GLOBAL DEVELOPMENT AND ENVIRONMENT INSTITUTE
WORKING PAPER NO. 17-01

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A transition towards a more liberalized and sustainable market

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February 2017

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Abstract

In recent years, important policy developments have impacted the electricity market in the European Union (EU), affecting the cost of energy and resulting in changes to countries' electricity generation mix. This paper details the Spanish and Portuguese attempts to transition to a cleaner energy economy.

At the end of the last century, Iberian countries started the process of liberalizing their electricity market and promoting the use of renewable energies in the electricity mix. Their objectives included establishing a "greener" energy supply, opening new employment opportunities, reducing dependence on imported fossil fuels, and pursuing a more sustainable economy and society. Assuming a leading role in the energy transition process has been a novel and challenging endeavor for both countries. The economic crisis only increased those challenges, leading to mixed results. In addition to covering the evolution of the Iberian electricity sector, this paper identifies key considerations for the future.

Photo: Javier Joló Recio

Acknowledgements

The authors would like to thank Ramon Bueno and Jonathan Harris for commenting on earlier drafts and providing valuable edits to this paper, as well as Paula Angel and Erin Coutts for the translation and formatting of the working paper.

Funding for this project was provided by the Junta de Extremadura through a 2016-2017 travel grant for teachers and researchers.

JUNTA DE EXTREMADURA
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1. Introduction

Few issues are as controversial and important today as the challenges confronting the world energy sector: reducing energy dependency, increasing the security of energy supply, enhancing energy efficiency and diminishing the emission of greenhouse gases. The electric sector is one of the major players in this energy transition. European countries (as well as many other countries throughout the world) have addressed power supply reform with different strategies aimed at addressing both specific characteristics of the power sector and the need to confront environmental threats.

This substantial change in the energy model is not a new phenomenon. As Timmons et al. (2014) indicates, the history of industrial evolution goes hand in hand with the transition from some energy resources to others. What is unique is the way in which the Iberian energy sector (Spain and Portugal) is coping with such a shift. Even though the energy sector has traditionally evolved with some delay relative to neighboring countries, both Spain and Portugal currently lead the way towards more sustainable energy systems.

The process has been uneven, showing acute contrasts. While some recent press reports highlight the success of promoting a renewable-energy-based system, others stress problems with uncertainty and misjudgment in designing incentives.[4] Nonetheless, there has been notable achievements. Whether these achievements continue will determine the success or failure of policies designed not only to reduce the emission of greenhouse gases, but also to modernize two economies historically facing structural problems.[5] This project aims to review the transition in the Iberian power sector, which is currently constrained by the economic crisis. We will try to provide an overview of the major challenges in this sector over the following years.

Despite a different historical evolution in their respective power sectors, there are concurrent trends in the electric sector development in Spain and Portugal. Thus, a joint and comparative analysis of the two countries can be undertaken. The present study describes some relevant facts in this evolution process along with different changes in which a transformation, pursuing different aims, has taken place. On the one hand, improving market efficiency and increasing competition have been pursued to reduce end-user (households and businesses) electricity prices. On the other hand, attempts have been carried out to reduce the environmental impact of electricity generation, following the steps set out by an increasing social awareness about the issue.[6] Transformations in the Spanish and Portuguese sectors are highly constrained by the design of energy policies in the EU, in which a liberalization process has been launched since the early 90s. Factors such as the creation of the European market in greenhouse gases emissions allowances, the *European Union Emission Trading System* (*EU ETS*), or the launch, since 2004, of the *Mercado*

[4] The Economist (20/7/2013), The Guardian (18/5/2016), El País (21/5/2016), El País (26/5/2016).

[5] Controversy exists about the effectiveness of the policies, real competitiveness gains in the sector or the efficiency of the measures aimed at reducing the use of fossil fuels and energy dependency. We can find an analysis related to this in Haas et al. (2011).

[6] 67 percent of Europeans support the EU's involvement in environmental protection. Whereas 52 percent consider current actions insufficient, 37 percent perceive them as adequate (Eurobarómetro, 2016).

Ibérico de la Electricidad (*MIBEL*), have certainly conditioned the evolution of the sector in Spain and Portugal.

The outline of this report includes the following: section 2 will review the background of the Iberian electric sector until the 90s; section 3 will describe the liberalization process in the sector, whereas section 4 will look through the consequences of such process for the competition in the Iberian electric markets. Section 5 will describe the *Mercado Ibérico de Electricidad* (*MIBEL*), and section 6 will depict the role played by renewable energies in the transition towards a more sustainable market. Our conclusions will examine both the strengths and weaknesses that the electric sector should potentiate and resolve in order to achieve greater sustainability in the long run.

2. Background: features of the Iberian electric sector until the 90s

The evolution of the electric market to the present day has followed a range of patterns somewhat common around the world. The electric sector in Spain and Portugal (Iberian power from now onwards) show a range of strategic, technical, economic, environmental and social peculiarities that are inherent in the provision of this good. While not intended to be exhaustive, we can clearly indicate that the Iberian power sector is a capital-intensive one that requires large investment with high sunk costs within different phases of its production and supply. This has led to a scarcely competitive configuration, created upon horizontally and vertically integrated organizational structures. Further, its strategic character has resulted in a strong public sector intervention that guaranteed an adequate level of service provision.[7] Once electricity use went beyond mere illumination, especially in public areas, and it started to be used in transportation and industry, governments began to intervene. From that moment onward, public sector intervention in all the electric production and supply stages prompted the configuration of highly regulated markets.

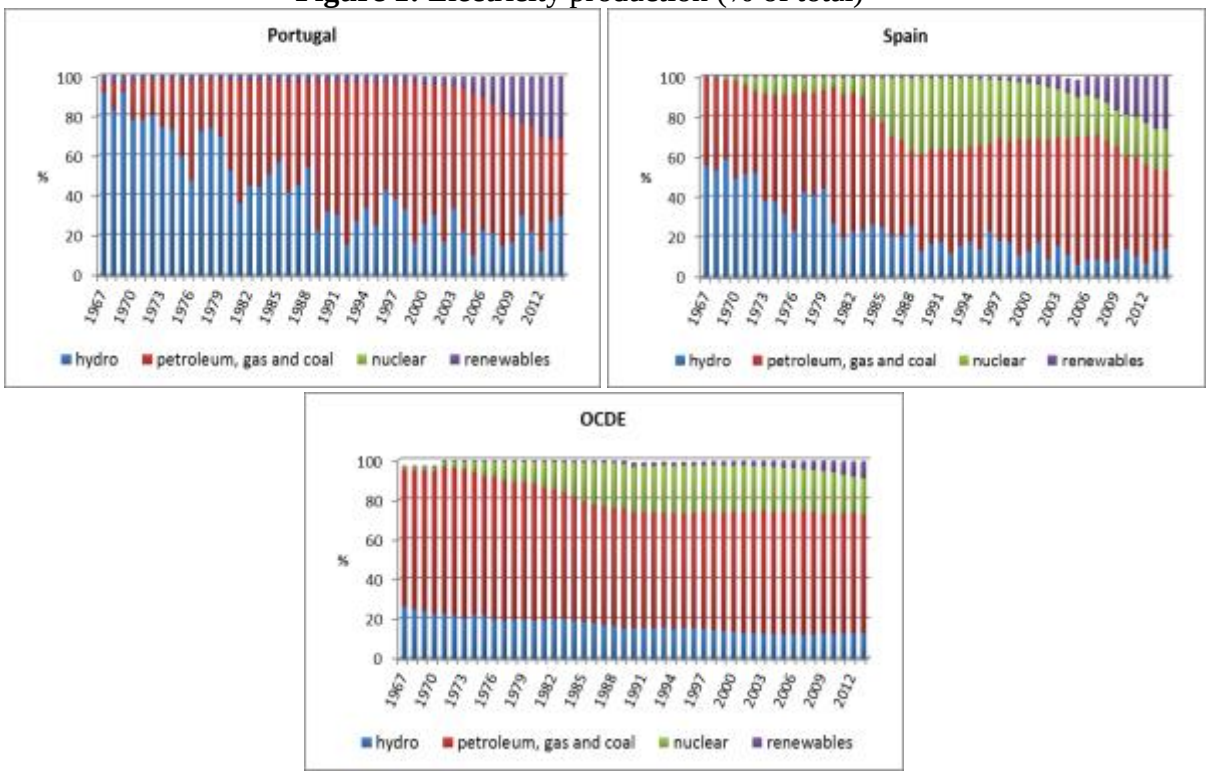
In the first half of the 20th Century, as a result of the scarcity of fossil fuels, energy production in the Iberian Peninsula was fundamentally based on water resources and fuel imports for thermoelectric plants. In both countries the available coal was highly scarce and low calorific content. It was in Spain that investments in hydraulic infrastructures first started. In Portugal, the involvement in hydropower began following the enactment of the *Lei de Electrificação do País* (1944). External energy dependence was noticeable (especially on British coal). By the end of the 60s, hydric power generation reached 80 per cent whereas in Spain it fell below 60 per cent (**figure 1**).

The sector's configuration was different in comparison to that of most developed countries, hydropower being far higher than the OECD average. In a period of strong economic growth, Iberian electric generation was highly dependent on hydraulic reserves and thus susceptible to periods of droughts. Furthermore, this sector was highly dependent

[7] Joskow and Schmalensee (1983) review the peculiar characteristics of the electricity sector that justify regulation. Jamasb and Pollit (2005) raise a number of issues related to market structure and the process of integration and liberalization of the electricity market in Europe.

on imports of fuels. Hence, a transformation to accompany the development of both countries was required.

Figure 1: Electricity production (% of total)



Source: The World Bank Data

The design of the electric sector had to quickly serve the needs of the demand, which had been bolstered by the economic growth in the 60s. It was necessary to increase the generation capacity and strengthen the security of supply so as not to restrain the country's socioeconomic development. Accordingly, over the following years, as oil prices went down, there were significant improvements in the electricity distribution grid and diversification of sources. In addition to this, building nuclear plants was aimed at increasing and diversifying the capacity, as well as reducing dependence on external sources of energy. As a result, the contribution of hydraulic energy was gradually decreasing.

In the case of Portugal, dependence on hydraulic energy remained very high. The pressure from demand was not as urgent, given the lags in the process of industrialization and modernization of its economy, which ultimately restrained the evolution of the Portuguese electric sector until the oil crisis.[8]

In terms of the business configuration, generation in Portugal was initially concentrated in regional companies, as the basic electricity grid was highly oriented toward the main urban areas in the face of reduced productive activity. Local governments played

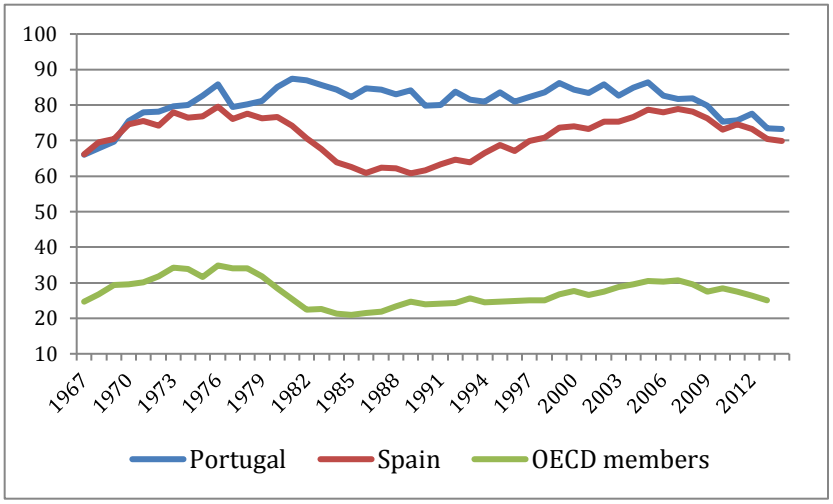
[8] To review the beginnings of the sector in Portugal, see Cardoso et al. (2004) or Monteiro (2012).

an important role in distributing and progressively enlarging the electricity grid in the territory until the central government [9] assumed this competence. Subsequently, the Government increased its participation in the sector, hence defining its role in generation and distribution by teaming up with the big energy companies of the country.[10]

In the case of Spain, the company *Unidad Eléctrica*, S.A. (*UNESA)* was created in 1944, which encompassed the main enterprises and thus reinforced the monopolistic nature of the sector. It was not until 1960 that Portugal developed a similar concentration with the creation of the *Companhia Portuguesa de Electricidade* (*CPE*), whereby the Government acquired an extensive control over the generation and supply. The presence of the public sector kept progressively increasing until 1975, when the nationalization of the electricity sector crowned the concentration and regulation process initiated in the 60s.[11]

The two 70s oil crises had an extremely negative impact on the Iberian economies. Both countries were immersed in a phase of social, economic and political transition that worsened due to the global energy crisis.[12] The Iberian energy dependence was much higher than the average of OECD countries (**figure 2**).

Figure 2: Energy imports (% of energy use)



Source: OCDE

After these crises, several nuclear plants came into operation in Spain. However, this process was interrupted in 1982, with the decision not to authorize such functioning. This meant continued energy dependence in the short-run and also forced the redesign of the sector.[13] As depicted in **figure 2**, until the beginning of the 21st Century and the commitment to renewable energies, external dependency remained at levels close to 80 per

[9] In 1936 the *Junta de Electrificação Nacional* was created with the objective of developing the electricity network throughout the territory.
[10] *Lei de Electrificação do País* (1944).
[11] In 1976 the company *Electricidade de Portugal* (*EDP*) was created.
[12] During the decade of the 70s the transition towards democratic regimes takes place.
[13] Through the *National Energy Plans* of 1975 and 1979. The *Plan* of 1979 already establishes the need to invest in cogeneration and renewables.

cent, with an increasing trend.[14] External dependency was yet far higher in Portugal, where there was no such commitment to nuclear energy. The role of hydropower and its lack of capacity to address the demand needs lagged behind the ongoing increase in the use of fossil fuels, thus consolidating in the following years a dual energy dependence: external and climatological.

The 80s were marked by a far-reaching economic and social change in the Iberian Peninsula. The process of accession by Spain and Portugal to the European Economic Community (EEC), completed in 1986, encouraged a modernization process within their productive system that, at some point, also affected the electricity sector.

In Spain, the design of the sector was performed in accordance with forecasts of high-energy requirements alongside the economic growth of the 60s, when substantial investments were made to increase the capacity. The 70s economic crises generated a gap between the demand and the generation capacity. The financial situation of the sector was complicated by several factors: a substantial increase in investments, the cessation of nuclear plants and a negative evolution of interest rates and exchange rates. Furthermore, the system worked through regulated prices not directly related with the evolution of costs, but rather subject to the crucial need of controlling inflation.

In this situation, concrete measures were necessary to concrete measures to continue modernizing the sector and restoring financial stability. Amongst others, the actions in the sector were the following ones:

- The exploitation of high-voltage transmission lines was defined as a state-owned public service.[15]
- *Red Eléctrica de España* (*REE*) was created in 1985 to deal with transportation and electricity system operation.[16]
- In 1987, the central Government and several companies concluded a plan to alleviate the financial hardship. The *Marco Legal Estable del Sector Eléctrico* (*MLE*) bolstered diverse fusions in order to ameliorate the business structure. It also identified the commitment to maintain an electricity tariffs policy that is compatible with the aims of reaching financial stability.

In Portugal, the aforementioned Enterprise *EDP* played an outstanding role in the evolution of the sector since its inception. In the mid-80s, its distribution grid almost operated throughout the whole country. It virtually functioned under a monopoly regime in all the different stages, from generation through commercialization stages. As in the case of Spain, the evolution of the sector had followed a process of concentration and regulation.

Under this configuration, the price paid by consumers was determined through a regulated tariff that tends to evolve depending on the costs associated with the supply, but does not consider the efficiency of the process.

[14] Despite the fact that, in the 80s several thermoelectric plants were built to make use of national coal.
[15] *Ley de Unificación del Sistema Eléctrico Nacional* (1984)
[16] In 1999, the privatization of *REE* was initiated and in 2010 it became the only one in charge of managing the entire electricity transmission network.

Nevertheless, as of their full inclusion to EEC, European directives added a supranational reference framework to the governments' decisions on the organization of their electric sectors. In Spain, for instance, the *MLE* was constrained by European directives, whereas the Portuguese Government was obliged to modify the policy pursued with *EDP*, hence limiting its central role.

3. Deregulation of the Iberian electric sector

During the 90s, the EU plans its policies to promote a common European electricity market. This plan seeks a better efficiency in the sector by introducing competition, with the objective of preserving the supply quality and with special dedication to the protection of the environment.[17]

This reform, launched by the EU, has drastically constrained the evolution of the Iberian electric sector in the last 25 years. If we look at the goals of this reform, Spain and Portugal have joined the group of leading countries in the transition. The unwavering commitment to renewable energies sought to comply with the climate change mitigation objectives of the EU, although it was also an attempt to modernize the economies of both countries.

Regarding the deregulation process, during the 80s some attempts had already taken place. Such efforts were made in different countries aiming to change the traditionally accepted model, in which the public sector controlled the whole process so as to guarantee an adequate electricity supply. In this sense, the introduction of competition is justified on the basis that it can boost economic efficiency and because such improvements might be shifted to the consumer through electricity prices (instead of being left in business' hands).[18]

There is abundant literature on this subject, both about the configuration and features of the competitive electric market and about the results of the very different deregulation processes.[19] A non-vertical business structure is needed in order to introduce the competition in the sector, but it is also detrimental that the different activities leading to the electric supply are separately regulated with regulatory bodies independent of the government. Whereas transmission and distribution are industrial activities with specific characteristics of natural monopolies, this is not the case for the stages of generation and commercialization, where it is possible to introduce competition. [20]

[17] Directive 96/92/CE.
[18] García-Álvarez and Moreno (2016)
[19] OECD/IEA (2001) and Joskow (2008) review the results of the process of liberalization of electric markets, with references to European markets.
[20] However, the *MIT Energy Initiative* (2016) reviews the traditional perspective, due to the proliferation of distributed generation systems (see page 138 et seq.).

The EU-initiated reform entailed:[21]

- Freedom to install plants and lines.
- Freedom of access to the grids.
- Independent management of the transportation network.
- Segregation of the electric activity within generation, transmission, distribution and commercialization.
- Progressive freedom of supplier choice by consumers.
- Freedom to import and export within the EU.

The process was complex and slow, yet coupled with a wide legislative development. European countries were progressively incorporating the requirements of the different directives to their national legislation, which means that such process of adaptation and its effects have not been uniform. [22]

The liberalizing target represented a major shift in the orientation of Iberian policies. In the case of Spain, *MLE* had established a centralized management model with tariffs aimed at retrieving those companies from the consequences of the oil crises and the unsustainability of some investments. In Portugal, this sector operated as a public monopoly. In both countries, the legislative shift to restructure the sector, and also to introduce competition, established a transitional period for adaptation, as well as mechanisms to ensure companies to cover the costs derived from the deregulation process.[23]

The following are some annotations on the process:

- Introduction of competition in electricity generation by the creation of an electricity wholesale market.
- Gradual introduction of competition in the marketing stage.
- Regulation of shipping and distribution phases of electric energy by the establishment of access charges that are compatible with the competition in the liberalized activities.

Regulatory bodies, fully independent of the Government, were created. Specifically, the *Comisión Nacional de la Energía* (*CNE)*[24] is set up in Spain and the *Entidade Reguladora do Sector Eléctrico* (*ERSE*) in Portugal.

Compensation mechanisms for the companies: in the case of Portugal, the electric power acquisition system is established through the *Contratos de Adquisición de Energía* (*CAE*s). The *CAE*s covered operating and maintenance fixed costs, amortizations, return

[21] Directive 96/92/EC. Developed in subsequent Directives: 2003/54 / EC, 2005/89 / EC and 2009/72 / EC.
[22] Steiner (2000) found evidence of a positive impact on efficiency at European level, with some impact on consumers. However, it also points out that Portugal and Spain were among the countries with the least degree of success in the liberalization process.
[23] In Spain, the *Ley del Sector Eléctrico* of 1997 and subsequently legislation in 2003, 2006 and 2011. In Portugal, the *Programa E4* (*Eficiência Energética e Energias Endógenas*) is highlighted, which, in 2001, sets out targets on market liberalization but also on the promotion of renewable energies. On the fulfillment of some of the objectives marked, see Alves y Silva. (2011)
[24] In 2013 it was integrated into the *Comisión Nacional de los Mercados y la Competencia* (*CNMC*).

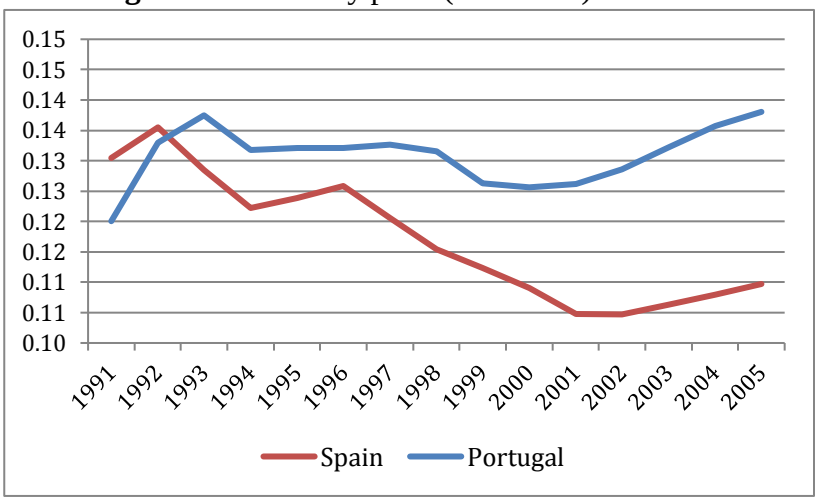
on capital and variable costs associated with the production. The latter were annually adjusted by inflation and the contracted availability against the actual availability of the production plants. In the case of Spain, the *Costes de Transición a la Competencia* (*CTC*s) were acknowledged in the *Ley del Sector Eléctrico* of 1997, as a compensation to those generating companies for the costs incurred in the process of transition from a regulated system to a competitive one.

The deregulating process was both complex and controversial. García-Álvarez and Moreno (2012) point out that "… *the opening of the electric market does not necessarily mean an effective competition and competitive prices: the effective deregulation and adequate operation of the electricity wholesale market is fairly constrained by the special features of the sector*" (page 110). Some peculiarities in the domestic sectors might explain the differences that have been observed in the implementation of the objectives. Specifically, in the Spanish case, it is noted that the main constrains on the effective competition come from:

- The horizontally integrated structure.
- The vertically integrated structure.
- Inelasticity of supply and demand.
- Regulatory distortions.
- Entry barriers to new competitors.

These elements have played a distorting role on the proper performance of the market, hence hindering prices to transfer efficiency gains to consumer through costs. **Figure 3** depicts the evolution of final electricity prices in both countries after the early years of the deregulation process and before the inception of the EU market.

Figure 3: Electricity price (euro/kWh) – tax included

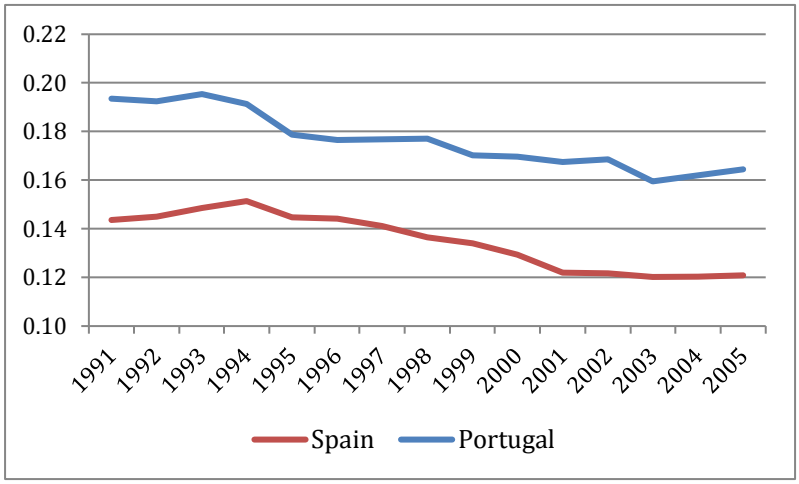


Source: Eurostat

Note that the deregulation process appears to have been reflected on the prices paid by Spanish consumers during these early years. By contrast, this is not the case in Portugal.

However, if prices are corrected in terms of purchasing power parity (PPS), a price decrease is seen in both markets over the same time period **(figure 4).**

Figure 4: Electricity price (PPS/kWh) – tax included



Source: Eurostat

The high level of external energy dependence during the initial period of reform is a distinguishing feature of the Iberian sectors. This might be another constraint to achieving the benefits of competition through prices. As **table 1** indicates, in 2005 both countries maintained a dependency that exceeded 80 per cent, against an EU average of 65 per cent. In this regard, only Italy registers a comparable dependency. During these years, the strong economic growth inevitably led to an increased demand for fossil fuels, as bolstering hydroelectric generation was impossible, nuclear energy was virtually non-existent or stagnated and renewable energies had so far a shortage of installed capacity. In such a way, the behavior of the energy internal market was highly constrained by the operation of international markets, higher oil prices and changes in the exchange rate.

Table 1: Energy dependence (%)

	Spain	Portugal	EU (19 c)	Germany	France	Italy	UK
1990	63,1	84,1	57,4	46,5	52,4	84,7	2,4
1991	63,9	82,3	58,2	51,6	52,5	82	5,2
1992	66,7	84,2	59,6	54,5	52	84,2	4,1
1993	66,3	82,8	58	55,5	47,9	80,8	0,2
1994	68,1	81,5	59,2	56,7	47,7	81,1	-13,7
1995	71,7	85,3	59,7	56,8	48	81,9	-16,4
1996	70	80,4	59,8	58,7	48,5	81,9	-14,5
1997	71,3	83,9	61	59,3	49,2	80,8	-15,4
1998	74,2	84,1	62,7	61	51,3	81,9	-16,4
1999	76,6	87,4	62,6	59,2	51,5	82,9	-20,3
2000	76,6	85,1	64,1	59,4	51,5	86,5	-16,9
2001	74,7	85,1	63,2	60,9	50,8	83,2	-9,3
2002	78,5	84,1	63,8	60,1	51,1	85,6	-12,3
2003	76,7	85,5	64	60,5	50,6	83	-6,4
2004	77,6	83,9	64	60,9	50,8	84,4	4,5
2005	81,4	88,6	65	60,4	51,6	83,4	13,4
2006	81,2	84	65,4	60,8	51,5	85,9	21,2
2007	79,6	81,4	63,6	58,4	50,4	83	20,5
2008	81,3	83,4	64,5	60,8	50,8	82,9	26,2
2009	79,1	81,4	63,4	61	51	80,8	26,4
2010	76,7	75,1	62	60,1	49,1	82,6	28,4
2011	76,3	77,7	62,4	61,6	48,7	81,4	36,2
2012	73,1	79,3	61,1	61,3	48,1	79,2	42,3
2013	70,4	72,9	60,1	62,6	48	76,8	46,4
2014	72,9	71,6	60,3	61,6	46,1	75,9	45,5

Source: Eurostat

Moreno and García-Álvarez (2016) stress the fact that the degree of integration in the sector might similarly restrict the effective competition in the market. However, in the Iberian sector the concentration data does not identify this as a distinguishing factor, especially if Spanish data is compared with neighboring countries **(Table 2)**. The main generating company evolved from a contribution of almost 52 per cent in 1999 to 35 percent in 2005. During the initial period, this contribution has experienced a progressive reduction, although such decline has not been too pronounced, though it remains in a better position than other electric sectors in European neighbors. Conversely, in Portugal, the decrease in the market share only amounted two points between 1999 and 2005, including an early increase in the market share to 61,5 per cent. [25] Ultimately, despite this deregulation process, there is still a high market concentration, especially in the case of Portugal, whereas the Spanish value is in the range of the Italian, German and British market environment.

[25] In the following years, there was a decline, although the weight of the main company remained very high (46.5 percent), almost twice as much as in the Spanish market (23.8 percent).

Table 2: Market share of the largest electricity generator (% total generation)

	Spain	Portugal	Germany	France	Italy	UK
1999	51,8	57,8	28,1	93,8	71,1	21,0
2000	42,4	58,5	34,0	90,2	46,7	20,6
2001	43,8	61,5	29,0	90,0	45,0	22,9
2002	41,2	61,5	28,0	90,0	45,0	21,0
2003	39,1	61,5	32,0	89,5	46,3	21,6
2004	36,0	55,8	28,4	90,2	43,4	20,1
2005	35,0	53,9	31,0	89,1	38,6	20,5
2006	31,0	54,5	31,0	88,7	34,6	22,2
2007	31,0	55,6	30,0	88,0	31,3	18,5
2008	22,2	48,5	30,0	87,3	31,3	15,3
2009	32,9	52,4	26,0	87,3	29,8	24,5
2010	24,0	47,2	28,4	86,5	28,0	21,0
2011	23,5	44,9	-	86,0	27,0	45,6
2012	23,8	37,2	-	86,0	26,0	51,7
2013	22,0	43,9	32,0	83,8	27,0	29,3
2014	23,8	46,5	32,0	86,8	29,0	-

Source: Eurostat

In spite of the progress in market liberalization, most scholars in this field indicate that, 10 years after the publication, in 1996, of the European directive behind the process (Directive 96/92/CE), the level of competition achieved in Iberian markets was limited.[26] Governments themselves acknowledged the need to take on further reforms with new legislative developments.[27] In short, in 2005 it was obvious that the deregulation process had to continue with such reforms, thus applying new norms aimed at increasing competition.[28] Furthermore, both countries were meeting the additional challenge of building a new regional Iberian market, also inspired by the European Directives, which included the creation of regional markets as a tool for improvements in both efficiency and competition.

4. The *Mercado Ibérico de la Electricidad* (*MIBEL*)

To make progress in the goals stipulated by the European legislation, a strategy based on the creation of regional markets was developed to achieve a more competitive and efficient domestic energy market. In the Iberian Peninsula, the integration process began in 1998. After some delays, in July 2007 *MIBEL* started its operations as a common

[26] Work providing information on the degree of competition gradually achieved with the reforms includes: García-Díaz & Marín (2003), Fabra & Toro (2005) or Moutinho et al. (2014).

[27] In Portugal the *E4 Program* established the need to promote market liberalization and quality of service. In Spain, the *Libro Blanco sobre la reforma del marco regulatorio de la generación eléctrica* (White Paper on the reform of the regulatory framework for electricity generation) states that the main objective had not been achieved and the generation market was still very uncompetitive (Pérez Arriaga et al., 2005)

[28] In Portugal, the resolution of the *Council of Ministers* of 2005 or the *Estratégia Nacional para a Energia 2020*, of 2010. In Spain, Law 17/2007 and Royal Decrees 3/2006 or 302/2011.

market for both the Spanish and Portuguese operators. This was accomplished by an intense harmonization effort, in which several regulatory bodies and system operators (*ERSE* and *REN* in Portugal, and *CNE* and *REE* in Spain) took part. The process was complicated due to regulatory and technological concerns. These sectors differed substantially regarding generation and market organization. Such differences were further complicated by the economic and social repercussions of a strategic sector. Thus, a strong institutional support for the process was necessary, aimed at conciliating the different political climate in each country.

The agreement reached in 1996[29] allowed Spanish companies to participate in the Portuguese market and *REN* (*Redes Energéticas Nacionais de Portugal*), additionally, to operate in Spain as an external agent. The need to harmonize the different productive sectors, from both the entrepreneurial and regulatory points of view, further complicated this deregulation process that had been started shortly before. The market situation was not homogenous. In Spain, although supply was private and advances were made in the market liberalization, the degree of business integration was high. Since January 2003, regulation entitled consumers to choose a supplier. In Portugal, however, despite the liberalization process initiated in 1995, the sector was still operating under a public monopoly and consumers were not free to choose a supplier. Furthermore, achieving an adequate scope of international connections was another paramount issue to settle for the Iberian market to be viable.

The adaptation process was gradual. A *Polo español (OMIE*- Spanish division of the Iberian Energy Market Operator) was defined as a spot electricity market with daily transactions, and a *Polo portugues* (*OMIP*-The Portuguese division of the Iberian Energy Market Operator) as a forward market. In January 1998 *OMIE* started to operate for the Spanish market and in July 2006 *OMIP* did the same. Eventually, a joint operation was started for the entire Iberian market a year later. That is to say, in July 2007 *MIBEL* fully started its activity, whose configuration, looking at the information provided in its website,[30] entails:

> **Electricity**
> Spot:
> ***OMIE*** *– Operador del Mercado Ibérico de Energia, S.A.* (The Spanish division of the Iberian Energy Market Operator) is the managing entity for the spot electricity market with daily transactions and intra-day adjustments (intra-day markets), wherein electricity sale (production) and purchase programmes are established for the day following that of the trade. Thus, OMIE is responsible for the settlement of the daily and intra-day markets.
>
> Foward/Derivatives:
> ***OMIP*** *– Operador del Mercado Ibérico de la Energía, SGMR, S.A.* (Iberian Energy Market Operator - Portuguese Division) ensures the management of the

[29] Agreement for cooperation in the field of electrical energy. (Madrid, 1998)
[30] More information available on www.mibel.com/

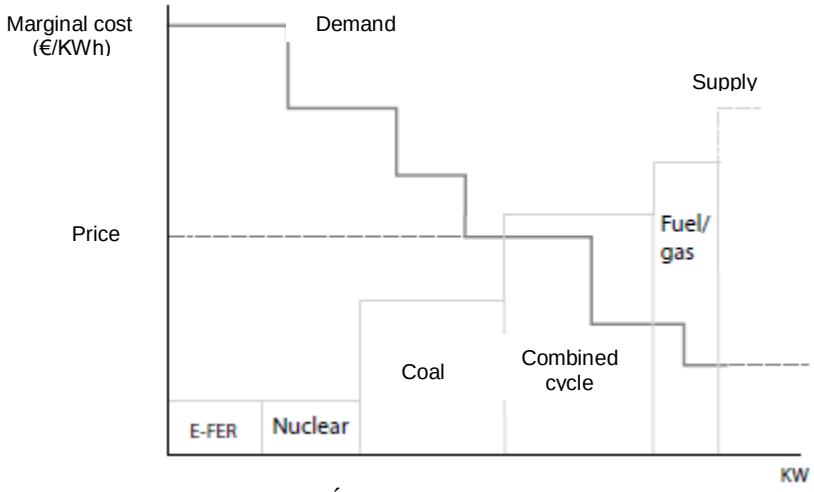
MIBEL futures market (Iberian Electricity Market) in Portugal and is currently a regulated market.
OMIClear – *Sociedade de Compensação de Mercados de Energia, SGCCCC, S.A.*(The Clearing Platform for the Iberian Forward/Derivatives Markets) was created on 6 April 2004 as a clearing house, central counterpart and settlement system

System Services
Portugal:
REN – *Redes Energéticas Nacionais, SGPS, S.A* (National Energy Networks)
REN is responsible within the national electricity system, for the electricity transmission network activity exclusively and as a public service via concession. The electricity transmission network activity includes the development, operation and maintenance of the National Electricity Transmission Network (*RNT*) as well as its interconnection with other networks and the global technical management of the National Electricity System (*SEN*) and ensures the coordination of its production and distribution plants.

Spain:
REE – *Red Eléctrica de España*
The *REE* is responsible for the transport network and is an operator/agent of the Spanish electric system.

Whereas energy is negotiated on the spot market with a one-day time horizon, on the forward market transactions are made with a time horizon greater than one week. The Clearing Platform for the Iberian Foward/Derivative Markets (*OMIClear*) deals with compensation, registration, risk management and clearance of negotiated operations in *OMIP*.

Figure 5: Supply and Demand in the electricity daily market



Source: García-Álvarez y Moreno (2016)

Prices are determined in daily market through the marginal system, the same as the practical entirety of liberalized markets. The aggregate supply curve is composed of the

supply of energy plants, ranked by their marginal cost (merit curve) ranging from the lowest marginal cost (including the costs of fuels, emissions…) to the highest marginal cost. Hence, hydraulic, renewable (*E-FER*) and nuclear plants are the ones first considered, whereas gas and fuel oil are the last ones, as they have higher marginal costs. Despite such differences in marginal costs in diverse technologies, the final price paid for all exchanges is the one of the last technology accepted.

There are also intraday markets, which allow the adjustment of deviations in forecasts for electric generation or demand forecasts. On the basis of the results of these markets, the system operator (*REE* and *REN)* resolves issues arising from the operations to undertake (for instance, those related with energy transmission).

5. Repercussion of reforms on competition in markets.

Table 3 depicts some competition indicators in electricity and retailer generation of both countries. The *Herfindahl-Hirschman indicator (HHI)* demonstrates limited competition for the year 2014. The EU considers as acceptable a *HHI* lower than 2.000 and a market share below 25 percent. If these figures are surpassed, one might come across horizontal competition concerns. However, such statement might need qualification and one must cautiously take it. [31]

Table 3: Electricity markets indicators (2014)

	HHI Index				Market share (%)	Household switching rate (%)
	Generation	Retail				
		Household	Industry	Household		
Spain	1.329	-	-	2.240	23.8	12.1 ®
Portugal	3.567	6.918	2.815	-	44.9	13,2 (h)

®: entire retail market, (h): only household retail market

Source: Eurostat, CEER, National Regulatory Authority

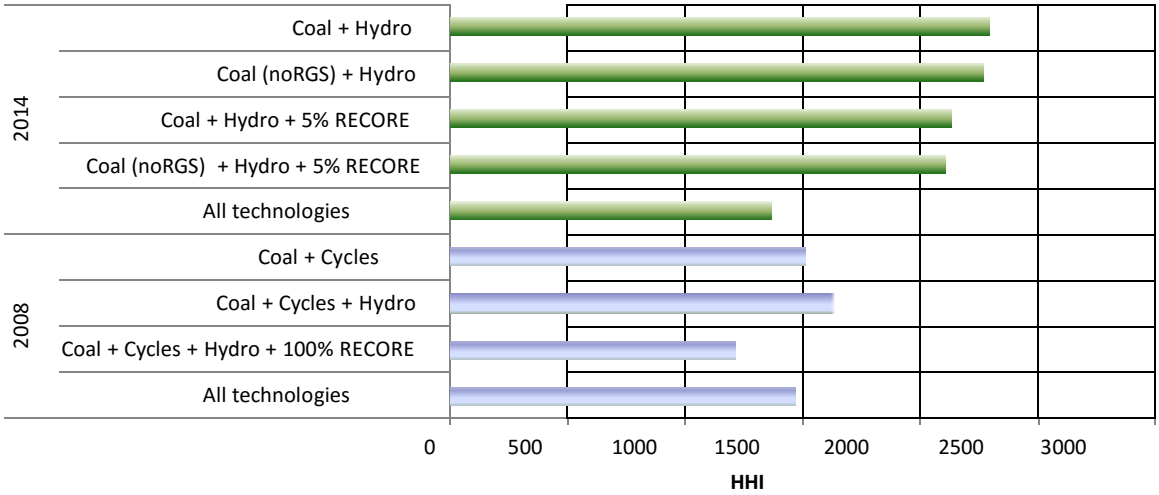
According to available data, it appears that before the economic crisis started there was an adequate increase in horizontal competition within the wholesale market, where *MIBEL* participates (**figure 6**). At least, this is supported with the analysis conducted by the *Comisión Nacional de Energía* (*CNE*) through *HHI Index*, according to data from 2008. Figure 6 depicts a decline in all the different indexes in 2014.

This change in trend is fundamentally explained by a lower market share by combined cycles-technology (due to the crisis), hence removing the companies that are not related with those traditional ones in the sector. Nevertheless, none of these generating

[31] See *CNE.* (2012)

companies possess such "pivotality",[32] probably because of the oversupply derived from the economic crisis since 2009.

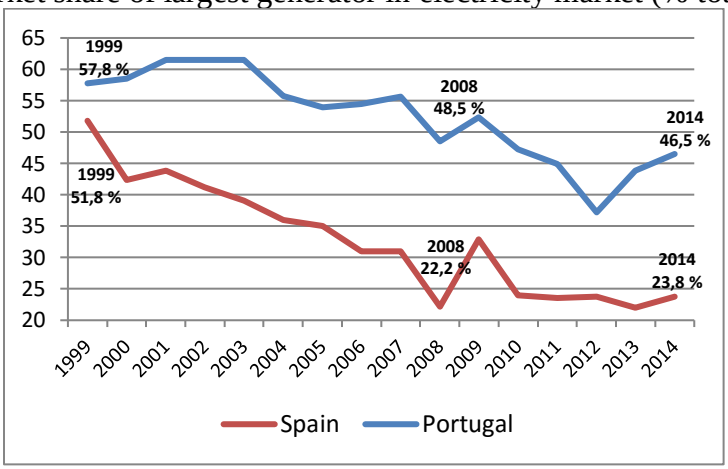
Figure 6: *HHI Index* (daily market + bilateral agreements *MIBEL*) – 2008 & 2014



RGS: Supply security constraints (*Restricciones por Garantía de Suministro*)
RECORE: renewable, cogeneration and waste.
Fuente: *Comisión Nacional de los Mercados y la Competencia* (*CNMC*)

Figure 7 also indicates such trend towards concentration and loss of competition. The deregulation process has marked a decreasing trend in the percentage of participation of large companies, even though this inclination appears to be broken in recent years.

Figure 7: Market share of largest generator in electricity market (% total generation)



Source: Eurostat

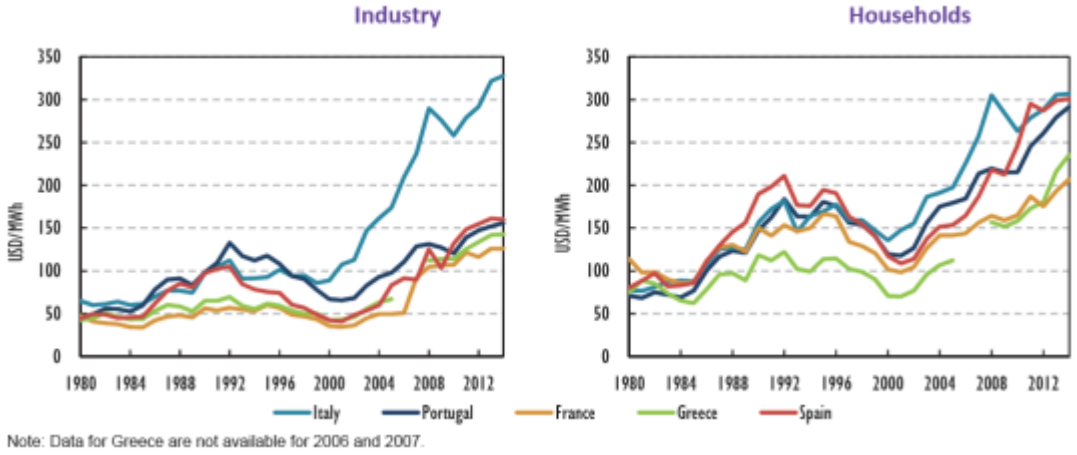
Hence, it is necessary to assess the extent to which the benefits of the resulting increase in the competition of electric generation have been transferred to consumers.

[32] Pivotality is another indicator of the degree of competition. This index calculates if at any time the power of a particular generator is essential to meet all the market demand.

According to the European Directives, this was one of the inspiring compromises enshrined in the European energy market. Such market would transfer the benefits of the sector's efficiency to consumers through prices. In this line, in the case of the Iberian markets, both Spanish and Portuguese retail markets should reflect in the prices the results derived from creating the *MIBEL* and increased competition in generating electricity.

The following graphs (**Figure 8)** show the evolution of prices paid by industrial consumers and households in different European countries. We can see an increase in prices since the 80s (a not exclusive phenomenon in Iberian countries). The commissioning of *MIBEL* coincides with a period in which prices experienced a major growth, specifically in households. After a steady growth phase, which might reflect an increase in fossil fuels prices, during the 90s electricity prices remained suppressed. However, during the last 15 years it can be clearly recognized a continuous increase in prices paid by households.

Figure 8: Electricity prices in Spain, Portugal, Italy, France and Greece (1980-2014)



Source: IEA (2015c), *Energy Prices and Taxes 2015*, Q3, www.iea.org/statistics/

In any case, price behavior requires a more rigorous analysis rather than a mere observation of the time profile, as there are many features that might explain such behavior during the deregulating process. Not wishing to go into detail about the limiting factors of competition in the retail market, we will summarize some of them.

Firstly, aside from the reforms introduced in the market, it is worth recalling the high exposure of the sector to the international prices of fossil fuels (and therefore to fluctuations in exchange rates).[33]

On the other hand, for the benefits of competition to reach the consumers it is a necessary, but not a sufficient condition, that the latter have the ability to choose their electricity supplier. Although in both Spain and Portugal, consumers are entitled to choose electricity supplier, this does not guarantee a more effective competition. Consumers seem

[33] Several papers have analyzed this question: García-Álvarez & Moreno (2012), Fernández-González & Moreno (2015) o García-Álvarez & Moreno (2016) in the Spanish market. Within the scope of *MIBEL*, Pereira & Pereira (2015).

to show a certain aversion to change, which translates into a reluctance to change supplier, and even to abandoning regulated tariffs in favor of the free market.

EU legislation clearly states the right "…*to be supplied with electricity of a specified quality within their territory at reasonable, easily and clearly comparable, transparent and non-discriminatory prices. To ensure the provision of universal service, Member States may appoint a supplier of last resort*".[34] However, price paid by final consumers entails a range of surcharges (taxes, tolls on network access, regulated system costs, indirect taxes…) that hamper the average end user's ability to understand what s/he is paying for in the bill received. The lack of transparency in costs and the significant asymmetry in the information available for both consumers and business definitely obscure the effective competition, thus slowing down the transition towards a free market. In reality, a significant number of consumers decided to choose the supplier of last resort appointed by the legislation.

The Portuguese regulating body (*ERSE*) accepts the need for greater transparency in tariffs.[35] The selling price for final consumers is divided into three elements:

- Networks Access tariffs (regulated tariffs that are common to all consumers). It includes:
    - Tariff for the Use of Transmission Network.
    - Tariff for the Use of Distribution Network.
    - Tariff for the Global Use of System.
- Energy tariff.
- Retail Commercial tariff.

The regulated market tariff incorporates the energy tariff, which is linked to the market price.[36] The energy cost for free market clients shall be fixed with the supplier.

Since March 2014, Spanish consumers have three different contract options:

- Voluntary price for the small consumer [in Spanish *Precio Voluntario para el Pequeño Consumidor* (*PVPC*)[37]]: it includes the average price in the electricity market and, therefore, it may change in each billing.
- Fixed price with a 12-month term, compulsorily supplied by top-marketer companies as an alternative to *PVPC*. The price will be freely fixed by each company, hence including the following elements:
    - Transport network usage prices and some other costs that apply to supply.
    - Fixed cost for the remaining cost of electric supply.
- Free market.

[34] See Directives 2003/54/CE and 2009/72/CE.

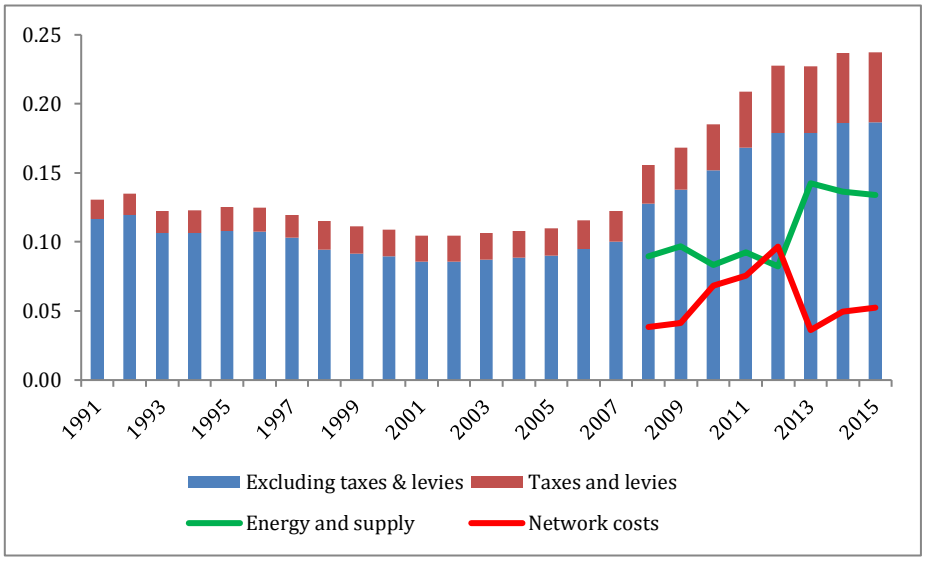
[35] http://www.erse.pt/pt/electricidade/tarifaseprecos/Paginas/default.aspx

[36] Until the liberalization of the market, the system for the acquisition of electric energy was maintained, based on the EACs, and replaced by the Cost of Maintenance of the Contract Equilibrium or *Costos de Mantenimiento del Equilibrio Contractual* (*CMEC*), which will disappear in 2027.

[37] The PVPC replaces the Last Resort Fee (TUR). The way of calculating the price is modified, incorporating the price of the electric market. Since 2009, it was allowed that the consumer could contract the supply in the free market or with a marketer according to the TUR.

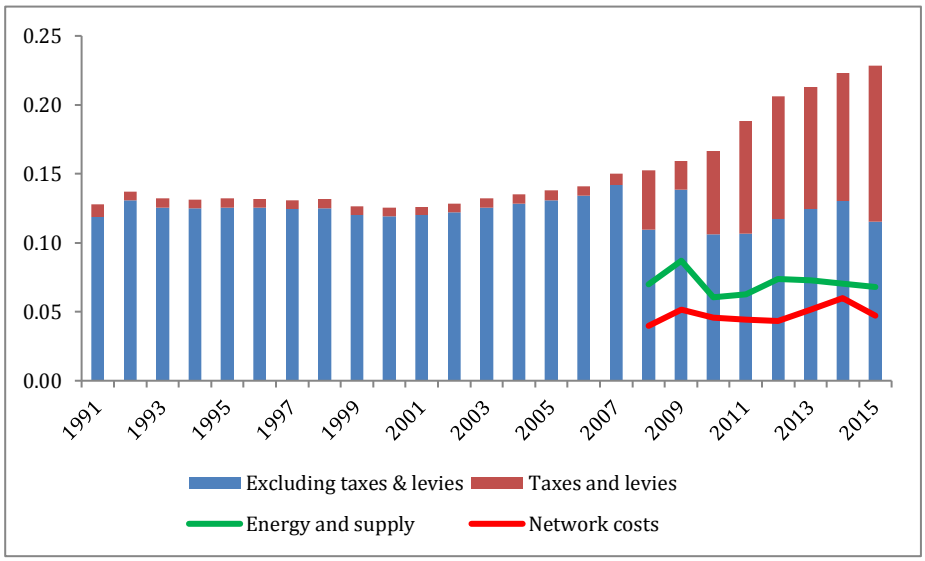
Figures 9 and **10** demonstrate rising electricity prices for both Spanish and Portuguese households since the commissioning of *MIBEL*. The costing structure has been changing quite a bit, with taxes having important influence, especially in Portugal as a result of the fiscal adjusting policy implemented after the economic crisis (**Table 4**). In 2013, the Spanish Government modified the tariffs' elements (Figure 9). Subsequently, further modifications have been introduced to link household prices to the wholesale market to a greater extent, thus attempting to transfer the positive effects of competition. The Portuguese Government has also recently modified its tariffs to achieve financial equilibrium (forced by fiscal constrains deriving form EU's intervention) and compensate the effects (through *MIBEL)* of the changes made by the Spanish Government.

Figure 9: Household electricity prices (€/kWh). Spain



Source: Eurostat

Figure 10: Household electricity prices (€/kWh). Portugal



Source: Eurostat

Table 4: Household electricity prices (€/kWh)

			1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
composition of the electricity prices for household consumers (€ per kWh)	Total price	Spain	0,131	0,135	0,122	0,123	0,125	0,125	0,119	0,115	0,112	0,109	0,105	0,105	0,106	0,108	0,110	0,116	0,123	0,156	0,168	0,185	0,209	0,228	0,227	0,237
		Portugal	0,128	0,137	0,132	0,132	0,132	0,132	0,131	0,132	0,126	0,126	0,126	0,129	0,132	0,135	0,138	0,141	0,150	0,153	0,160	0,167	0,188	0,206	0,213	0,223
	Taxes and levies	Spain	0,014	0,016	0,016	0,016	0,017	0,017	0,017	0,021	0,020	0,020	0,019	0,019	0,019	0,019	0,020	0,021	0,022	0,028	0,030	0,033	0,041	0,049	0,049	0,051
		Portugal	0,010	0,007	0,006	0,006	0,007	0,006	0,006	0,007	0,006	0,006	0,006	0,006	0,007	0,007	0,007	0,007	0,008	0,043	0,021	0,061	0,081	0,089	0,089	0,093
	Excluding taxes and levies	Spain	0,117	0,120	0,106	0,107	0,108	0,108	0,103	0,095	0,091	0,090	0,086	0,086	0,087	0,089	0,090	0,095	0,100	0,128	0,138	0,152	0,168	0,179	0,179	0,186
		Portugal	0,119	0,131	0,126	0,125	0,126	0,125	0,125	0,125	0,120	0,119	0,120	0,122	0,126	0,128	0,131	0,134	0,142	0,110	0,138	0,106	0,107	0,117	0,124	0,130
	Energy and supply	Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,089	0,097	0,084	0,093	0,082	0,143	0,136
		Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,070	0,087	0,061	0,063	0,074	0,073	0,070
	Network costs	Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,038	0,041	0,068	0,076	0,097	0,036	0,050
		Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0,040	0,051	0,046	0,044	0,043	0,051	0,060
share in price without taxes and levies (%)	Energy and supply	Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	70,0	70,0	55,0	55,0	46,0	79,7	73,3
		Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	63,7	62,9	57,1	58,6	63,0	58,6	54,0
	Network costs	Spain	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30,0	30,0	45,0	45,0	54,0	20,3	26,7
		Portugal	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36,3	37,1	42,9	41,4	37,0	41,4	46,0

According to the European Commission,[38] the share of Spanish consumers within the regulated market by the end of 2013 reached 60 percent, with a continuing trend towards regulated market exit (in 2011 it reached 70 percent). However, most of the consumers who leave the regulated market correspond to the commercial and industrial segment, many of whom have better access to information supplied in the market and thus act accordingly.

On the contrary, it is far more difficult for domestic consumers to access comprehensive information on markets. Also, the benefits from switching supplier are fairly limited. Hence, it is not surprising that, considering such complex cost structure, households have not been especially conscientious with this shift towards free market in neither country.

Moreover, EU data reveals that both Spanish and Portuguese consumers rate the performance of the sector negatively, far below the European average. This factor is also one the reasons behind the slow evolution towards the market rate.

Notwithstanding the *MIBEL* and all the reforms implemented, the degree of competition in Portugal is still limited, both in generation and retail market. [39] In 2012 legislation was adopted with the purpose of encouraging consumers' access to the liberalized market, leaving the regulated tariff behind. **Table 5** depicts an increasing trend in the switching rate from this initiative. In any case, the number of consumers in the liberalized market is still very limited.

Table 5: Switching rate

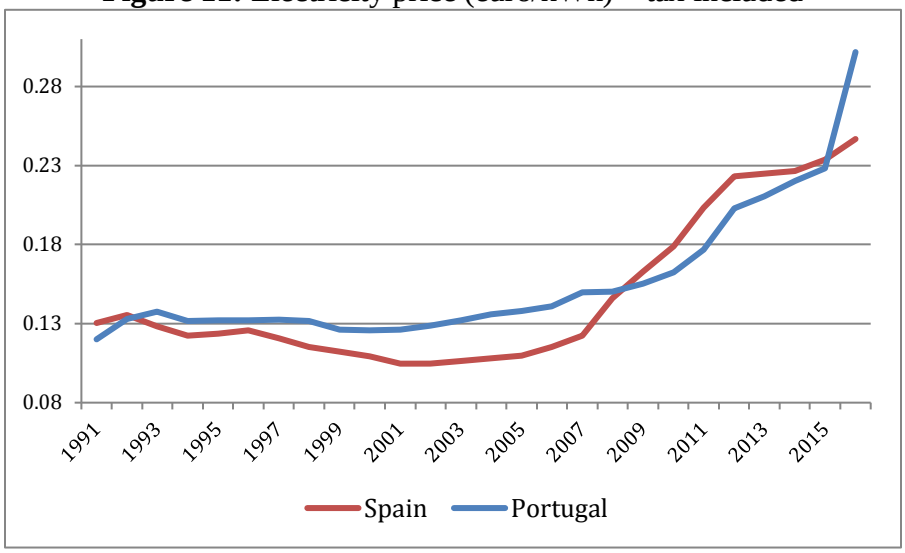
	2009	2010	2011	2012	2013	2014
Spain ®	5,2	7,4	10,6	12,1	12,2	12,1
Portugal (h)				13,2	26,8	13,2

®: entire retail market, (h): only household retail market
Source: CNE, Eurostat, CEER, National Regulatory Authority

In short, despite the measures implemented and a higher competition in the wholesale market, the retail market has not met expectations since it has not evolved enough. The market is still highly concentrated, electricity prices have experienced a significant increase and consumers do not have enough incentives or information to leave the regulated market or exercise the right to change the supplier. Important to note: such phenomenon occurred in despite of the low perception of the service received. [40]

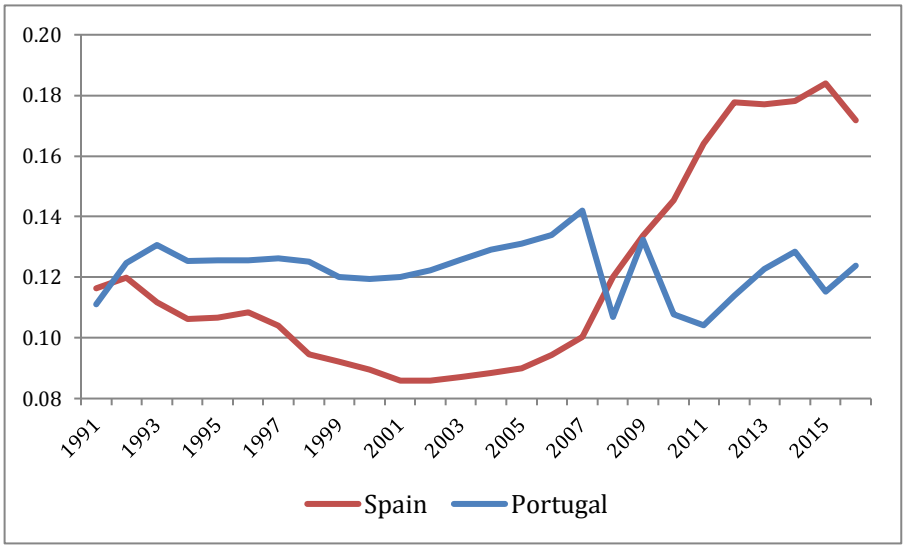
[38] *Single market progress report* (European Commission, https://ec.europa.eu/energy/en/data-analysis/country).
[39] According to the EU (2014), in 2013, 43 percent of the electricity stemmed from EDP. In addition, 42 percent of the offer was regulated, without any exposure to risks associated with the market.
[40] According to the EU (2014), the trust in the supplying companies and the satisfaction of the service occupy the last places in the EU. On the contrary, problem incidence values are the second and third highest in this rank.

Figure 11: Electricity price (euro/kWh) – tax included



Source: Eurostat

Figure 12: Electricity price – without tax



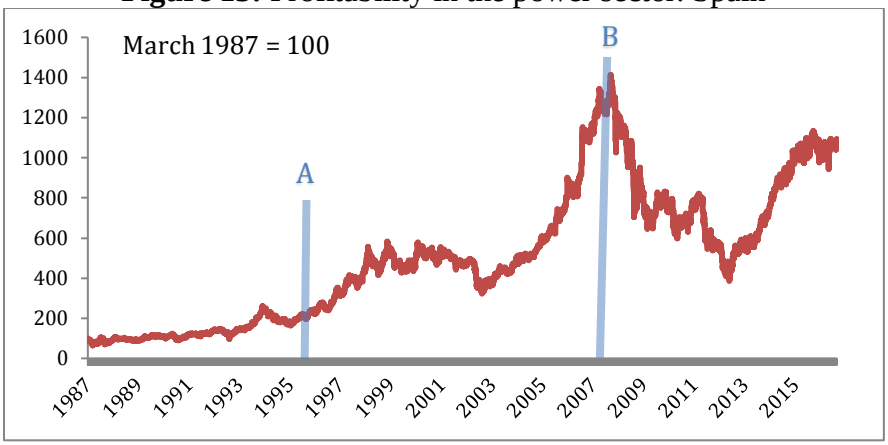
Source: Eurostat

Finally, a quick review of the companies' profitability through their quotations does not seem to show that the liberalization process has hampered power companies in terms of their quoted value (**figures 13** and **14**). As stated above, during the entire process the governments of both countries have guaranteed an income to the companies in the sector to safeguard financial sustainability and compensate the costs associated with the liberalization process.

In Portugal, the price does show a certain loss of value until 2003. In 2002 and 2003 there is an intensive legislative activity aimed at establishing mechanisms for the appropriate functioning of the market. During this period of more than 4 years, quotation shows a growing trend that breaks once the MIBEL starts operating, as similarly happens

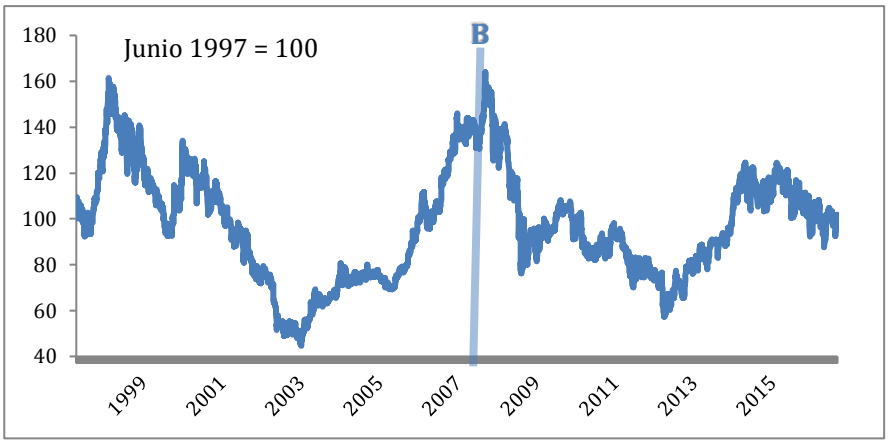
with the Spanish index. We observe a decline until there is a recovery at the moment in which incentives to the *E-FER (*renewable energies) are revised. Similarly, legislation is guaranteed to ensure financial stability of the electricity system. Portuguese data continue to reveal a downward trend to date.

Figure 13: Profitability in the power sector. Spain



A: Directive 96/92/EC (promoting a common European electricity market)
B: Start of *MIBEL*
Source: Based on Datastream.

Figure 14: Profitability in the power sector. Portugal



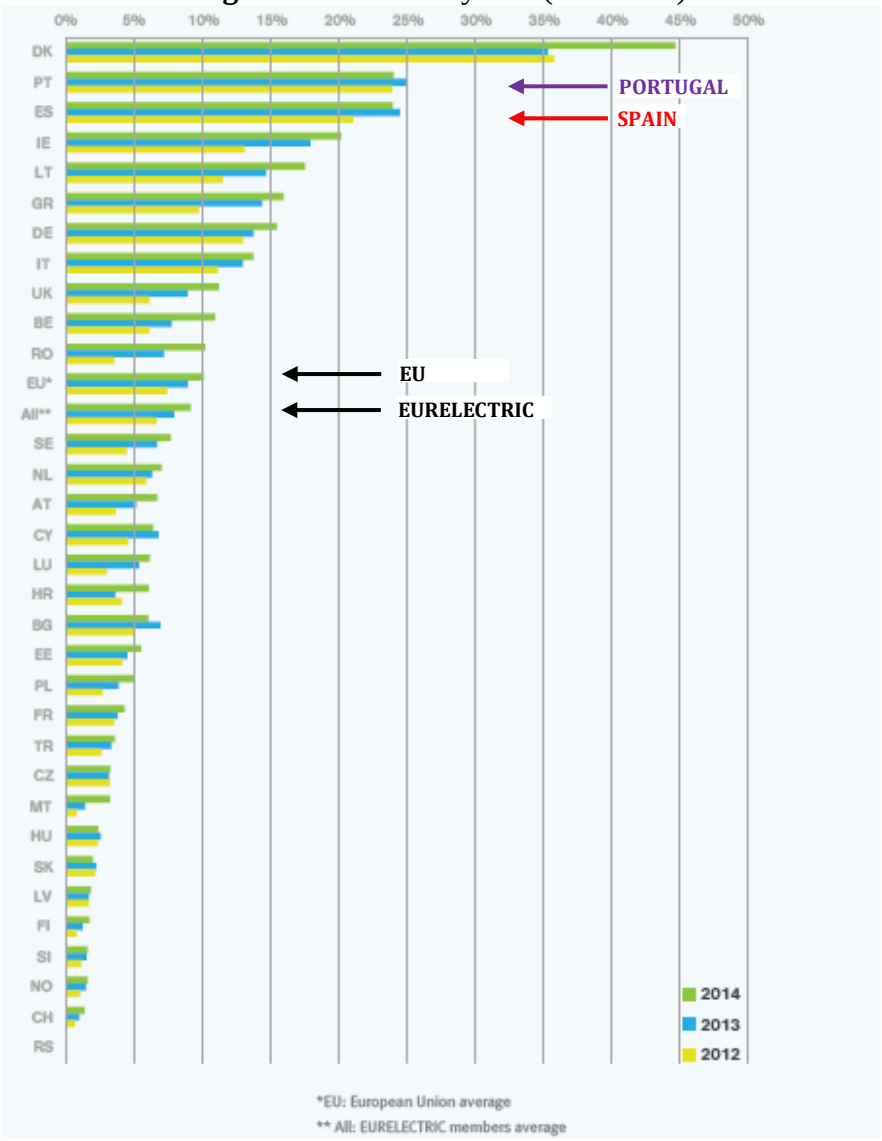
B: Start of *MIBEL*
Source: Based on Datastream.

6. The Iberian transition towards renewable energies

Beyond the different aspects that the present report has previously analyzed, including the different obstacles and lags in the increase of competition in the Iberian electric market, it is worth stressing that both, Spain and Portugal, are among the countries leading the energy transition. As shown in **figure 15**, in Europe both countries lead the way in the incorporation of renewable sources into their generating sector.

The objective transcends the environmental component, since it was expected that the commitment to renewable sources (*E-FER*) would surpass the scope of the electricity sector and would positively impact the progress of both economies.

Figure 15: Electricity mix (% *E-FER*)



Source: Eurelectric

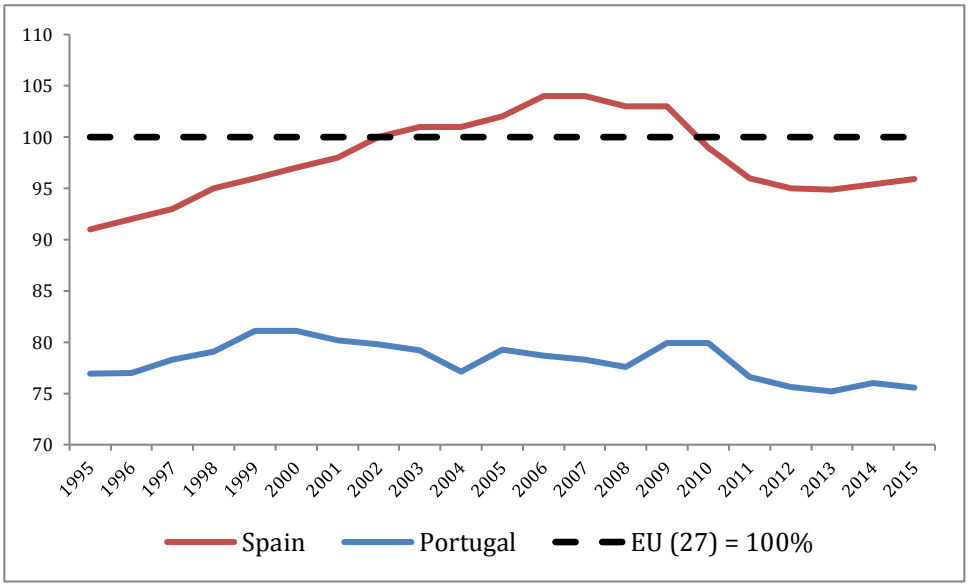
Spain and Portugal took up the challenge enshrined in the "20-20-20 strategy"[41] at the end of a period in which both economies had undergone a stage of unprecedented economic growth in their modern history. At that time, Portuguese per capita output had

[41] The *Europe 2020* strategy consisted on a set of measures included in legally binding legislation for EU countries in 2009, which were intended to ensure compliance with the EU's climate and energy targets for 2020. Fundamentally:

- 20 percent reduction in greenhouse gas emissions compared to 1990 levels.
- 20 percent increase in renewable energy in the EU.
- Improvement on 20 percent in energy efficiency.

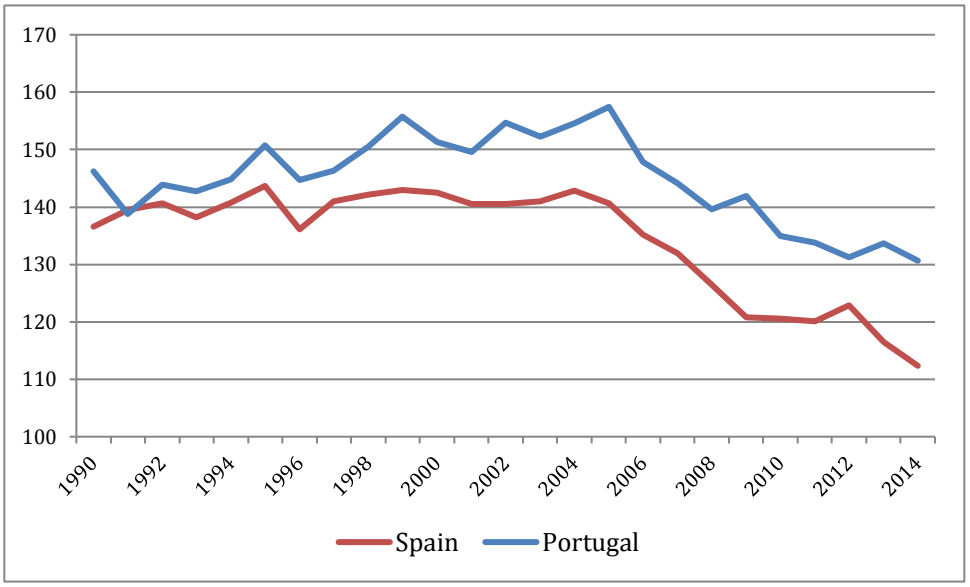
reached levels around the European average, namely, almost 80 percent. On the other hand, in Spain the European average had been exceeded after some years of convergence (**figure 16**). Such level represented a success that was difficult to predict in the light of the data on which they were based, when they were incorporated into the EU.[42] Rapid growth was reflected in a continuous increase in energy intensity until, in the last 12 years, this variable began to show a downward trend (**figure 17**), along the lines of European sustainability objectives.

Figure 16: GDP per capita (% over EU average). PPS.



Source: Eurostat

Figure 17: Energy intensity (toe/M€'10)



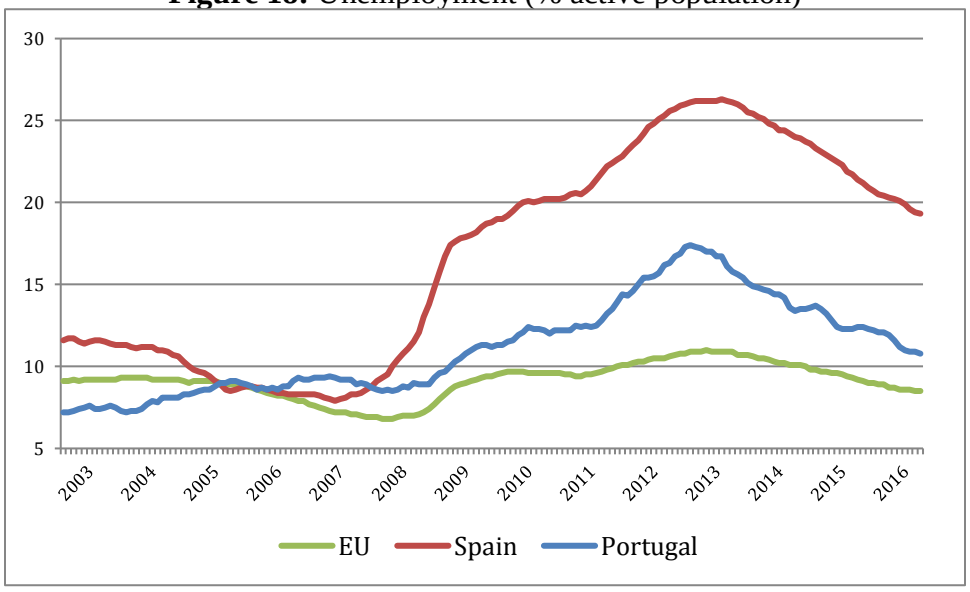
Source: Eurostat

[42] In 1985, whereas Spain did not reach the 70 percent of the European average per capita GDP, the Portuguese was below 65 percent of the European average.

The economic crisis affected the Iberian economies, which registered levels significantly worse than the European average. The data on the evolution of the labor market are particularly striking, with levels of unemployment difficult to accept (especially in the Spanish case), as shown in **Figure 18.**

For this reason, designing energy policies compatible with the creation of jobs is pivotal in the Iberian economies. There are several papers that address the problem of the transition to an environmentally and socially sustainable economy. Some scholars are optimistic about the chances of achieving equilibrium between economic growth and environmentally friendly policies towards cleaner energies. [43]

Figure 18: Unemployment (% active population)



Source: Eurostat

Pollin (2015) recently affirmed that investing in renewable energies and energy efficiency, which is fundamental in order to stabilize the climate, would lead to increased job opportunities and economic growth around the world. Spain is one of the countries included in this paper, which forecasts high returns in terms of employment gains through investment in renewable energy.[44] The consolidation of the renewable sector can be used as an opportunity to boost R&D, reaching positive effects beyond the electric sector itself. If the general climate is favorable to innovation, investment in *E-FER* can expand and

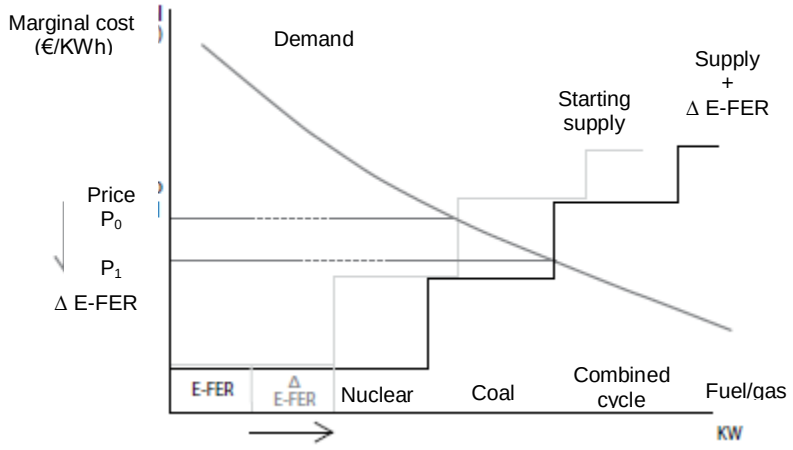
[43] Silva et al (2011) conduct an analysis with data provided by various countries, including Spain and Portugal. They conclude that in the initial stages of the development of renewables there can be a certain negative effect on growth. However, that effect may disappear as renewables have become more competitive. See also Alves & Silva (2011). Harris (2013) discusses options for reconciling policies that encourage growth and employment with respect for the environment.

[44] Moreno & López (2008) studied the employment generated by renewables in Asturias (Spain). *Asociación de Empresas de Energías Renovables* (2015) studies the macroeconomic impact of renewable energies in Spain. Ecofys (2011) notes that strong support for wind power in Denmark, Germany and Spain helped build a powerful industry, with beneficial effects for the three economies.

improve the positive effects of innovation, thus spreading them to the activity and employment of the whole productive system.

The integration and evolution of the *E-FER* in the Iberian market have been possible by developing a program of public incentives. In the wholesale electricity market, an increase in the use of *E-FER* is expected to lead to a contraction in the price of electricity (**Figure 19).** In the daily market supply curve, marginal costs of electric technologies (fuel prices, operation and maintenance of energy plants, cost on carbon emissions) are represented, which in *E-FER* are practically zero. An increase in *E-FER* would produce a shift to the right of the supply curve by reducing the price of electricity in the wholesale market.[45] With the progressive growth of *E-FER*, the price would be reduced, while investing in new generation capacity would cease to be gainful (the high costs of the new investment would not be offset by the low price of electricity). For this reason, the introduction of renewable energies in the electric market has required public incentives (which compensated the loss of income stemming from a fall in prices).

Figure 19: Expected effects of an increase in E-FER on the wholesale electricity market.



Source: García-Álvarez y Moreno (2016)

The incentive system has generated controversy over the effect they could have on electricity prices. Some scholars point out that the commitment to renewables, while reducing the wholesale price of electricity, has had precisely the opposite effect on the price paid by the final consumer.[46] In such a way, it would be one of the factors that would account for the poorly competitive evolution of the Iberian retail market.

[45] See in Moreno et al. (2012), Moreno & García-Álvarez (2013), Moreno et al (2014) and Moreno & García-Álvarez (2016) the effect of imported fuels, the promotion of *E-FERs* and competition in the price of households and industries.

[46] See, for instance, Alves & Silva (2011). Würzburg et al (2013) review various empirical studies on the effect of renewables on the price of electricity. MIT Energy Initiative (2016) points out that the introduction of *E-FER* in the electric mix can lead to volatility in spot prices and divergence between markets with different time horizons. (page 56)

On the other hand, the incentives design does not appear to have been sufficiently calibrated and, after some years of implementation, it was amended in order to obtain financial sustainability in a global crisis environment. In recent years, solutions have affected the development of E-FERs and have fueled the debate over their effects on prices. The picture is puzzling and it will force decisions on structure and dimension, adapting regulatory and market mechanisms.[47] The central role played by energy in the fight against climate change restrains the debate. The decision to invest in renewables is an issue that goes beyond economic profitability, as it creates strong externalities related to the environment and health. Nevertheless, there are some technical drawbacks to the environmental and economic strengths of renewables, such as their integration into the grid, the difficulty of storage or greater network requirements. Further, the negative implications on the supply, due to the intermittency and seasonality, are also considerable and neither are they resolved, either from the technological or regulatory point of view. As long as there is no technological evolution that permits large amounts of electricity to accumulate, it will be necessary to reinforce the electricity transmission networks and to ensure a reliable intermittent backup with alternative sources. The cost of backup capacity shall be included into the economic and regulatory analysis of the transition process.

Assessing the development of the incentive policy appears to be a complex task. In view of the evolution of installed capacity in renewables, it is clear that the incentive system did foster investment.[48] However, the objectives have been manifold and the assessment, in any case, is constrained by the prioritization of these objectives, including the financial sustainability of the sector or the purpose to generate employment.

It has already been indicated that incentive design is at the center of the debate, especially given the austerity policies imposed by the EU, which have particularly affected both Spain and Portugal.[49] In recent years, there has been a meaningful drop in investment in *E-FER*, explained by the necessity to rebalance public accounts.[50] In this environment of economic crisis and adjustment, some sectors of opinion have blamed *E-FER* promotion policies on the high final prices of electricity. For instance, it has been criticized that incentives are not directly linked to the amount of emissions avoided, but to the investment made, which might have generated speculative processes based on the high profitability of subsidized investments. Likewise, in the debate on the financial sustainability of the sector, it has also been argued that the "excess profits" obtained by hydraulic or nuclear facilities

[47] On the effects of renewables on investment in new capacity and the remuneration of such capacity see, for example, Fabra (2012). For a much broader analysis of the evolution of the sector, see *MIT Energy Initiative* (2016).

[48] The numbers are even more striking if we discount hydraulic power (historically with high capacity).

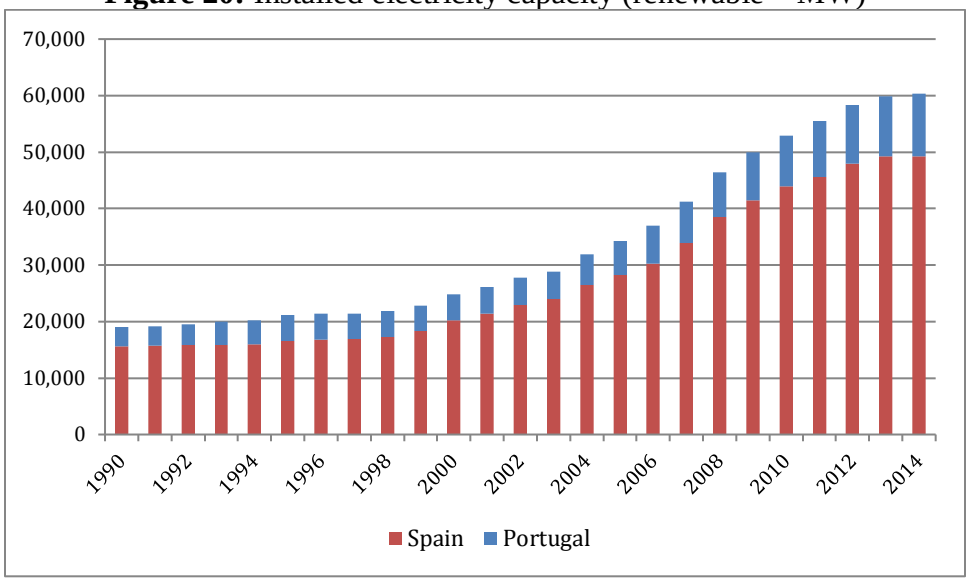
[49] After several adjustment plans, in April 2011 Portugal requested the intervention of the EU and the IMF to solve the serious financial crisis in which it was involved. One of the first impositions on the Portuguese Government was the privatization of three state-owned companies: *EDP* (*Energias de Portugal*), *REN* (Redes Energéticas Nacionais) and the airline *TAP (Transportes Aéreos Portugueses).* Likewise, in June 2012, the Spanish Government requested external financial assistance for the restructuring and recapitalization of its banking sector, which also led to a tough expenditure adjustment plan.

[50] The European Directive 2009/28 / EC on the promotion of the use of energy from renewable sources, established the need for each country to develop a specific plan for the period 2011-2020. This originated the Portuguese *PNAER* and the Spanish *PANER.*

to compensate the introduction of competition may have constrained the situation by limiting the capacity to maintain incentives to renewables.

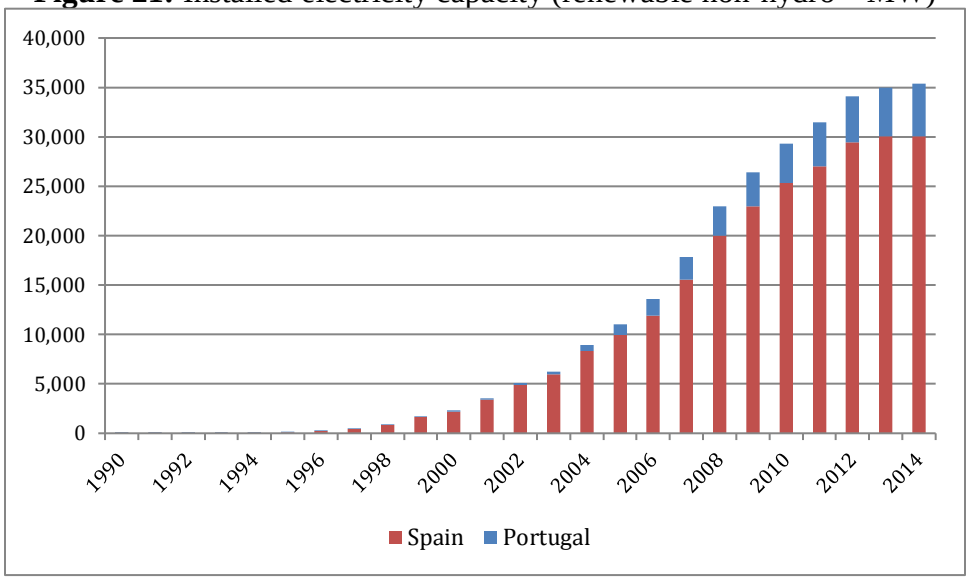
In Spain, the promotion of renewables through the *feed-in tariffs* system had generated a rapid growth of projects, but also did it originate problems due to oversized investment and the volume of resources required for its maintenance. In 2010, following the EU requirements, the National Action Plan for Renewable Energies in Spain (*Plan de Acción Nacional de Energías Renovables de España*, *PANER*) set up the objectives in terms of *E-FER* for the period 2011-2020.

Figure 20: Installed electricity capacity (renewable – MW)



Source: Eurostat

Figure 21: Installed electricity capacity (renewable non-hydro – MW)



Source: Eurostat

Such objectives are specified in a way that renewable energies account for 20 percent of gross final energy consumption, with a 10 percent transport share in 2020. The plan recognized the necessity to act on three fronts:

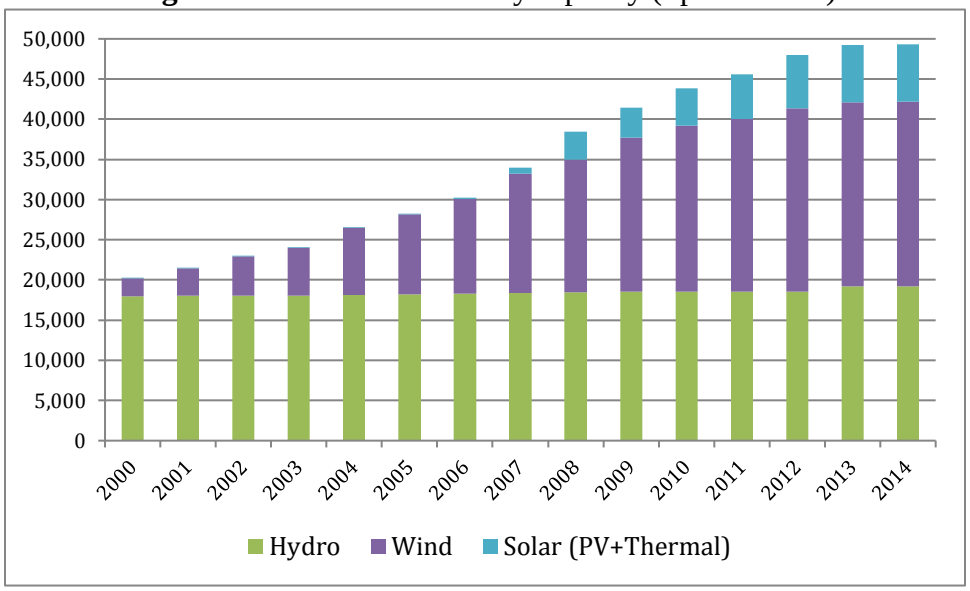
- Reduce energy intensity, thus encouraging energy efficiency.
- Reduce dependency: aimed at reducing the influence of primary energy prices and increasing the guarantee of supply.
- Reduce emissions of greenhouse gases.

Likewise, the expected positive effects on employment as of the promotion of *E-FER*s are indicated. According to *PANER* Spain, renewable energies have multiple positive effects on society as a whole, such as an increase in the level of employment and rural development, among others.[51] The plan indicated that, following the initial launch phase, it was time to implement a consolidation phase to ensure the future sustainability of the energy transition process. The principles for the future incentive system should be:

- Stability, ensuring sufficient return on investment.
- Flexibility, so as to incorporate the technological advances.
- Internalization of costs, in order to ensure sufficiency and stability of supply.
- Prioritization of innovative facilities that, among other factors, may reduce emissions.

In spite of the successful qualification of the policy followed in the promotion of *E-FER* and the wishes expressed in the *PANER* to carry on with incentives, this system was modified, in 2013, to attempt to solve the problems of financing.

Figure 22: Installed electricity capacity (Spain – MW)



Source: Eurostat

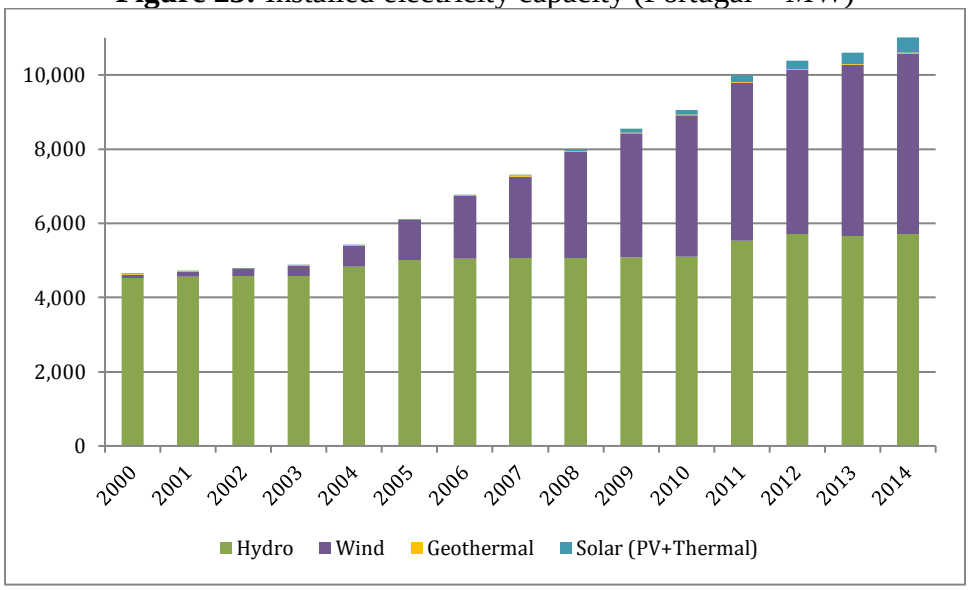
In Portugal, the momentum acquired through *E-FER* is the result of a wide legislative development, along with several plans and programs that reflect the

[51] *PANER* Spain (2010), pag. 8.

commitment of the Portuguese Government to international agreements on climate change. As in Spain, the effectiveness of the measures has been due to the country's economic situation. The basis for the transformation of the electric sector was set up with several plans, approved by the beginning of the century, which established an energy planning mainly based on the hydro and wind,[52] both renewable sources. Choosing these technologies was based on the fact that their cost of production would have the least impact on the final price of electricity. These plans also recognize the opportunities of other renewable technologies (not only hydraulic or wind) for economic growth. As *Diário da República* states, promoting energy efficiency and renewable sources can also make a significant contribution to economic growth by providing an important volume of investment opportunities for research.[53]

In Portugal, as in Spain, the design of the *E-FER* promotion policy has also been criticized, either in the definition of the sources, the sustainability of the incentives used or the impact of the latter on the prices of electricity. The initial bid for wind energy (**see Figure 23**) complied with the environmental objectives and reduced the need to import energy. Nevertheless, it also brought into the system other problems stemming from its irregularity. In 2007, to compensate this, a program was approved to take advantage of the hydroelectric potential,[54] hence attempting to supplement wind energy.

Figure 23: Installed electricity capacity (Portugal – MW)



Source: Eurostat

[52] For example, the National Program for Climate Change (PNAC) or *Programa Nacional para as Alterações Climáticas* (*PNAC*), in 2004, and the National Energy Strategy (ENE) of 2005 or *Estratégia Nacional para a Energia* (*ENE*).

[53] *Diário da República* (Nº 204-24 de Outubro de 2005). Subsequently, new definitions will appear in the PNAC of 2006 and 2007. In 2008, the Portuguese Government established a series of strategic lines aimed at reducing dependency, increasing energy efficiency and reducing CO2 emissions.

[54] *National Program of High Hydroelectric Potential Dams* or *Programa Nacional de Barragens de Elevado Potencial Hidroeléctrico* (*PNBEPH*): providing reinforcement in times of low wind or accumulating water in periods of excessive wind production.

The Portuguese hydraulic program raised several doubts in terms of its financial and environmental [55] viability. Few months after the approval of the program, the crisis made the development of investments unsustainable. In line with the European guidelines, in 2010 the *PNAER*[56] is approved, which establishes as fundamental objectives to insist on European commitments on energy and fight against climate change, reduce energy dependence, but also to boost and consolidate the industrial sector associated with the *E-FER*. [57] The plan continues to insist on hydropower and wind energy, stressing the complementarity of both sources. However, the goal also consists in reinforcing the role of solar energy, both in large and small-scale developments. The objectives associated with the *E-FER* contained in the plan are summarized in **Table 7.**

Table 7: 2020 goals

Renewable energy related to gross final energy consumption in 2005	%	19.8
Renewable energy related to gross final energy consumption in 2020	%	31.0
Total adjusted energy consumption in 2020	ktep	19.467
Renewable energy related to 2020 goal	ktep	6.035

Source: *PNAER* (2010)

The *Estrategia Nacional de Energía 2020* (National Energy Strategy 2020, *ENE 2020*) was also authorized. Among other measures, it condenses the objective of 20 percent reduction in final energy consumption in 2020, based on various fiscal measures, innovative projects (electric vehicles, smart grids), improvements in the energy management of lighting in public and private buildings, and ultimately in the generation of electricity from renewable sources.

In 2013, efforts were made to rationalize the attempts undertaken to achieve the country's energy objectives, by reviewing and coordinating energy efficiency initiatives (*PNAEE*) and those focused on the promotion of *E-FER* (*PNAER*).[58] The aim is to link both strategies to achieve more effective measures, strengthen those existing ones and reduce the cost of implementation, given the economic crisis environment in which the country was immersed.

The objectives set by the decree are constrained by the need to diminish the deficit and also by the guidelines set in the protocols, which result from the intervention of the Portuguese economy:

- Comply with economic rationality in all the commitments acquired,
- Reduce significant greenhouse gas emissions,

[55] A critical review of *PNBEPH* can be found at http://www.geota.pt.

[56] *National Action Plan for Renewable Energies (PNAER*) or *Plano de Nacional Acção para as Energias Renováveis* - 2010. On the situation of the sector in Portugal at the time of approval of the plan, see Alves & Silva (2011).

[57] The objective is to achieve a GDP of 3.8 billion euros in 2020 and the creation of 100,000 new jobs associated with the sector.

[58] Resolution of the Council of Ministers No. 20/2013. In addition, to the *PNAEE* and *PNAER*, the *Eco.AP* program was also launched in order to increase energy efficiency in the public sector. See http://www.adene.pt/programa/programa-de-eficiencia-energetica-para-administracao-publica-ecoap.

- Empower the diversification of primary energy sources so as to increase the guarantee of supply,
- Enlarge energy efficiency, especially in the public sector, thus contributing to the reduction of public expenditure and the efficient use of resources
- Increase competitiveness of the economy by reducing fuel consumption and operating costs of companies and the national economy, thereby freeing up resources to boost domestic demand and investment.

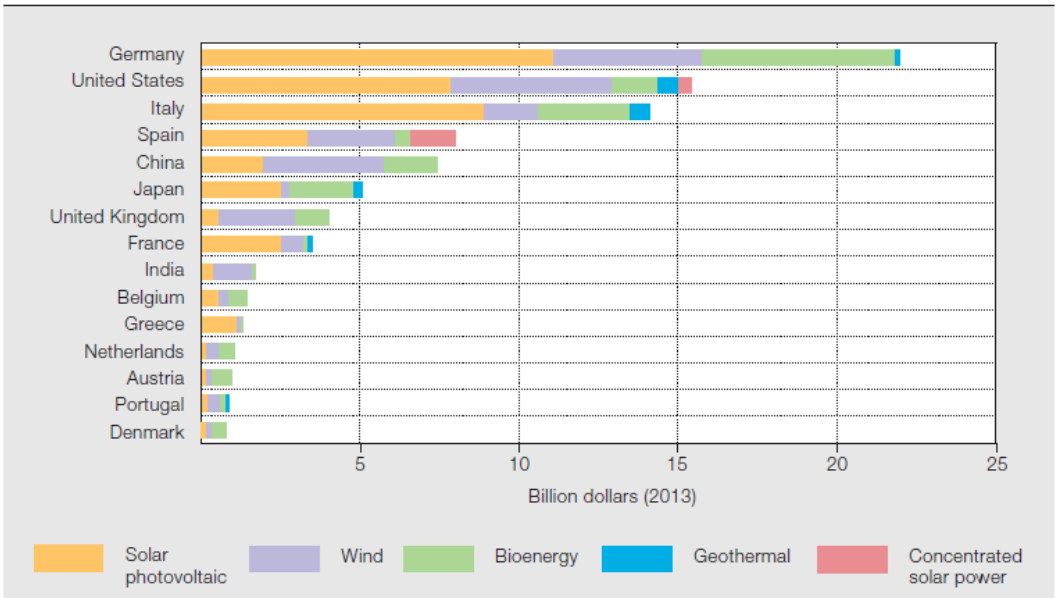
A reduction in the cost of the energy transition is sought by reviewing the relative weight of each of the *E-FER*s in the energy mix by 2020, considering production costs (*levelized cost of energy*) and the consequent potential in a competition regime. A more restrictive selection is established to support renewables, directed to more mature technologies. As *Diário da República* states: *"replacing the development of less mature technologies by national or international R & D promotion instruments, freeing electricity consumers from the cost of additional investment in experimental technologies, notwithstanding the specific projects which, after a cost-benefit analysis and a comparison with international benchmarks, would be advantageous to the national economy* ". (p.2069)[59]

In short, reviewing the legislative evolution that has reinforced the commitment to the *E-FER* reflects that, in recent years, there has been a brake on incentives to prevent the State from increasingly assuming financial commitments. The programs continue to insist on the objective of enhancing *E-FER* in the energy mix, but it also restricts the commitment to environmental sustainability to the economic sustainability of the system.[60] These plans also add information on the expected impact in terms of employment. Although incentives have been reduced in both countries, according to the International Energy Agency (IEA), in 2013 Spain and Portugal were still among the countries that most favored *RES-E* (see **figure 24**).[61]

The policies followed in both countries present common elements. Nevertheless, whereas initial investments in Portugal were mainly directed to wind energy, in Spain solar energy was encouraged. Throughout the process, different series of financial and fiscal incentives were designed to hold up investment, reinforced by the creation of feed-in tariffs for electricity produced from renewable plants, which were modulated according to the degree of maturity of the different technologies. In addition, as outlined in the European guidelines, *E-FER* was given priority in planning and access to networks.

[59] *Diário da República*, N.º 70, April 10th 2013.
[60] According to Amado (2016) the need to contain electricity prices in the face of the economic crisis and the maintenance of incentives for renewables has generated a "tariff deficit" in Portugal of around 5,000 million euros. In Spain, according to the *CNMC*, the deficit was above 25 billion in 2015.
[61] Estimation of the real value of the support provided by European countries for the promotion of *E-FER* can be found on Ecofys (2011).

Figure 24: Renewable power subsidies by source in the top 15 subsidy-supplying countries



Source: International Energy Agency (IEA), WEO 2014

The *feed-in-tariff*-based incentive scheme has been the most widely used system in Europe to encourage renewables.[62] Most of the European countries that employ this system have a regulated fixed tariff by technology (*fixed FIT*), as in the case of Portugal.[63] However, the system in Spain was mixed, hence allowing choosing either a fixed FIT or a tariff based on the price of kWh in the market along with a premium (*premium FIT*).[64]The effectiveness of this type of incentive depends on its adequate design, being crucial the definition of its temporary evolution, as they attempt to boost investments in the long term. For this reason, recent legislative reviews and, primarily, the retroactivity of some measures, may negatively affect the development of new investments.

In addition to the direct incentives for the promotion of *E-FER* (*FIT*, Green quotas and certificates, tax incentives…) there are other strategies that may indirectly support their development, such as penalizing electricity from non-renewable sources or through policies based on CO2 emissions.[65] Since 2005, Europe has developed, in this line, a market for CO2 allowances, which is in its third phase[66] since 2013. Likewise, other

[62] Some countries, such as UK, Sweden, Belgium or Italy, use the green quotas and certificates system.

[63] Decree-Law No. 168/99 recognizes a monthly compensation system for the E-FER plants, the essence of which has been maintained until today. Amado (2016) a review is made of the system used in Portugal and also an assessment of future options, from a legal perspective.

[64] In 2012 and 2013 the system was changed. Royal Decree-Law 1/2012 suspended the economic incentives for new *E-FER* plant projects. Royal Decree-Law 9/2013 adopts urgent measures to ensure the financial stability of the electricity system. The *E-FER* facilities already in operation are remunerated on the basis of a "*reasonable profitability*" defined by the Government.

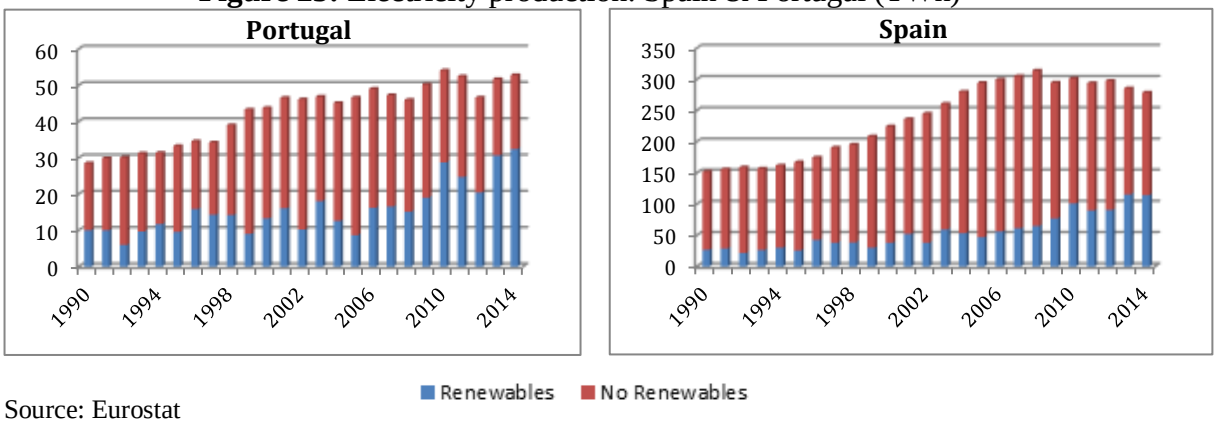
[65] A critical review of renewable energy incentives and their effects on emissions can be found in Schmalensee (2012)

[66]The evolution of coal prices can affect the decisions and the profitability of the electricity companies. However, the effects of this measure can be extended to the other polluting sectors.

European initiatives aimed at diminishing emissions from sectors such as transport or the residential sector may alter consumer and business decisions, hence affecting the electricity sector.[67]

As for the realization of investments in *E-FER* and its implementation, it is perceived that the evolution has not been homogeneous over time. In this regard, although it does present common guidelines, it has not evolved equally in the two countries. The increase over the last 25 years has been especially intense since 2009, following the definition of the *Europe strategy 2020.*

Figure 25: Electricity production. Spain & Portugal (TWh)

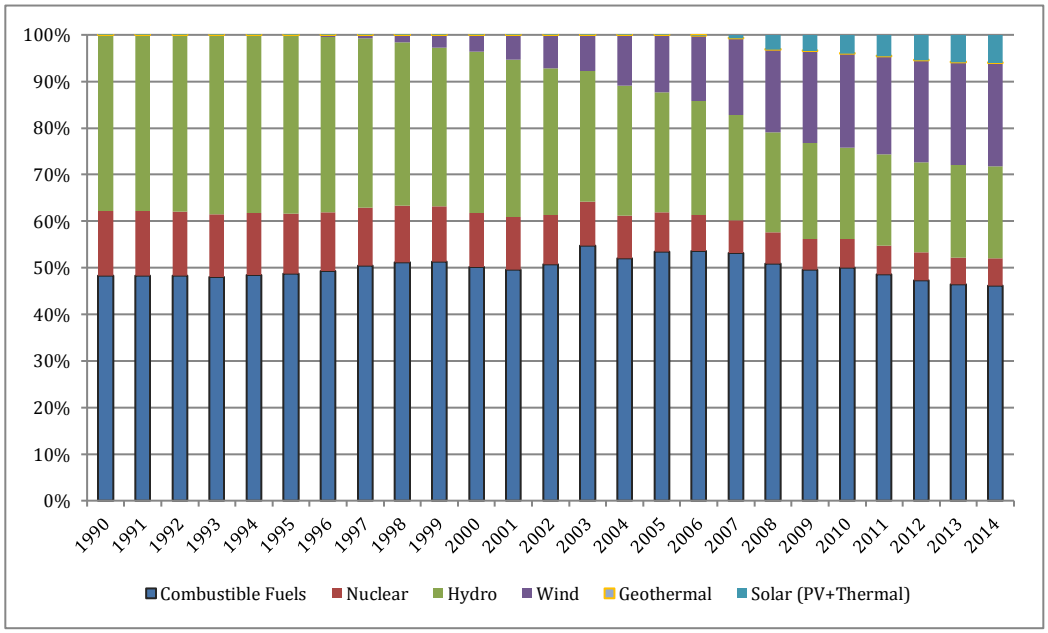


Source: Eurostat

During the 1990s, the constant increase in capacity was chiefly obtained by an increase in renewables, maintaining the weight of the fossil fuels capacity, which accounted approximately for a 50 percent of the total (**figure 26**). Since the end of the 90s, the increase in renewable capacity is remarkable, mainly in wind power. However, there is also an increase in fossil fuel capacity, which throughout this period experiments a transformation towards the use of natural gas. Nuclear energy is losing weight and hydraulics hardly does it.

[67] For example, in Spain, the Royal Decree 163/20142014 was approved. It creates carbon footprint registration, compensation and carbon dioxide absorption projects.

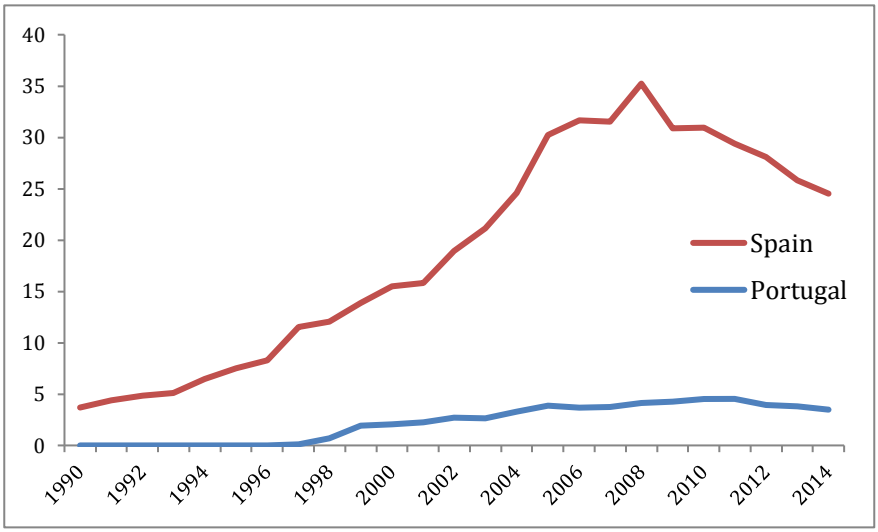
Figure 26: Installed electricity capacity (% of source) for Spain & Portugal.



Source: Eurostat

Investments in generating capacity, based on natural gas, arise in response to the need to ensure electricity supply in a structure highly dependent on water and wind resources. In Spain, such plans were initiated in the 80s. Investments in this technology led to a significant increase in production, which underpinned the increase in demand from the years before the economic crisis (**figure 27**). With the fall in activity from 2009, generation from gas in Spain declined, hence reducing the need to import natural gas. Likewise, the instability of the gas-exporting countries compelled to diversify its importers to minimize the risks and to guarantee energy supplies.

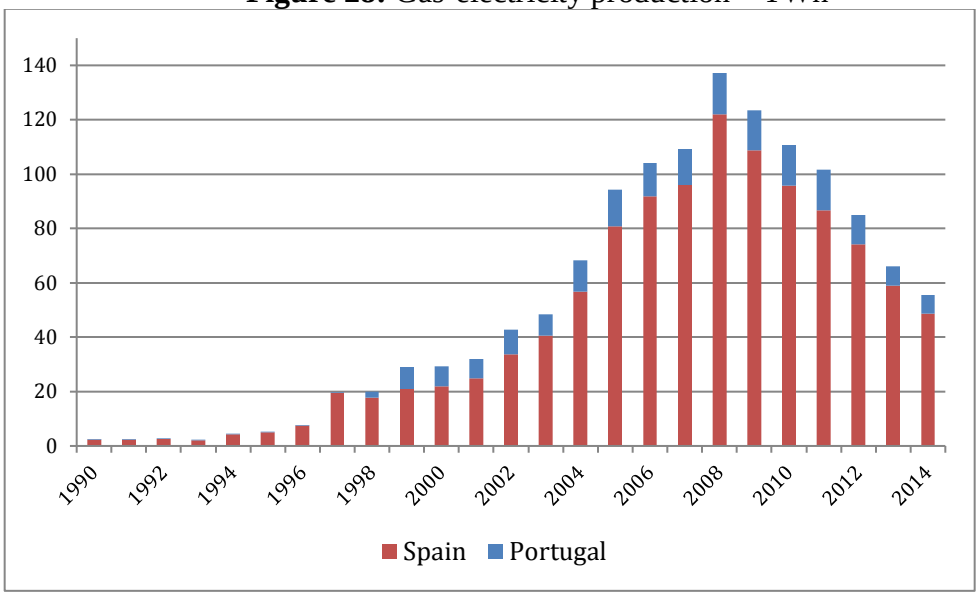
Figure 27: Gas. Net imports (Mtoe)



Source: Eurostat

In Portugal, the commitment to this fuel came later. In the early 1990s, natural gas-based plants began to be built to replace oil and coal. In both countries coal imports have followed a downward trend since the beginning of the century. However, the increase in capacity in natural gas, alongside the need to continue importing oil, have maintained a high dependence on external energy, despite the promotion of renewable energies.[68]

Figure 28: Gas-electricity production – TWh

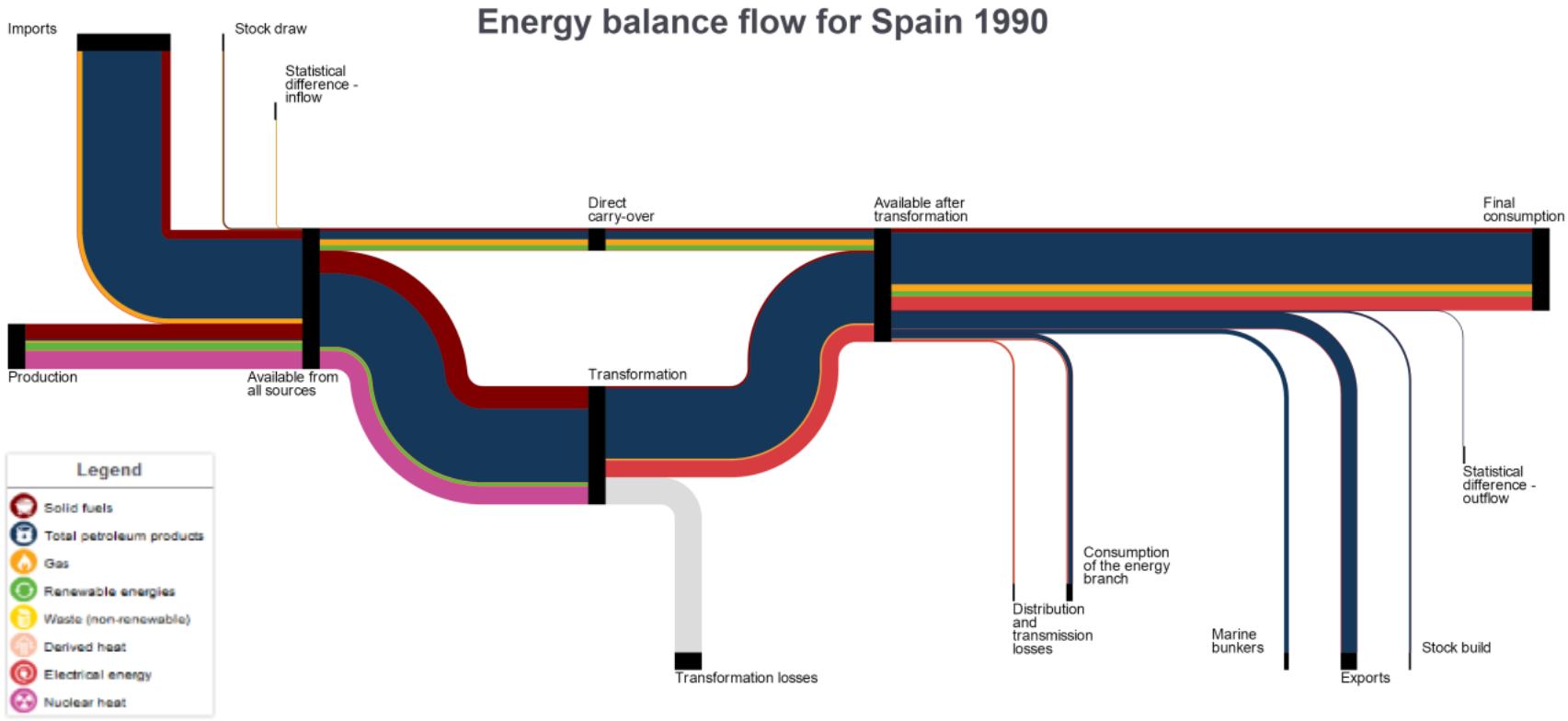


Source: Eurostat

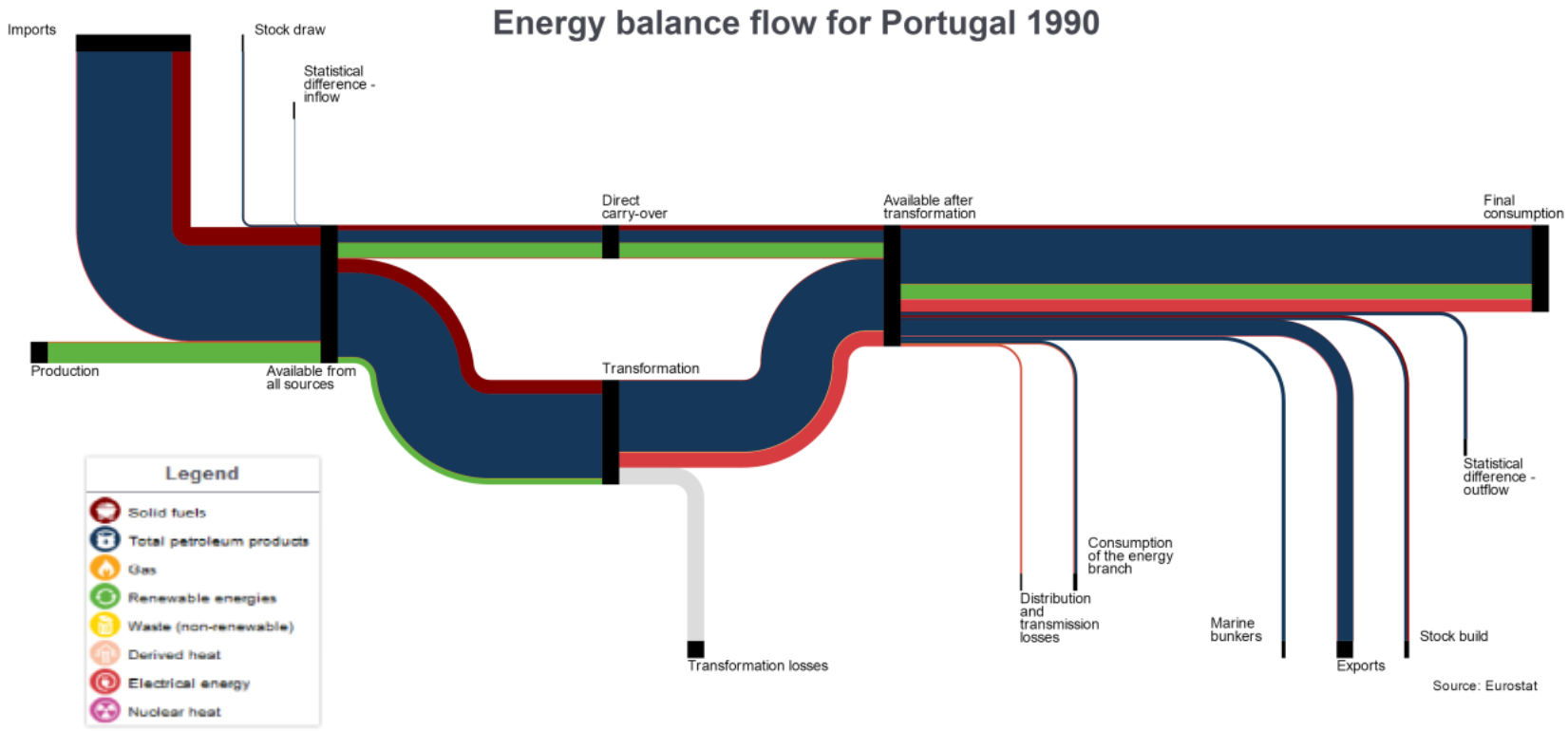
Figures 29, **30**, **31** and **32** indicate both energy balances in Spain and Portugal, showing a clear transformation of the Iberian energy sector over a 25 year-period (1990-2014). The commitment to introduce renewable energies, the increase in imports of natural gas and the reduction of imports of coal are also observed. In general, it is highly discernible that Spain has remained dependent on import fuel, whereas gas has replaced a percentage of oil and imported coal, hence promoting renewables that replaces the use of national coal. In Portugal, there is also a rise in gas as a substitute for oil and coal. Further, the increase in renewable sources is also notable.

The purpose of this paper is not to draw a detailed analysis of the energy balances of Spain and Portugal. However, at first sight they reinforce the fact that, despite of the advances of these years, there is still a long way to go, both in the electricity production using renewables sources, and in reducing the consumption of fossil fuels in sectors such as transport.

[68] Whereas in both countries the rate is above 70 percent; the EU average is around 60 percent.



Source: Eurostat



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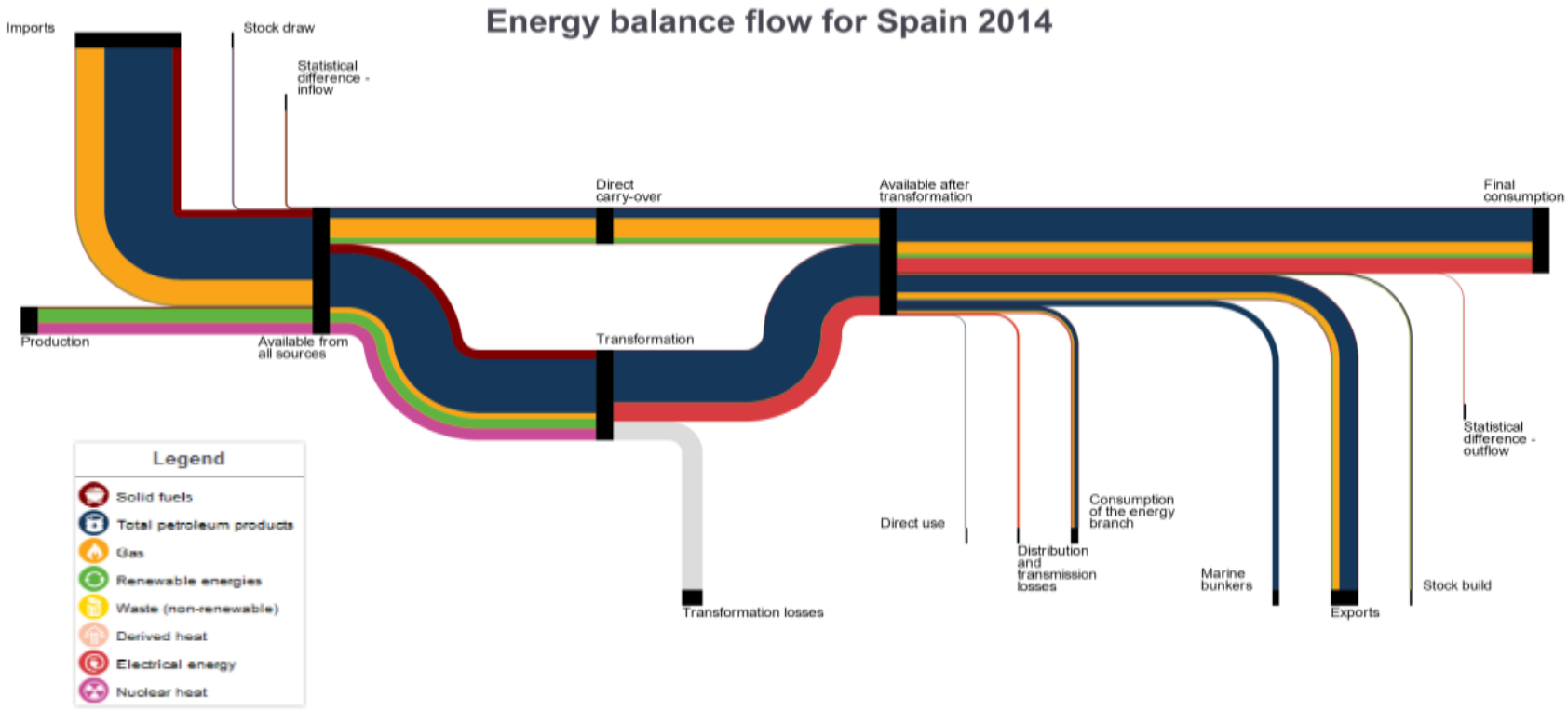

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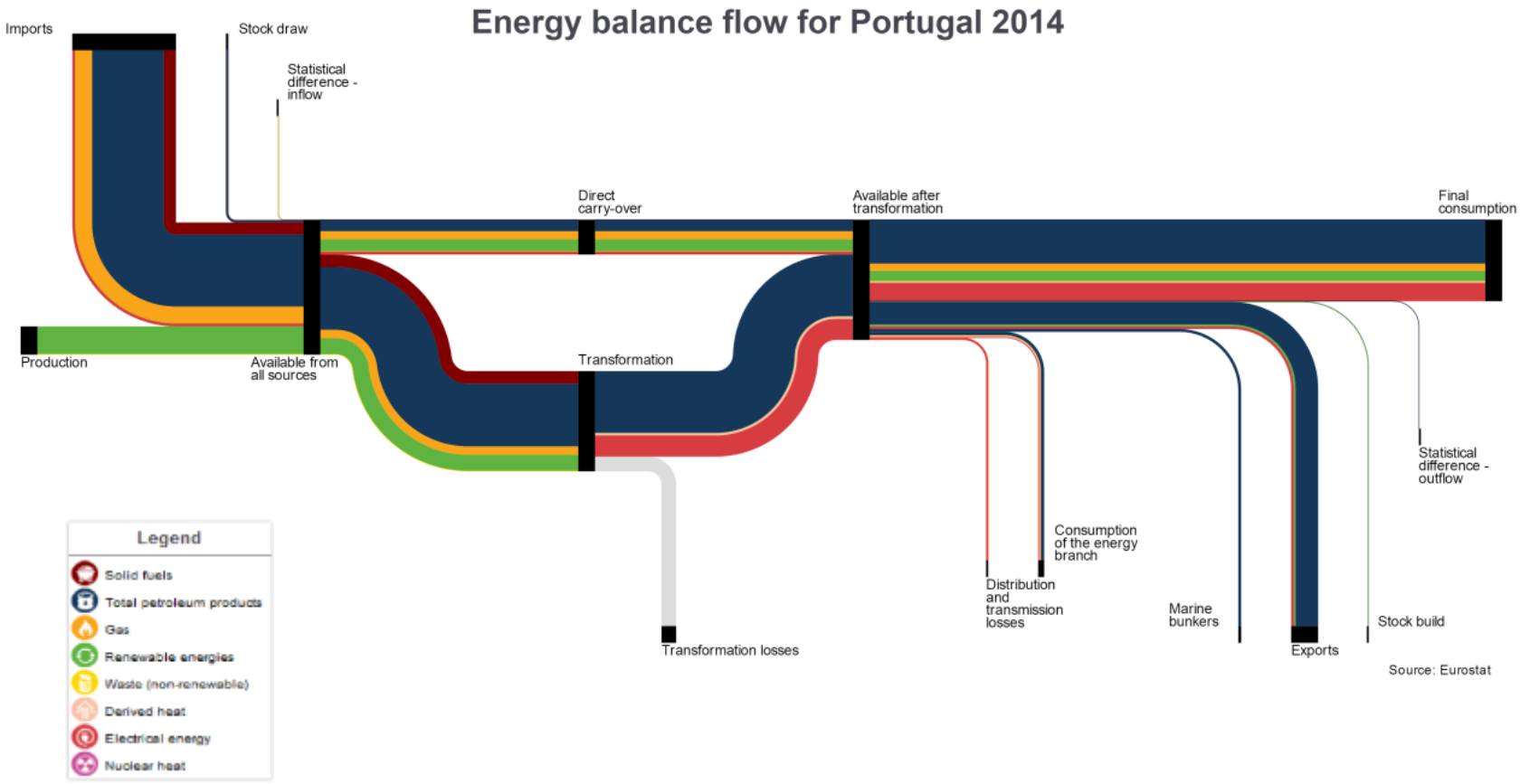
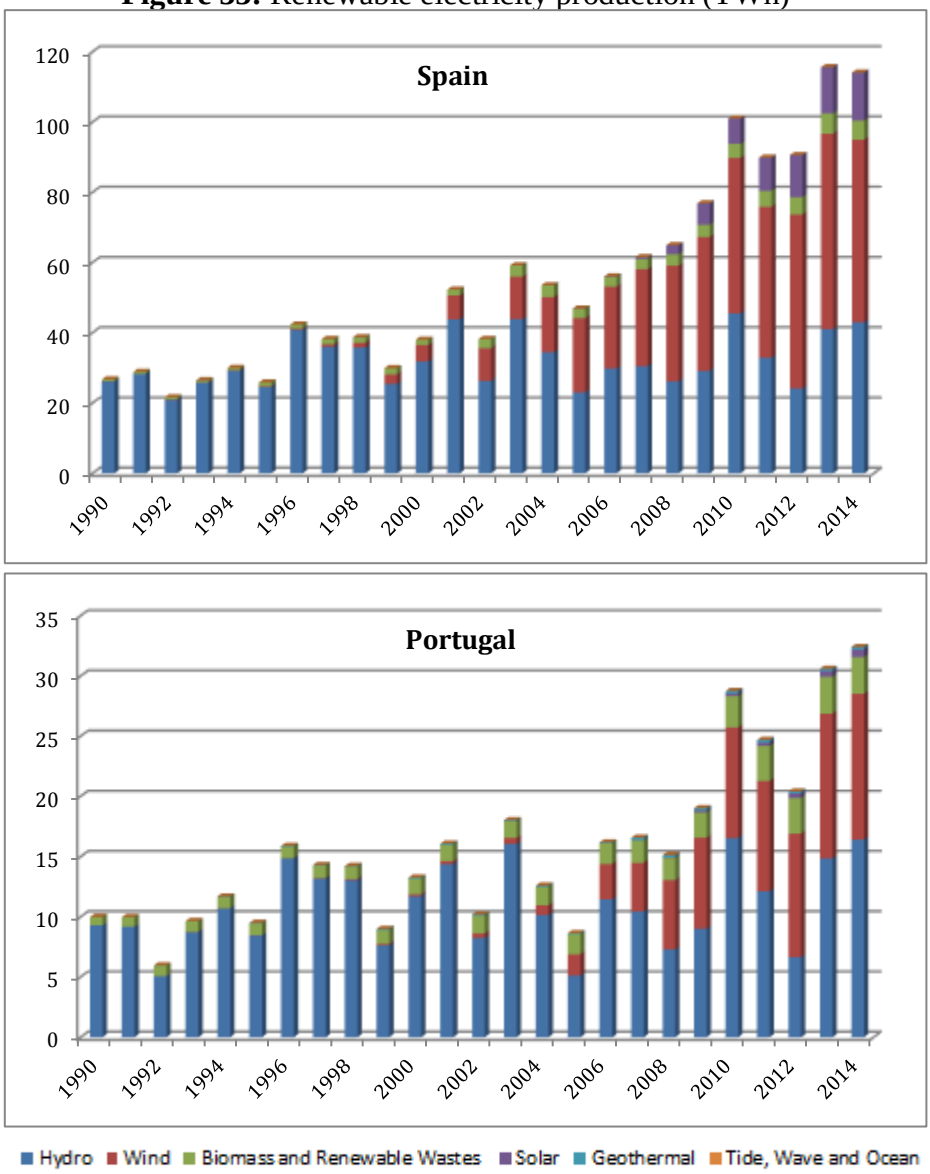


Source: Eurostat

Coming back to the transition towards the *E-FER*, this paper show a brief review of the evolution followed by electricity production from renewable sources during those 25 years, when the commissioning of plants reduced the use of fossil fuels. As described above, the situation in recent years is particular, and decisions taken by governments may condition the evolution in the medium term.

In recent years, there has been a drop in electricity demand associated with the economic crisis, which has led to a reduction in electricity production, especially notable in the case of Spain. The progressive reduction of production from fossil fuels (started in 2005), suffered a parenthesis during the years 2011 and 2012, although it is progressively recovering these years (**figure 33**). The elevated weight of hydropower is the cause of this temporary failure in the reduction of fossil fuels.

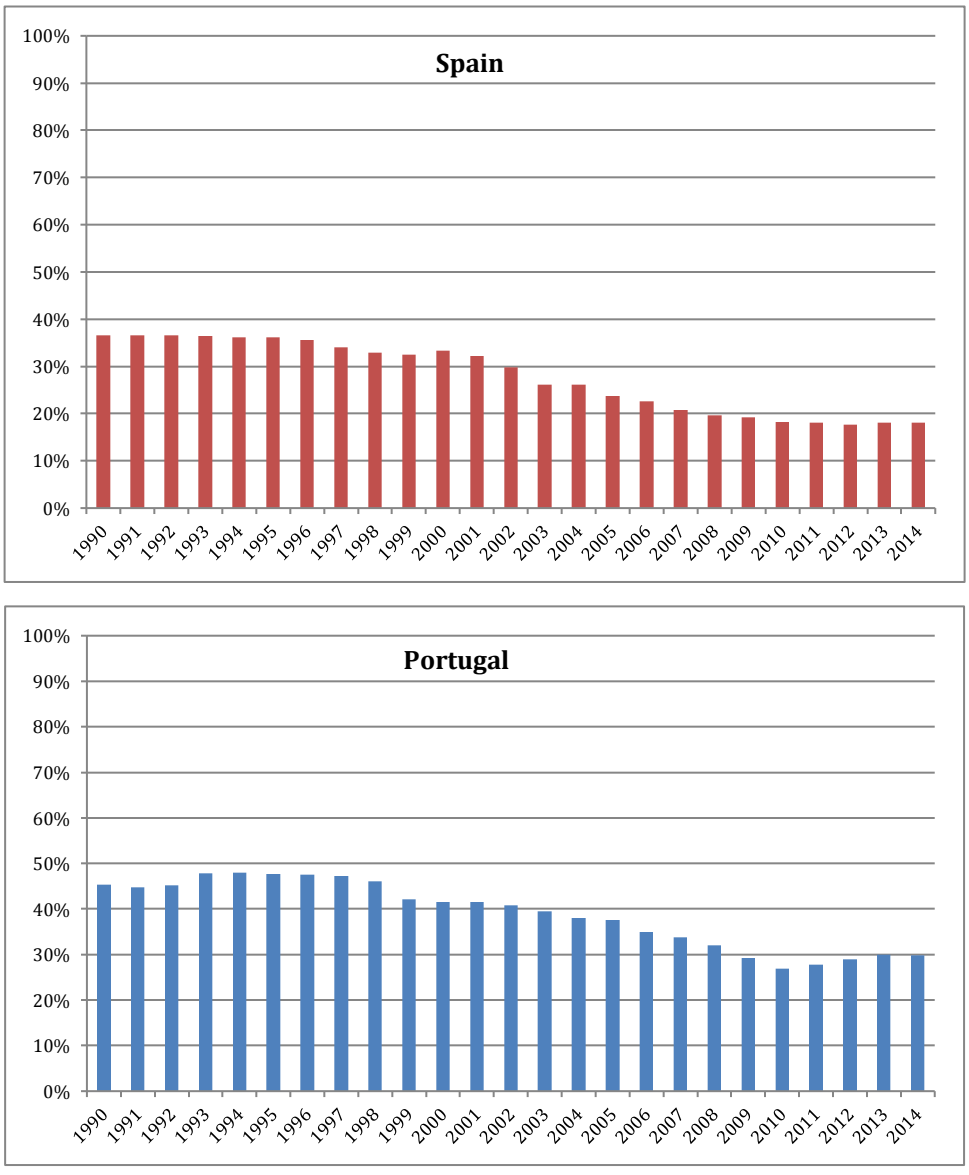
Figure 33: Renewable electricity production (TWh)



Source: Eurostat

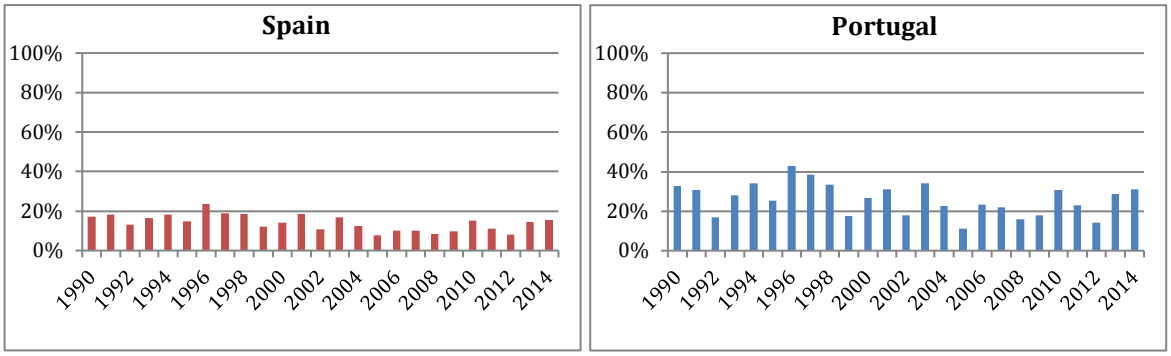
In the case of Portugal, a much more volatile profile is observed, as the contribution of the hydroelectric plants is higher. As mentioned before, the use of water in electricity production played a central role in the origins of the Iberian generating sector, and it has continued to maintain such weight throughout the subsequent evolution (**figure 33**). However, its weight in Spain has been decreasing as the economy grew and demand pressure increased, to below 20%. In Portugal, such trend is the same until 2010, when the program of hydroelectric development (*PNBEPH*), approved three years earlier, begins to take effect. The capacity is currently around 30 percent of the total, whereas the European average capacity is close to 15 percent (and below 13 percent in generation).

Figure 34: Installed Hydro-electricity Capacity (%)



Source: Eurostat

Figure 35: Electricity production from hydro (%)

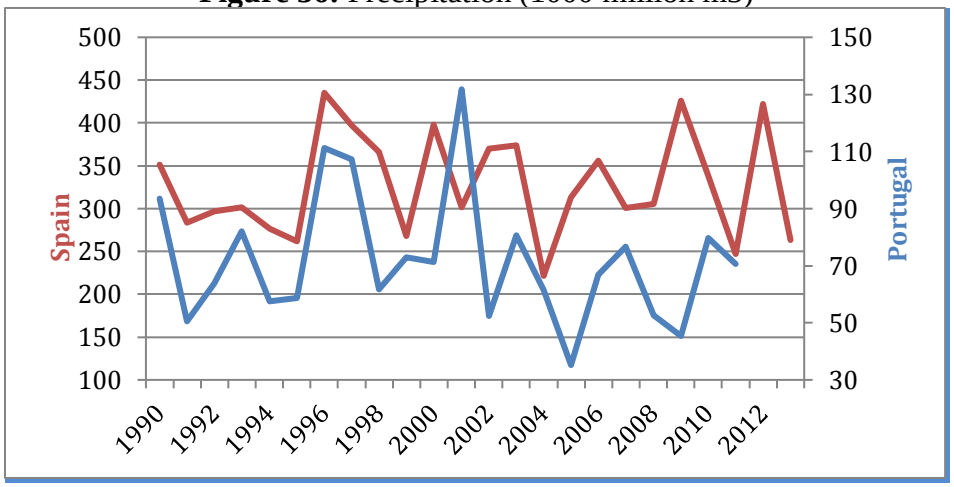


Source: Eurostat

The dependence of generation on impounded water and irregularity in the rainfall regime (**figure 36**) add uncertainty and volatility to the sector, yet even more when one of the effects associated with climate change may be the appearance of long periods of drought.

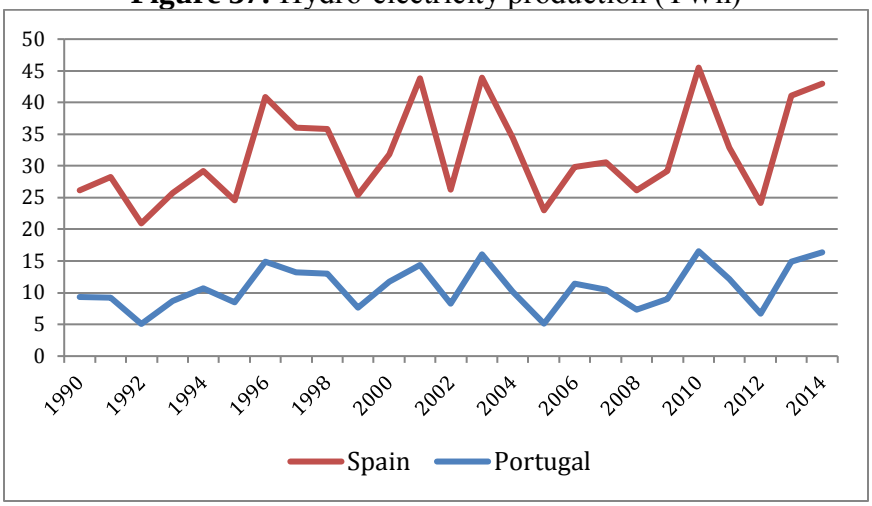
The intermittency of wind energy further complicates the situation, this time due to the volatility and short-term unpredictability. The growth of installed wind capacity in the Iberian electricity sector has been the most outstanding of all renewable sources. As a result, at the beginning of 2015, Spain produced 52 TWh of wind power, becoming the second EU country-producer, which was only surpassed by Germany (57.4 TWh). Conversely, Portugal remains in seventh position with a production of 12.1 TWh. More than 25 percent of all EU wind energy during 2015 was produced in the Iberian Peninsula (the previous year this figure exceeded 28 percent).

Figure 36: Precipitation (1000 million m3)



Source: Eurostat

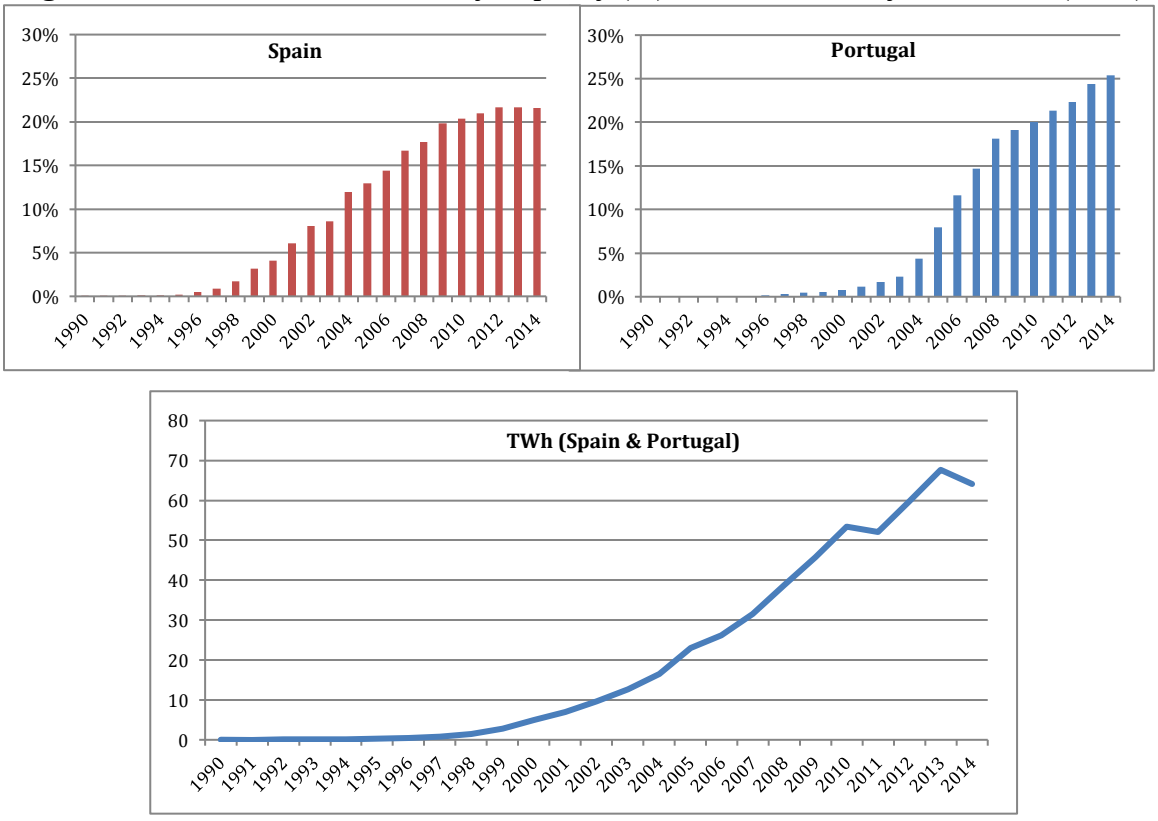
Figure 37: Hydro-electricity production (TWh)



Source: Eurostat

Portuguese wind capacity accounted for almost 30 percent compared to the total amount, reaching around 20 percent of the total energy produced between the two countries. Such factor demonstrates an important growth since 2000 (**figure 38**). These values are above the EU average, with an installed capacity of around 23% alongside electricity generation that, although it has grown rapidly in recent years, it has not exceeded 10 percent.

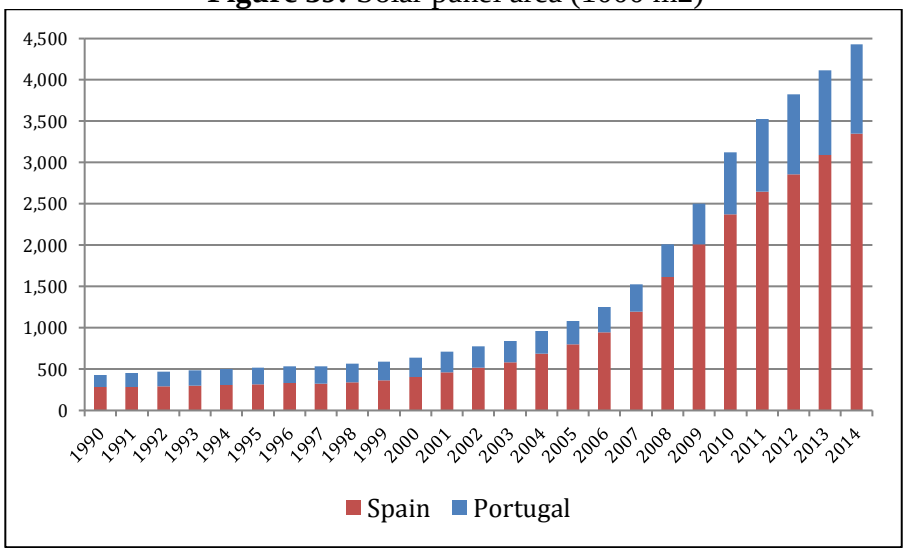
Figure 38: Installed Wind-electricity Capacity (%) & Win-electricity Production (TWh)



Source: Eurostat

As for solar energy, the increase in installed capacity mainly corresponds to Spanish investment (**figure 39**). Portuguese contribution, although growing, it is still modest, as it reaches an approximate production of 0.6 TWh in 2014.

Figure 39: Solar panel area (1000 m2)



Source: Eurostat

In spite of the current problems, in 2004 Spain became the third largest producer in the EU, producing 8.2 TWh from solar panels. The intense capacity growth and the economic costs associated with the generous incentive design have created the need to rethink development policies. In an environment of economic crisis and public austerity, policy orientation appears to have gone from one end to the other. In this regard, it has even come to implement strongly controversial retroactive measures. A break in incentives for new investment and the revision of the premiums to the investments already made have resulted in a very complex picture.

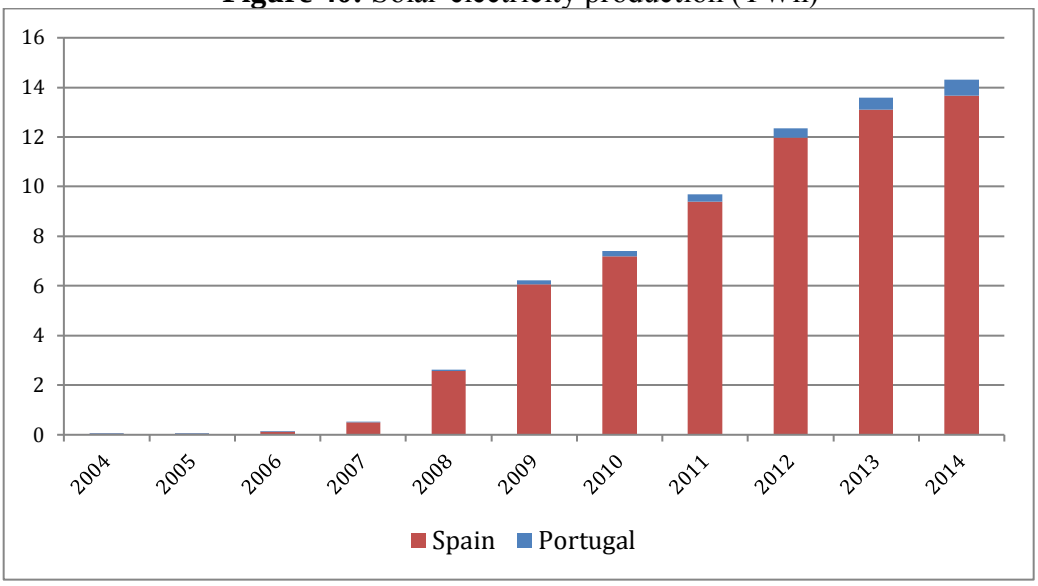
Notwithstanding the policy change, the total production of the Iberian photovoltaic solar sector accounts for almost 10 percent of the European total. This situation occurs as a result of the previous Spanish commitment, the increase of Portuguese capacity and the particularly propitious conditions for this type of energy in the Iberian Peninsula. [69]

It is foreseeable that in the near future, once the economic crisis is overcome, the Iberian markets will stand up again for the sector, under the protection of a more thoughtful and better-designed regulation. To achieve this, it will be necessary to resolve some relevant issues, such as the regulation of self-consumption. [70] The same situation of paralysis has taken place in the generation of concentrated solar energy (CSP). Spain had developed an electricity generating capacity with this technology, which has progressively

[69] Spain is the fifth country in terms of installed solar power, yet the third in production. Likewise, Portugal occupies the 15th position in installed capacity, although it is the thirteenth country in production.
[70] Given the inability to adequately solve the challenge of self-consumption, the legislation establishes obstacles that hinder the development of investments with a high potentiality.

come into operation.[71] However, it is not expected that its capacity will increase in the short term.

Figure 40: Solar-electricity production (TWh)



Source: Eurostat

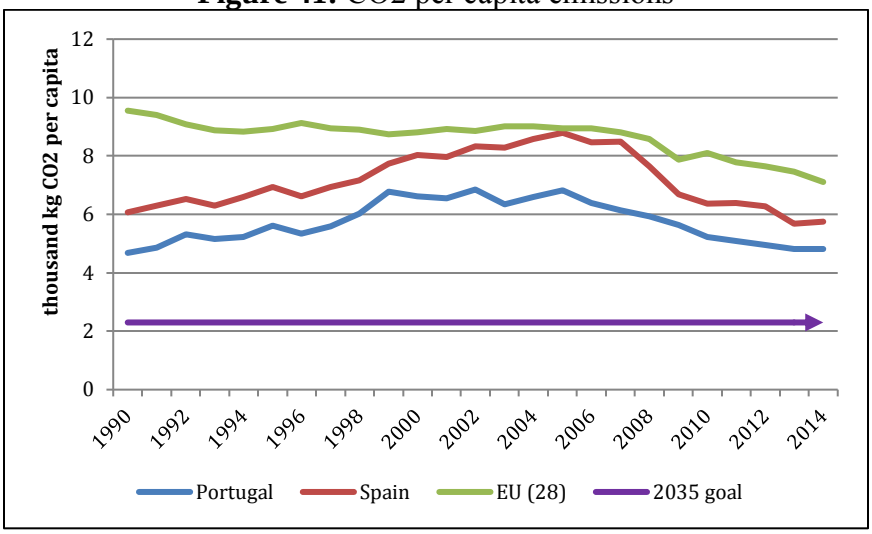
Generally, questions about the evolution of the sector are varied and have regulatory, economic, technological and environmental components that further complicate the picture.[72] It is conspicuous that CO2 emissions have been reduced as a result of the energy mix in electricity production in both countries. However, such commitment must have certain continuity, as there is still a long way to go from achieving the "acceptable" levels that are valued in the various reports with variable time horizons. Emissions per capita have progressively been approaching the European average as the Iberian economy came together with its European partners (**figure 41**). The measures adopted in Spain and Portugal at the beginning of the century has successfully changed the trend, along with the EU average. Nevertheless, the gap with per capita emissions targets remains broad.[73]

[71] Up to 2,300 MW. For more information in this topic see REN21 (2015).

[72] *MIT Energy Initiative* (2016) provides a comprehensive and up-to-date review of short-term sector challenges.

[73] The figure marks the global target of Pollin (2015), by 2035, based on estimations of world population growth.

Figure 41: CO2 per capita emissions



Source: Eurostat: June 2016; Market Survey/Feb 2016; CHP survey/May 2015; SHARES2014 from Feb 2016; ECFIN: AMECO macro-economic data June 2016; EEA/UNFCCC 2016. Pollin (2015)

Drawing an objective assessment of the results of the Spanish and Portuguese commitment to the promotion of *E-FER* seems to be difficult. As indicated by Linares and Labandeira (2013), it appears that the difficulties involved in the process, at least in the case of Spain, derive from the implementation rather than from the incentives design. The perception of success or failure of measures, in a policy with multiple goals (reducing dependency, CO2 emissions and unemployment), relies upon the different position of agents in the face of problems.[74] In this specific case, it is clear that progress in the fight against climate change, unemployment or energy dependence are assessed differently by actors such as the EU, national governments, industry, consumers, trade unions… All these factors obstruct the evaluation of the process, notably if one considers that it is a long-term commitment and the perception of the agents may differ over time when confronting obstacles (financial crisis or environmental disaster, for example).

7. Conclusions and future considerations

Throughout this paper we have reviewed the evolution of the Iberian electricity sector, with a view to characterize the most significant features that have given rise to the sector as we know it today. Traditionally, the economy and the Spanish and Portuguese electricity sectors have developed with certain delays compared to the developed countries. Nevertheless, in recent decades they have been incorporated into the processes of liberalization and modernization, even becoming to head the transition towards more sustainable models. The historical characteristics of both sectors have constrained those reforms promoted from the EU, both regarding the liberalization of the sector and the environment. In some cases, the objectives of the reforms sought more ambitious results than those initially identified by the EU (for instance, in the promotion of renewables) and

[74] Jenner et al. (2012). For more information on this topic, see Lestón (2014).

also addressed specific shortcomings of the Iberian sector (or its economies). Thus, reforms have been pursued with multiple objectives: reducing dependency, increasing security of supply, improving efficiency through increased competition, generating new employment opportunities, etc. Such wide range of objectives complicates the assessment of the effectiveness of reforms, which have also been further constrained by the effects of the recent financial crisis.

As for the **liberalization process**, it is necessary to stress the easing of the regulatory framework in Spain and Portugal in recent decades. Among the main objectives of the process, we must highlight the free exchange of electricity in a market subject to a competitive framework, the freedom to choose a supplier and the entry of new companies in the sector to increase the sector's efficiency and the quality of supply. [75] The liberalization of electricity has gradually developed in both countries, hence implementing a new structural organization in which production and marketing activities are open to competition.

When it comes from production activity, the creation of a wholesale electricity market, *MIBEL*, has been a major key. *MIBEL* is based on a set of contracting modalities that complement each other, such as market for term contracts, contracting spot market, services market and bilateral contracting market. Its operation relies upon a market splitting mechanism that encourages a better and more secure use of the available capacity.

From a supply perspective, the liberalization of electricity has been characterized by a high vertical integration, as activities in the same business group are not subject to regulatory constraints.

Dominant operators with high market shares have been usual in Spanish and Portuguese electricity sectors. The 2007 *Plan de Compatibilización Regulatoria* (*Regulatory Compliance Plan*) describes a dominant operator as any company that possess a market share greater than 10% of the electricity produced by *MIBEL* (only considering ordinary production for its calculation).

In this context, reducing the market power through the development of virtual capacity auctions has been essential. In the Spanish electricity market, *Endesa* and *Iberdrola* have been compelled to participate as auctioneers. Likewise, it is remarkable the participation of *REN* and *EDP* as vendors in the case of the Portuguese market.

Within the scope of MIBEL, the importance of identifying the dominant operators is recognized, with the purpose of establishing series of obligations and limitations to their activity. [76] Further, the rules laid down in Articles 81 and 82 of the *EU Treaty* prevent the development of abuses of dominant positions and collusive behavior aimed at hampering market entry.

[75] García-Álvarez & Moreno (2016).
[76] *MIBEL's Council of Regulators* (2009).

The result has been the horizontal deconcentration both in Spain and Portugal. The process itself of integrating the two electricity markets into *MIBEL* has been a first step toward mitigating such abusive behavior. This first step of integration will be complemented by actions to improve infrastructures in the medium term, as well as the harmonization of procedures of operation and management of interconnections.[77] This will ease the integration processes in terms of market expansion laid down by the EU.
In addition, these measures are not only complemented by the implementation of monitoring commissions on the results of *MIBEL* and the behavior of the agents involve, but also the development of penalties for situations where market power exists.

With regard to the marketing activity, liberalization involves a new context in which agents compete in the retail market so as to ensure supply to final consumers. In order to meet this goal, it is imperative to develop forward markets that allow all agents to acquire energy in the timeframe required by customers.[78]

We must stress that important progress has been made in different areas from the liberalization process and the integration of the electricity markets in both Spain and Portugal in *MIBEL*. Among such advances, we highlight the following ones:[79]

- Daily market prices are similar in level and behavior to other European markets.
- A reduction in concentration index values (such as HHI).
- The market share of the largest agent accounts for less than 25%.
- More competitive structure: the European Commission (2010) shows in its Benchmarking Report that Spain is among the groups of countries with the lowest concentration in the electricity market.
- Supervision of *MIBEL* by five agencies (*MINETUR* and *CNMC* in Spain, *RESE* and *ADC* in Portugal and *ACER*), which could discourage anticompetitive behavior in the market.
- Information transparency, as laid out in the DG *Competition Report on Energy Sector Inquiry* published by the European Commission (2007) in the case of Spain.
- The *Market Operator* and the *System Operator* do not have in their shareholding the influence of any market agent.

In spite of the achievement of such advances in the scope of *MIBEL*, yet we can find significant constraints, which mainly stems from the existence of barriers to market entry. The *Tribunal de Defensa de la Competencia* (2005) identifies such barriers as "... *all those difficulties and costs that hinder or directly prevent new operators from entering in a given market...*" We can stress some of such obstacles within the scope of *MIBEL*:

- Poor interconnection capacity due to isolation.
- Possible sunk cost due to the high installation costs and the diversification of generation facilities. This is coupled with a long period of maturity of investments and a high uncertainty concerning fuel prices.
- The incumbent companies own the strategic assets of the sector.

[77] Sánchez & Silveira (2016).
[78] García &Moncada MIBEL (2015) has developed this type of market allowing liquidity and coverage possibilities to the new companies that enter the market.
[79] Energía y Sociedad (2016).

- Vertical integration, which may lead to cross-subsidies between activities within the same group and access to inside information.

It is thus necessary to keep up developing policies within the scope of *MIBEL* to attempt to reduce these problems. Hence, it is also paramount to avoid potential competitors from consuming costs that are smaller (or do not exist) for the companies already established in the market. For this reason it is necessary to continue developing programs that reduce vertical integration, enhance interconnection capacity and reduce potential sunk costs in the sector.[80]

Regarding the **promotion of *E-FER***, the Iberian energy policy should seek to reduce dependence, increase security of supply along with energy efficiency and diminish greenhouse gas emissions. The electricity sector plays a key role in achieving such goals. Thus, the greater share of renewable energies in the MIBEL mix has made possible a reduction of 25.3 percent in per capita greenhouse gas emissions in Spain, and 22.8 percent in Portugal in 2014 in comparison with the year 2000. (Eurostat)

Public policies have been decisive to ensure that the percentages of electricity generated from renewables accounts for 37.8 percent in Spain and 52.1 percent in the case of Portugal, which are well above the European average (according to Eurostat 27.5 percent in the year 2014). Development policies have suffered from the effects of the economic cycle, which have shown errors in the calculation of subsidies. Firstly, during the years of economic upswing, over-optimistic and generous incentives were made, hence resulting in drastic cuts in the wake of the crisis and jeopardizing the future viability of the most recent *E-FER* plants.

On the other hand, the greater participation of the *E-FERs* in *MIBEL* have not meant a decline in the price of electricity paid by the final consumer. Although *E-FERs* reduce the wholesale price, public subsidies have been included in the final electricity bill paid by households and businesses. Thus, Spain and Portugal are among the countries with a higher final price. Indeed, such elevate energy cost is one of the deficiencies of the competitiveness of the Iberian industry [81] and, in turn, a reason for increasing energy poverty in many households in the peninsula.[82]

In Spain, the current *Real Decreto 413/2014* regulates generating electricity production from renewable energy sources, cogeneration and waste, and sets the new remuneration scheme for these sources. This new scheme replaces the feed-in tariffs system, hence connecting the collection of additional payback to those of the market to a *reasonable* profitability.

[80] In spite of what has been said, *MIT Energy Initiative* (2016) points out the need to reconsider the separation between the transport and distribution phase, in view of the development of distributed generation systems (pages 60 and 81).

[81] In Spain, electricity is the highest energy consumption, representing a percentage of 51.7 percent of the total consumption in industry. (Instituto Nacional de Estadística, 2015)

[82] 7 percent of Spanish households suffer from energy poverty. Also, an 11 percent is unable to maintain their home at an adequate temperature in winter. This percentage has increased by 22% in only two years. (Asociación de Ciencias Ambientales, 2016)

It will be compelling to assess how this remuneration system will affect not only the evolution of *E-FER* in Spain, but also the price of electricity paid by the final consumer. It is also important to recall that the growth of renewables in the Iberian energy mix has compensated for the reduction of jobs linked to agriculture or forestry, as well as fostering research and development in these technologies. Likewise, there are doubts about the effects of the change in the impetus of *E-FER* on employment and R & D.[83] It is clear that the previous remuneration systems did compel Spain and Portugal to develop an installed electrical capacity in renewables with the highest levels in Europe. According to Eurostat data, Spain reached 22,975 megawatts (the second in Europe, after Germany with 39,193 Megawatts) and Portugal, with 4,855 Megawatts (eighth position) in 2014. When it comes to solar energy, Spain achieves the fifth place in Europe, with an area of installed solar panels of 3,348 thousand square meters.

As we have previously pointed out, the development of *E-FER*, apart from achieving environmental objectives, aids the reduction in energy dependence, which in Spain and Portugal has traditionally been high (Eurostat). It also creates employment and offers new opportunities for agriculture and forestry through the use of indigenous resources. Among others,[84] we may note inconveniences such as: their integration in the network, intermittency, difficulty of storage and greater network requirements.

Accordingly, as in Spain and Portugal the *E-FER* installations are mostly small generating plants, their grouping with other conventional power generation plants, through Virtual Power Plants, would deliver tangible benefits on reliability, energy efficiency and quality of electrical energy. Virtual Power Plants are new concepts, which consist on groups of distributed electric generators introduced into the framework of smart grids. By grouping renewable and non-renewable generation facilities, their uncertainty in the daily supply of electricity is reduced, so they are permitted to take part in the auxiliary markets for electricity (frequency and voltage).

On the other hand, among the pending advances in energy storage, increasing the interconnections of the Iberian electricity system with the rest of Europe would be a potential solution to ease a greater integration of renewables into production and resolve, partly the variability of some *E-FER*. This would allow not only to increase the profitability of the large capacity installed in *E-FER* (via electricity exports), but also to move forward the single European electricity market. The EU plans to reach a 10 percent interconnection by 2020 and 15 percent by 2030.

Despite the increase in the Iberian *E-FER* capacity, energy dependence has not dropped lower than 70 percent. In addition to increasing the percentage of *E-FER* in the mix of electric generation, reducing the dependence on fossil fuels implies a combined

[83] The Spanish renewable energy sector assigned 3.41 percent of its direct contribution to GDP to R & D. In this regard, it is noteworthy that the average investment of the Spanish economy in R & D was 1.2 percent of the GDP. (Asociación de Empresas de Energías Renovables, 2015)

[84] *MIT Energy Initiative* (2016) shows an approximation to the changes that may occur in the electricity market, such as the increase of *E-FER*, paying special attention to the incentives in renewable explained in ch. 7.

action within the transport sector. On the one hand, it would be appropriate to enhance the consumption of biofuels and also to promote electric cars (and / or hybrids), which could take advantage of *MIBEL*'s electricity supply. To achieve this, it would be necessary to raise awareness of its benefits by carrying out campaigns, with the objective of supporting their purchase, as well as stimulating their use by facilitating recharge.[85] It appears that, in order to succeed, more advances shall be made to obtain greater autonomy.[86]

Finally, we would like to stress that the future of the Iberian electricity sector is correlated to the *EU Emissions Trading System*, which began operating in 2005, (*Directiva 2003/87/CE*, Comisión Europea, 2013) and established a scheme for greenhouse gas emission allowance trading. Hence, the main purpose is to reduce emissions from various activities, including electricity production.

In the current *Plan Nacional de Asignación de Emisiones 2013-2020* (Third National Emission Allocation Plan) the allocation scenario is far more demanding than in previous assignments (2005-2007 and 2008-2012), where the free allocation of emission rights has been removed from the electricity sector. Thus, the profitability of electric power might face constraints. [87] In order to reduce emissions and fulfill the commitments acquired,[88] it will be necessary for Iberian electricity companies to adopt energy saving and efficiency measures, together with investment in clean or decarbonization technologies.

[85] It is expected that the Iberian Peninsula will benefit from two new lines in the Pyrenees and a submarine by the Bay of Biscay.

[86] Spain, Portugal and France are planning to create a Franco-Iberian freight corridor, as well as interoperability solutions between energy recharging systems and services between users. (Gobierno Español, Luso y Francés, 2015).

[87] In Spain, a recent study has shown that both high price of the electric car and low battery life are the biggest barriers for the consumer. (Junquera et al., 2016)

[88] As Moreno & da Silva (2016) and da Silva et al (2016) demonstrate.

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