and implementation of policies related to energy sources. The competencies relating to energy efficiency at the local or regional levels rest with municipal authorities. Local actors are supported by regional energy agencies, whose main role is to identify local needs and to find solutions to reduce energy consumption (IEA 2016).

The Energy Services Regulatory Authority (ERSE) is the national regulatory authority for natural gas and electricity. It is a financially autonomous public corporate body whose purpose is to oversee the natural gas and electricity sectors, protecting the rights and interests of consumers in relation to prices, service quality, information access, and security of supply, while also regulating transmission, distribution, and supply infrastructures. The Agency for Energy (ADENE) is responsible for managing and certifying the energy efficiency sector and related areas (IEA 2016). Finally, the Portuguese Environmental Agency (APA) is a public institute under the authority of the environmental ministry. Its mission is to propose, develop and monitor environmental and sustainable development policies, in close cooperation with other public and private entities. APA also manages the Portuguese Carbon Fund, which provides financial support to the transition to a low-carbon economy (IEA 2016).

*Green parties and the environmental movement*

Despite their impact on politics and policy, a strong Green party supported by the main environmentalist organizations is still missing from the political landscape (Queirós 2016: 64). There are two small environmentalist parties in Portugal – Ecologist Party "The Greens" (PEV) and People-Animals-Nature (PAN). Founded in 1972, PEV has always been in an electoral coalition with the Portuguese Communist Party (PCP) and is seen as an attempt by the PCP to take hold of the environmental electorate (Biorcio 2016: 191; Silveira et al. 2019: 15). PAN, which gained its first seat in parliament in 2015, was founded in 2009 by a small and diverse group of activists who advocated for a strengthening of animal rights and environmental protection and who reject a right-left-positioning (Silveira et al. 2019: 85). In the 2019 elections PAN received 3.3% of the vote and gained 4 parliament seats. Since its foundation the party has gradually moved from a single-issue animal rights party to a more broadly positioned green party. In the European Parliament it has joined the Greens while the PEV together with PCP is part of the Left in the European Parliament.

PEV presents itself as an alternative to the "economic environmentalism" of the two main Portuguese parties – the Socialist Party (PS) and the Social Democrat Party (PSD) – defending a decentralized and participative environmental strategy (Silveira et al. 2019). Despite close coordination of its program and activities with the coalition partner PCP, the two parties sometimes diverge on energy matters. While PCP is in favor of nuclear energy and the strategic use of fossil fuels, PEV rejects it completely, defending renewable energies and the closure of nuclear plants in neighboring Spain (Carius and Jörgens 1993; Biorcio 2016; PCP 2019; PEV 2019). PAN, on the other hand, defends an energy transition based principally on wind and solar power, and greater democratization and decentralization of energy production, with greater investment in new RES, such as tidal, hydrogen, and geothermal power (PAN 2019).

Despite their rather small membership, Portuguese ENGOs have gained increasing influence on the national environmental agenda since the 1990s. This has mainly been due to the high level of professional skills of their members and representatives. Taking a technocratic approach, they ground their positions on scientific knowledge, allying with private and public actors to pursue ecological objectives (Franco 2015:99; Sardo & Weitkamp 2012). According to Queirós (2016), the environmental movement has transformed into a form of "professional environmentalism", focusing its activity on influencing policy-making, rather than changing the populations' beliefs (Queirós 2016: 63-65; see also Carius and Jörgens 1993). Nonetheless, environmental groups still engage in localized strategies, mobilizing popular support for causes that are physically closer to citizens (Guimarães and Fernandes 2016). The most relevant environmentalist organizations, by size and influence, are LPN (League for Nature Protection), founded in 1948, Quercus (1984), Geota (1986), and Zero, created in 2015. LPN is a conservationist organization that focuses on species protection, responsible for the creation of the main protected areas in Portugal (Queirós 2016: 62). Quercus was founded by academics and skilled professionals who aimed to

become agenda-setters in environment-related policies in Portugal. It has strong connections with public bodies and environmental authorities (Queirós 2016: 63). Two years after Quercus, Geota (Environmental and Land Use Planning Study Group) was founded, working as a think tank dedicated to environmental education (Queirós 2016:63). Zero was created by Quercus dissidents. Inspired by the 2015 Paris Agreement, it focuses on achieving "zero waste, zero unsustainable consumption and zero ecosystem destruction" (Neves 2016).

*Transmission and distribution companies*

The management of natural gas and high voltage electricity distribution networks is under the responsibility of National Electric Network (REN), which has the concession to explore the Portuguese transmission network in a public service regime (IEA 2016; Torres et al. 2016). The medium to low voltage distribution network is managed by EDP Distribuição, a company that was created when EDP was split into different companies in 2005 (Lourenço 2010:23).

*Energy generation and retailing companies*

The energy transition brought new players into the energy market, although incumbents also seized the opportunity to grow in the market for renewable energies. Considering wind energy – the fastest-growing energy market in Portugal in the late 2000s and 2010s – EDP Renováveis (23.5%), Iberwind (13.6%), Finerge (12.7%), Trustwind (9.2%), and Generg (8.2%) accounted for more than two-thirds of installed capacity in 2016 (https://www.iberwind.pt/pt/o-poder-do-vento/mercado-portugues/). The retail electricity market is dominated by EDP Comercial, with over 77% of the liberalized market. The natural gas market is dominated by two main distributors: GALP Energy and EDP Comercial (IEA 2016). GALP Energy is also the most significant player in the Portuguese oil market, operating both refineries and maintaining a strong position in the downstream oil market (IEA, 2016).

Horizontal concentration in the Portuguese energy generation and retailing markets is high, and new entrants are often incumbents in other domestic markets (Teixeira and Salavisa 2016: 232), such as Endesa and Iberdrola – both are Spanish companies with a leading role in the Iberian energy generation and retailing market (EDP 2018: 20). The importance of energy companies in the Portuguese economy is significant: the two leading companies in the national stock market are EDP and Galp, and more than 40% of the national stock market belongs to four energy companies: EDP, GALP, EDPR (EDP Renewables) and REN (Moreira 2020).

*Associations*

In the renewable energy market, the Portuguese Association for Renewable Energies (APREN) represents the companies from the sector, lobbying for greater investment in renewable energies and a greater influence in the European energy market through policy advice, monitoring, and development of studies and statistics (Delicado 2015a). The Portuguese Energy Association (APE) is a non-profit, non-governmental public

service institution whose mission is to promote public debate on the development of the energy sector (IEA 2016).

## 3. Coordination, instruments, and issues of the Portuguese energy transition

### 3.1. Drivers of the energy transition

In the 1990s, the Portuguese energy policy stood at a crossroads: hydro power potential was not fully explored (less than 50% (PNBEPH 2007: 9), yet one of the highest rates in Europe), coal reserves were not productive (Miguel et al. 2018; Fidalgo et al. 2019), nuclear power was not a viable option (Pereira et al. 2018:522) and energy dependence from imports was close to 90% (European Commission 2020). The prospect of growing energy demand – in a period of consistent growth – led Portugal to make a shift in its energy policy and invest in renewable energy, coupled with more investment in hydro and in combined-cycle power plants fired by natural gas (more energy-efficient and less pollutant than coal) to balance the renewables' intermittency problem. While many of these constraints had been present in the 1980s already, additional drivers of the Portuguese turn towards renewables were growing environmental concerns, which were prominent on the EU agenda and subsequently gained influence in national energy policymaking (Araújo 2013), and the liberalization of the energy market, which Portugal pushed forward in tandem with the EU. These two drivers were embraced by Portuguese political actors to transform the energy sector in Portugal.

*Liberalization process*

The 1996 Electricity Directive (96/92/EC) was one of the first initiatives of the European Commission to liberalize the European energy market. All energy market players should have access to the grid and vertically integrated energy companies should be split into smaller companies operating in their market segment activity. In Portugal, the first steps towards liberalization had been taken in the 1990s (see section 2.1). However, in 1997, the planned privatization of the public electricity company (EDP) was reconsidered and only a minority percentage of the company was to be privatized (Decree Law 56/97). In 1999, the legislation that allowed the participation of new companies in the energy distribution segment (high and medium voltage) was revoked so that only EDP could operate as an energy distribution company (Decree Law 24/99). Finally, in 2000, new legislation guaranteed that the national electricity transmission grid RNT would remain under public control and that its operations would be independent of medium-to-low voltage distributers (Decree Law 198/2000).

The 2001 energy program (E4 – energy efficiency and endogenous energy) (Resolution of the Council of Ministers 154/2001) defined five main energy guidelines, two of which were related to the liberalization of the energy market: the implementation of an internal energy market in line with European recommendations and the establishment of an Iberian energy market (the other three were the reduction of

energy intensity and energy dependence, the promotion of energy efficiency in both supply and demand, and the development of RES, in line with the 2001 EU directive). New guidelines for the implementation of a free and competitive electricity market (Decree Law 185/2003) in line with EU recommendations were laid down and the vertically integrated energy market was broken down: producers, distributors, and retailers were to operate as independent entities. The 2003 Internal Market in Electricity Directive (2003/54/EC) turned some of the 1996 directive's guidelines mandatory and demanded member state compliance. In Portugal and Spain this was followed by the creation of an Iberian electricity market (OMIP and MIBEL) in early 2004 (Resolution of the Assembly of the Republic 33-A/2004), to complement (and eventually replace) the traditional over-the-counter market and enable competitive energy trading.

In the following years, liberalization of the energy sector accelerated. Regulatory changes were introduced in the energy markets – market agents could now operate in either the gas market, the electricity market, or both – and the EU's 2003 liberalization directive was transposed into national law in early 2006 (Decree Law 29/2006). MIBEL was created in 2007, although interconnection capacity developed more slowly than expected and has impeded a true common market until today Cardoso 2011).

In 2009, a new national renewable energy plan (Resolution of the Council of Ministers 29/2010) proposed the liberalization of the energy market for small consumers, which was formally approved in 2011 (Decree Law 104/2010) and scheduled to happen until 2012. In the Memorandum of Understanding, signed with the European Financial Stability Facility in May 2011, Portugal committed to conclude the liberalization of the electricity and gas markets, reduce its energy dependence, reduce the costs with electricity production, review fiscal incentives in the energy sector, and conclude the Iberian integration of the energy market (Araújo 2013). In June 2011, the 2009 Internal Market in Electricity Directive 2009/72/EC was transposed into national legislation (Decree Law 78/2011).

During the financial crisis, the government's main policy goal was to push forward the liberalization of the energy market along the lines of the EU directive (Decree Laws 215-A/2012, 215-A/2012, 178/2015). In 2012 a new law determined that all residential consumers should participate in the liberalized consumption market, and that regulated consumption tariffs were to end. However, this law was updated every year to postpone its implementation (Decree Laws 75/2012, 256/2012, 13/2014, 15/2015, ordinance 39/2017, ordinance 364-A/2017). Only since 2017 consumers are allowed to choose between market-based tariffs and the regulated tariff (Law 105/2017). The electricity VAT was also increased from 6% to 23% (Law 51-A/2011).

Liberalization also included the privatization of EDP (in 2011) and REN (in 2012), which became powerful private stakeholders. Both were acquired by Chinese companies (themselves owned by the Chinese state) in one of the major Chinese investments in Europe (Pareja-Alcaraz 2017), which shows the relevance of finance

in the liberalization of the energy market and the promotion of renewables (Mazzucato and Semieniuk 2018).

*Renewable energy policy*

The Single European Act, approved in 1987, defined three goals for future energy policies: positive environmental impact, energy security, and a single energy market. In 1992, environmental problems were further discussed and acknowledged in the Rio Conference, which led to the signing of the Kyoto protocol in 1997, a revision of the energy policies in place, and an emphasis on renewable energy. In the 1990s, the European Commission started defining a Renewable Energy Policy (de Lovinfosse 2008: 63-75; Solorio and Bocquillon 2017).

With Portugal's accession to the EU in 1986, the EU's focus on ecological issues was at least partially transferred to the national level, leading to an increased salience of environmental issues (Araújo & Coelho, 2013) the creation of a Ministry of Environment and Natural Resources and a National Council of the Environment and Sustainable Development (CNADS) in 1990 and an increased use of European funds to design and implement pilot projects of innovative RES. The European Commission's 1996 Green Paper on RES (COM (96) 576 final) described the status of renewable energy in Europe and suggested approaches for its future development. One year later, the White Paper "Energy for the Future" (COM (97) 599 final) detailed the advantages of renewable energy for Europe and suggested the adoption of a target for renewable energy production. These recommendations were included in the 2001 Renewable Electricity Directive (2001/77/EC), which established renewable energy targets for all member countries (Solorio and Bocquillon 2017). In 2000 and 2007, Portugal held the presidency of the Council of the EU. The first coincided with the negotiation of the 2001 EU directive, where Portugal joined the countries that defended (with success) that large hydro power should be considered RES (de Lovinfosse 2008: 74). José Sócrates, the future Prime Minister who would become a main political actor pushing RES forward, was then Minister of the Environment.

The 2001 national energy plan prioritized the security of supply and sustainable development, without risking national competitiveness (Resolution of the Council of Ministers 63/2003) and ambitious goals for RES deployment were set. By 2010, the amount of electricity generated from RES should more than double – from 4603 to 9680 MW. With more than 3600 MW, onshore wind power was assigned the largest share. In 2007, the Lisbon treaty was approved under the Portuguese EU presidency. Alignment with EU goals was crucial in three dimensions: access to funds, circulation of ideas, and political support. During the preparation of the Lisbon treaty, Portugal was generally perceived as being at the forefront of RES development due to its significant investment in renewables. The Portuguese government tried to rebrand Portugal as technologically developed and environmentally committed. Portugal had also successfully sidelined with advocates of feed-in-tariffs as the main support scheme for electricity from renewables, such as Spain and Germany, against supporters of a system based on RES quotas and tradeable certificates (Jörgens &

Solorio, 2017). Also in 2007, a new plan for hydro power was approved to explore the remaining hydro potential (PNBEPH, 2007) and RES technology bonus factors were reviewed to increase RES operational returns (Decree Law 225/2007).

In 2009, the EU Renewable Energy Directive, which revised and updated the 2001 directive, consolidated the 20% average renewable production target for the EU in 2020. The 2010 Portuguese renewable energy plan – Plano Nacional de Acção para as Energias Renováveis – revised the guidelines for RES policies (Resolution of the Council of Ministers 29/2010): existing feed-in tariffs should be less costly (to reduce the costs passed on to end-consumers), investment funds would be created to develop innovative RES technologies with export potential (solar thermal energy was then seen as a promising technology), the Iberian Center for Renewable Energy and Energy Efficiency was to be created (it was never implemented), wind repowering procedures were simplified (Decree Law 51/2010) and a smart city pilot concept with smart metering technologies, electrical vehicles, and demand-side management, was to be launched. In the period from 1995 to 2010, installed renewable energy sources increased dramatically – *e.g.* installed wind power jumped from 8 MW in 1995 to almost 4000 MW by 2010 (PORDATA).

By the end of the 2000s, the continued strengthening of Portuguese RES policy became increasingly affected by the financial crisis. In 2012, the new government canceled all future electricity power contracts (Decree Law 25/2012) (including RES contracts) as the recession led to a decline in energy consumption. In 2013, energy selling price incentives for micro-production and mini-production were canceled (Decree Law 25/2013): local power production had to be below 50% of local power consumption and used for self-consumption. Although the government kept committed to the global RES targets set by the previous government, technology-specific targets were reviewed, with priority given to mature RES technologies (Resolution of the Council of Ministers 20/2013).

Overall, the past three decades saw a continued strengthening of renewable energy policies which was slowed down, but not dismantled, by the financial crisis. During this period, renewable energy – the core of the Portuguese energy transition – was promoted primarily because of its positive environmental impact and as a strategy to reduce the Portuguese external energy dependence. However, during this period energy costs rose substantially for end consumers (Peña *et al.*, 2017).

### 3.2. Strategies and instruments

The Portuguese energy transition's main goal is to increase the endogenous supply of clean energy for final consumption at competitive prices (República Portuguesa 2019b). This includes the following strategies:

1. Increase the share of renewable production.
2. Liberalize the energy market by enforcing competition in all segments of the energy value chain and by extending the market to Iberia.
3. Promote energy efficiency in buildings and transportation.

4. Electrify final consumption.
5. Replace fossil fuels used in transportation with biofuels, electricity, and other clean fuels (such as hydrogen).

The key instrument for increasing the share of electricity from renewable energy sources were the feed-in tariffs. Feed-in tariff incentives for wind and solar energy were progressively revised upwards, which led to a surge in RES projects. While for solar energy there were feed-in tariffs for small production, most RES incentives favored large-scale electricity production. The major operator in Portugal was EDP; it became the most important investor and operator in wind power. Feed-in tariffs were replaced in the 2010s by premium feed-in tariffs and, more recently, complemented by auctions. These changes coincided with the financial crisis in Portugal and with decreasing trends in the levelized cost of energy of wind and solar energy. The simplification of licensing procedures and public tenders for renewable energy have also accelerated the deployment of RES (Heer and Langniß 2007). Grid connection rules were simplified in 2001 (Decree Law 312/2001) and 2004; in 2007, new legislation was approved to simplify the repowering process of existing wind parks; and in 2014 (Decree Law 94/2014) ownership rules of repowered wind turbines changed. Direct subsidies were used in early RES deployment but became less relevant over time. In 1986, the government created an investment line that used EU funds to subsidize the deployment of fully researched and innovative energy production technologies (Decree Law 250/86, enacted by ordinance 464/86) open only to companies in the energy industry or with meaningful energy production operations. Direct subsidies were also used in targeted low-scale applications. In 1988, investment subsidies were available for any private company engaged in technologies or processes that would reduce its oil dependency (Decree Law 188/88).

To achieve the goal of market liberalization, regulatory instruments were used in combination with privatizations with regulations imposing the unbundling of the energy market and the creation of specific markets for each stage of the value chain – production, transportation, distribution, and retailing. Production and retailing were deregulated, and energy companies in the public sphere were privatized. The redefinition of the electricity market structure also demanded the revision of long-term energy supply contracts: the previous schemes (named CAEs) were replaced by new schemes (the CMECs) (Decree Law 240/2004).

A third dimension of the Portuguese strategy is energy efficiency. Incentives were given to companies, households, and public institutions to reduce their energy consumption (Resolution of the Council of Ministers 2/2011). These policies, together with the shift of the economy to the service sector, were partially responsible for reducing the energy intensity of the Portuguese economy (Guevara and Rodrigues 2016; Guevara and Domingos 2017).

The goal of electrification of consumption has not been fully embraced in the Portuguese strategy until recently, as in the 2000s the plan was to use natural gas in combined cycle power plants and in supplying households. In late 2010, the incentives

for micro-production were reviewed (Decree Law 118-A/2010) to promote widespread solar micro-production, up to an aggregate maximum power of 25 MW. The revision mandated micro-producers to adopt energy efficiency measures and utilities to buy micro-produced electricity, while it lowered the premium on the price paid for micro-produced energy. A new bonification system to incentivize public institutions to become micro-producers was also created. RES targets were also updated according to the 2009 Renewable Energy Directive (Decree Law 141/2010): by 2020 Portugal should reach 31% of RES on final consumption. In 2011, the procedures to become a solar mini-producer (up to 250 kW) were simplified and third parties could conclude energy service contracts to establish mini-production units (Decree Law 34/2011). New self-consumption incentives for using RES in buildings (Decree Law 162/2019) are now creating energy communities – and virtual power plants in the future – which push for the electrification of households. Electric vehicles are also a part of this strategy. The purchase of electric vehicles has been incentivized through subsidies and no public charging costs since 2010 (Decree Law 39/2010).

Finally, the Portuguese transition in the transportation sector has not been successful. The percentage of vehicles running on diesel (the most pollutant fuel) is high due to tax incentives that were only revised in 2017 (Resolution of the Council of Ministers 88/2017) and the use of biofuels in transportation has remained relatively low in Portugal (Ferreira et al. 2011). The production of clean hydrogen to fuel heavy-duty vehicles (buses and trains) has recently emerged as a potential future policy strategy (República Portuguesa 2020).

In the following, we present in more detail two mechanisms of the Portuguese energy transition: the feed-in tariffs, which have been the core mechanism, up to the crisis, in the promotion of RES, and solar energy auctions, which have been used recently to select new photovoltaic energy plants.

*Feed-in tariffs*

Portugal has been an early adopter of feed-in tariffs, the first of which was approved in 1981. Compensation was given to independent producers (which produced their own electricity) for dispatching excess electricity to the grid with the price per kWh being set by the grid operator (Decree Law 149/86). In 1988, a new version of the feed-in tariff was approved (Decree Law 189/88). Entities were recognized as being independent energy producers if the installed power was below 10,000 kW (an exception was made for combined heat and power installations) and became eligible for a compensation subsidy equal to the compensation subsidy given to thermal power plants – 1 kWh was equivalent to 300g of fuel-oil – which was added to the grid selling price of the voltage level above the interconnection and paid for by government funds. The compensation was guaranteed to cover at least 90% of the price negotiated between the grid operator and the energy supplier (during the first eight years of operation).

In 1995, the feed-in tariff was updated (Decree Law 313/95). The guaranteed price was matched with the average tariff applicable to the voltage level of the interconnection (which meant a higher price) and only installations of less than 10 MW were eligible. The price of the feed-in tariff was further changed in 1999 to include three components (Decree Law 168/99): a component proportional to the power installed (about 1090 PTE/kW), a variable component proportional to the energy produced (about 5.00 PTE/kWh), and another variable component related to the positive environmental impact also proportional to the energy produced (5.55 PTE/kWh). The length of the feed-in contracts was extended to twelve years (instead of eight). RES electricity was given grid priority. Incentives to combined heat and power plants were also reviewed along these lines (Decree Law 538/99). A technology modulation factor was introduced in the calculation of the environmental incentive in 2001 (Decree Law 339-C/2001): wind power plants were given a bonus factor of 1.70 for the first 2000 hours of operation, which was gradually reduced to 0.40 for operations above 2600 hours, while photovoltaic power plants in the range of 5kW to 50 MW received a bonus factor of 6.55 and those below 5kW were given a bonus factor of 12.

In 2005 the feed-in contracts were extended to last 15 years (instead of twelve) and the variable components of the feed-in tariff were changed (Decree Law 33-A/2005): the energy supply component was set to €3.6ct/kWh and the environmental component was set to €2ct/kg $CO_2$. The technology bonus factors, which differentiate the tariff according to the technologies used, were also reviewed: the wind power bonus factor was reduced to 4.6; the solar power bonus factor was increased to 35 for installations above 5kW and 52 for installations below 5kW (up to a maximum of 150 MW installed nationally); the biomass bonus factors were set to 8.2 and 7.5, for forest residues and animal residues respectively; other technologies, such as wave energy, received no bonification. Wind power was the only technology for which the technology bonus factor remains unaffected. For solar micro-production (up to 150 kW), a premium price was added to excess local production that was not used for self-consumption, so that instead it could be sold to the grid at a profitable rate (Decree Law 363/2007).

In 2013, the feed-in tariff changed to a premium feed-in tariff. When the feed-in contract ended (or before it ended), wind energy producers had to contribute €5,000 to €5,800 per MW installed to continue to operate and adhere to a premium tariff for the next 5 to 7 years (respectively), with two options (Decree Law 35/2013): either a doubly bounded market-based payment price, with a minimum guaranteed of €74/MWh and an upper limit of €98/MWh, or a lower bounded market-based payment price with a minimum guarantee of €60/MWh. This last option was compulsory for the cases of wind turbine repowering.

*Renewable Energy auctions (for solar)*

More recently, auctions have become an important complementary policy instrument to promote the production of electricity from renewable energy sources in a more cost-

efficient way. While in 2005 only six countries used auctions of renewable energy sources, by 2017 at least 84 countries had adopted this instrument (Kitzing et al. 2019). Portugal was one of the first European countries to use such renewable energy auctions. In the first-generation auctions, electricity producers were still subsidized. The government set a reference tariff for electricity produced from renewable energy sources above the market price, which could be undercut by participants in the auction. In this way, the volume of subsidies was significantly reduced (del Río 2016).

In 2019, the Portuguese government modified the instrument of renewable energy auctions with the new photovoltaic solar auction. The maximum price producers now obtain is below the market price (del Río et al. 2019) and what is auctioned is the access to the electricity grid. The first auction of this new generation was launched in June 2019 to increase installed capacity for renewable energy production. Competitors could choose between two remuneration systems: 1) a guaranteed tariff for 15 years where competitors offered a discount on a reference price set by the government, and 2) a general tariff corresponding to the market value where competitors offered a fixed contribution to the National Electric System. The tariff that served as the basis for bidding was around €45/MWh, which at the time was slightly below market value. The auction covered a total of 1,400 megawatts (MW) divided into 24 lots in four regions of the country (Centro, Lisboa e Vale do Tejo, Alentejo, and Algarve). The auction was considered a success (del Río et al. 2019): of the 24 lots (1,400 MW), 23 were awarded (1,292 MW). The demand articulated by the 64 bidders was nine times higher than the auctioned network capacity. The average tariff for the lots awarded was €20/MWh, which corresponds to less than half of the reference price. The most competitive of the bids was only €14.76/MWh, which at the time was the lowest ever feed-in tariff worldwide for electricity from renewable sources.

A second auction, scheduled for March 2020, but postponed because of the Covid-19 pandemic, started in June 2020. A total of 670 MW of capacity in the Alentejo and Algarve regions was auctioned. In addition to the fixed tariff and the fixed contribution to the National Electric System, bidders could bid through a third modality based on the creation of storage capacities for at least 20% of the granted network capacity (Bellini 2020). With a total allocation of 483 MW, this storage modality turned out the biggest of the three. The lowest bid for a fixed feed-in tariff was set at €11.14/MWh, which corresponds to a 73.3% discount from the reference tariff established by the government and which once again set a new world record (SEAE 2020). But a comparison of the 14 successful bids based on their Net Present Value – a measure developed by the Portuguese government to make offers in the different modalities comparable and calculate each project's net benefit to the National Electric System – shows that four projects based on fixed contributions and/or storage capacities were even more compatible than the one based on the fixed tariff of €11.14/MWh (Antuko 2020). Overall, the Portuguese photovoltaic auctions show that solar energy has become competitive, even if combined with requirements to build the storage capacities necessary for more efficient distribution and greater grid stability. In 2021

the government considers to extend renewable energy auctioning to green hydrogen and wind energy auctions are being discussed, albeit without concrete plans.

### 3.3. Coordination mechanisms and multilevel governance

Over the past decades, energy governance in Portugal has become a matter involving a broad range of public and private organizations, the participation of non-state actors, both from business and the environmental movement and spanning different levels of government from the global and EU level to the national and sub-national. Early RES policy in Portugal was partially a product of the EU's renewable energy directives and the EU's financial support, but also horizontal policy transfer between member states. Incentive framing and incentive schemes observable in other EU countries led to the early adoption of a FIT scheme. In the early 2000s, Portugal was a policy-taker rather than a policy-shaper in EU environmental policy (Fernández and Font 2009: 72). The liberalization of the energy market, which culminated with the creation of an Iberian energy market (MIBEL), strengthened policy cooperation between Portugal and Spain. RES promotion relied on similar schemes, and both committed to develop the interconnection grid – which developed at a slower pace than predicted. European support declined with the financial crisis of 2008, but incentives to liberalization persisted. While in Spain, RES policies were suspended – or even revoked – in Portugal RES policies were only temporarily put on hold and then reconfigured.

Despite high levels of environmental concern, civic participation in environmental decision-making is still low in Portugal. A centralized administrative tradition undermines the chance of participation of civil society actors in decision-making (Carvalho et al. 2014; Delicado et al. 2014), the population lacks technical and environmental knowledge, and public officials do not disclose information transparently. RES development in Portugal remains a product of pre-determined political decisions taken from above (Delicado 2015b). The process of liberalization and administrative reforms, together with EU compliance and growing societal mobilization, led to an increasing interdependence of state and nonstate actors. In 2008, a Climate Change Forum was created to promote interactions between government officials and civil society representatives but evolved towards a top-down structure where there was limited space for active participation and feedback (Carvalho et al. 2014).

The national institutional setup within which energy policy takes place has been characterized by a continuous strengthening and differentiation of the responsible government departments. At the same time, responsibilities for energy governance have gradually moved from the economic to the environmental policy domain. Since 2018, matters related to energy are of the responsibility of the Ministry of Environment and Energy Transition (since 2019 Ministry of Environment and Climate Action) (República Portuguesa 2018). The Directorate General for Energy and Geology (DGEG) within the Ministry of Environment is responsible for the design, promotion, and assessment of energy policies. The Portuguese Environment Agency (APA), also

under the tutelage of the Ministry of Environment, is responsible for the design, implementation, and monitoring of environmental policies that combat climate change. The National Policies and Measures System (SPeM), created in 2015, assesses the implementation of mitigation policies and reinforces the accountability of different sectors regarding climate change (República Portuguesa 2018, 2019). An Interministerial Climate Change and Air Commission (CIAAC) was created in 2015 to monitor policies for air and climate change. Recently renamed Interministerial Air, Climate Change and Circular Economy Commission (CA2), it oversees the promotion and supervision of policies related to the circular economy, monitors the Portuguese compliance with international commitments, and validates the Portuguese position in international negotiations. The Commission is coordinated by the Minister of Environment and composed of representatives from the remaining ministries (República Portuguesa 2018, 2019).

The autonomous regional authorities of Madeira and Azores enjoy a certain degree of independence and autonomy in energy policymaking as they develop their own strategies and plans within the established national and European frameworks (República Portuguesa 2019). Local authorities (*i.e.* municipalities), on the other hand, share competencies related to energy efficiency and adopt municipal climate change mitigation plans (IEA 2016; Campos et al. 2017). However, according to a recent survey, municipal actors do not find climate change to be an important issue, and the absence of appropriate organizational structures – mostly in inland small municipalities – compromise effective policy-making processes (Campos et al. 2017).

## 4. Outcomes, challenges, and prospects of energy governance in Portugal

*Outcomes*

Four outcomes of the Portuguese energy transition stand out as most important: the increase of energy costs, the decline in energy dependence, the creation of powerful national stakeholders, and a competitive energy market. Higher electricity costs are in part related to the promotion of RES, as grid costs and subsidized production are passed on as taxes that add to the tariffs of end consumers. If, as Fidalgo et al. (2019) show, it is possible to have a system entirely based on renewable sources by 2050, it is important to consider what the costs of that system will be for Portuguese consumers and for the Portuguese economy. On the other hand, the Portuguese energy dependence has been declining steadily and in 2019 stood at 75.1% (DGEG 2019), (13.7% less than in 2005 (Observatório da Energia *et al.* 2020). The investment in RES technologies also led to the creation of a new industrial cluster within the energy sector and to the investment in RES project development and operation. In the second half of the 2000s, several solar companies were founded and a wind power consortium, ENEOP, was founded in Viana do Castelo, backed by EDP, to manufacture wind turbines. With increasing competition from Asia, the solar cell manufacturers have disappeared, while the wind turbine consortium in Viana do Castelo dissolved in 2019, but its former members will continue their commercial activities individually.

Investment in RES project development and operation was early on led by EDP, backed mostly by foreign capital. A myriad of market players – large international funds, banks, established Iberian companies, construction companies, and new startups – have come to populate the energy market, seizing the financial and market opportunities (Bento and Fontes 2015). Nonetheless, EDP was the company that benefited most from the Portuguese energy transition. Before the liberalization of the energy market, EDP had the monopoly of the electricity market and invested in RES technology, becoming the national leader in wind energy production, and later aiming at the internationalization of its operations. In 2007 EDP created a new company that concentrated on RES – EDP Renováveis – which is one of the largest RES companies in the world (Wehrhahn et al. 2011). The stability of the Portuguese energy transition, which was only temporarily affected by the financial crisis – especially if we compare the Portuguese RES policies in this period with Spain's RES policies – can only be understood if the importance of these actors is taken into account. The strong and enduring power alliance between the (former) monopolist utilities – which were privatized during the energy transition – and the state, guaranteed that these companies reaped a great share of the economic benefits of the Portuguese energy transition and supported it even in times of financial austerity.

Finally, the Portuguese energy market has become increasingly competitive. Portuguese companies entered the Spanish market – most prominently, EDP – and all large Spanish companies entered the Portuguese market – Endesa, Iberdrola, and Unión Fenosa as energy retailers and some, notably Iberdrola, also as RES

producers. The former electricity monopolist EDP and GALP, the oil and gas monopolist, compete now in the same markets. Although EDP's market share in the electricity market is still above 77%, EDP has recently been losing market share (ERSE 2020a).

*Challenges*

Portugal's location in the European continent is peripheric (as is its economy (Santos et al 2017)), with land borders only with Spain, which in turn is separated from continental Europe by the Pyrenees. As electrical interconnections are land-based, Portuguese access to the European energy markets is technically more difficult and economically more costly, especially since the interconnection between Portugal and the rest of Europe must go through Spain. Therefore, one of the main challenges that hinders the consolidation of an Iberian market is the interconnection between Portugal and Spain (and also the interconnection between Spain and France). These interconnections remain underdeveloped, below the capacity needed to have equal wholesale energy prices for both markets, and the energy market price in Portugal is generally higher than in Spain (MIBEL 2019). However, the development of the interconnection between Portugal and Spain is more interesting for Portugal than for Spain, due to relative national market sizes (Cardoso 2011). The development of the French interconnection is also relevant for Portugal because it would enable energy exports when both Portugal and Spain are saturated by RES production, which already drives prices down in certain periods of excess production. With increasing RES penetration – and if current market rules are maintained – zero cost energy may endanger other energy producers that are responsible for balancing electricity needs, while the viability of some RES projects may also be threatened.

Energy poverty is another challenge that Portugal must overcome. With 15 to 23% of households living in energy poverty in 2013 (Horta et al. 2019), Portugal is one of the countries in the EU most vulnerable to energy poverty. Until very recently, the problem has been overlooked by national decision-makers. The price of electricity has increased in the last decade and is above the EU28 average since 2012. In 2010 and 2011, the government established social tariffs for electricity and natural gas to assist vulnerable households. However, this has been insufficient, as low incomes and high energy prices result in an increasing vulnerability to energy poverty (Horta et al. 2019). In addition, many low-income households had been deterred by the bureaucratic requirements of applying to the social tariff, but this obstacle was removed in 2016 when social security data was used to identify eligible households and automatically switch them to the social tariff (Observatório de Energia 2019). While the social tariffs help those in poverty, stronger consumer protection policies, which are notoriously weak in Portugal, and additional forms of financial aid would help low-income households (Kyprianou et al. 2019: 52–53). Energy poverty is often associated with low-quality housing, as 70% of the building stock was built before any energy performance regulations were implemented in the country (Horta et al. 2019; Vaquero 2020: 541). Since 2017, there is a loan-based investment program (IFRRU 2020) for the renovation of buildings (Horta et al. 2019), which was added to other funds directed

at home improvements in vulnerable households. These funds are coordinated at both national and municipal levels (Kyprianou et al. 2019:51). However, these programs have proved to be ineffective, with limited application and implementation. As of 2018, only 256 applications had been submitted to IFRRU, and only 71 contracts had been signed, mainly due to poor information and complex application procedures (Horta et al. 2019).

Finally, the Portuguese energy transition has yet to reach the transportation sector. In 2014, the Portuguese transport sector accounted for 41% of the final energy consumption and 35% of fuel combustion emissions. Road transportation dominates 80% of transportation energy consumption with fossil fuels accounting for 95% of its supply and renewable fuels for the remaining 5% (Lorenzi & Baptista 2018: 920). Electricity use is negligible in the transport sector, despite efforts to incentivize electric mobility and fossil fuels are expected to continue to dominate the transport sector in the next 15 years (Lorenzi & Baptista 2018). Nonetheless, there is a trend of decreasing consumption of fossil fuels (Pinho & Hunter 2019: 285) that can be further incentivized by market-based policies to promote cleaner vehicles (Nunes et al. 2019: 438).

*Prospects*

The future of the Portuguese energy transition depends on increasing the RES share in the energy mix and electrifying end consumption. The Portuguese goal is to transition to a carbon-neutral economy by 2050 and to implement the 2015 Paris Agreement (Republica Portuguesa 2019a). The new solar auctions are seen by the government as the optimal tool to balance the strong demand for generation permits with the scarcity of grid capacity as auctions speed up investment in new capacity, give priority to projects with lower costs and greater guarantees of execution, and allow for better articulation between the permitting process and investments in new grid capacity (https://leiloes-renovaveis.gov.pt/). The Portuguese solar energy auctions have received great international recognition and are regarded as a successful approach to a cost-effective increase of the share of renewable electricity. Del Río et al. (2019:18) consider the design of the auctions as "one of the most innovative in Europe (...) which provided the participants with flexibility with respect to their project risk profile". However, despite the surprisingly low-price guarantees achieved at the auctions in 2019 and 2020, it is still early to assess their success in terms of photovoltaic capacity creation. One of the biggest risks associated with renewable capacity auctions is the uncertainty of project implementation. The winners of the auction can only apply for photovoltaic power plant licenses – which includes obtaining land rights, the production license, the license or admission of prior notice to carry out urban planning operations and the operating license – after the rights to feed solar energy into the grid have been auctioned and granted. So far, the winners of the 2019 auction have completed the first phase of their contractual obligations relating to the presentation of the relevant documents attesting their land rights (Gabinete do Ministro do Ambiente e da Ação Climática 2020).

Another key strategy is the development of virtual power plants which is leveraged in three vectors: decentralized energy production, real-time energy monitoring, and new market mechanisms and agents (aggregators). Regarding the first vector, the Portuguese government recently approved new legislation that incentivizes local self-consumption and shared consumption of small RES production (Decree Law 162/2019). Regarding the second, the digitalization of energy monitoring is being pursued through widespread installation of digital meters that allow for measuring real-time production and consumption of energy, which also poses new challenges to the regulator (Crispim et al. 2014). Thirdly, it is expected that future market regulations and more flexible tariffs will open the door to new market players.

Last, but not least, Portugal is considering investing in renewable energy to produce hydrogen, which can be used to store renewable energy and as an alternative to fossil fuels in transportation. A National Hydrogen Strategy that sets out some general guidelines was adopted in 2020. However, investment in hydrogen generation is not consensual. The largest opposition party PSD claims that Portugal is betting on an uncertain technology that may not pay off (Marques 2020), whereas the energy regulator warned that infrastructure costs could endanger the prices of natural gas paid by end consumers (ERSE 2020b).

## Cross References

Energy Governance in Spain

Energy Governance in Europe: Introduction

Energy Poverty

European Union Energy Policy: A Discourse Perspective

European Transmission Grid

Energy Governance in Europe: Country Comparison and Conclusion

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