ENERGY MARKET CHALLENGERS: THE DISTRIBUTED GENERATION ON IBERIAN PENINSULA

DILEMAS DO SEGMENTO DE ENERGIA: A GERAÇÃO DISTRIBUÍDA NA PENÍNSULA IBÉRICA

Fernando Gonzalez Botija[1]
Doutor em Direito
Universidad Complutense de Madrid – Madrid/España

Abstract: Solar energy has become one of the main options for expanding the renewable energy matrix both in the Iberian Peninsula and in Brazil. Technology has advanced and, in addition to the possibility of installing centralized solar plants, there has been a growth in Distributed Generation (DG), through which consumers can generate their own electricity, becoming prosumers. The general conditions of the distributed micro and mini-generation create an Electric Energy Compensation System, which allows the surplus energy generated by a consumer unit to be injected into the distributor's network and later used to reduce the monthly consumption by the consumer. The hypothetical-deductive method was the methodological basis of the study to foster the debate about the current rules causing adverse environmental and distributional impacts. It is concluded that there is a need to balance the cost of energy between the consumer who wants to install the distributed micro and mini generation and the other users of the distribution network and distributors.

Keywords: Electricity Market. Distributed Generation. Compensation System.

Resumo: A energia solar vem se tornando uma das principais opções para a expansão da matriz energética renovável tanto na Península Ibérica quanto no Brasil. A tecnologia avançou e, além da possibilidade de instalação de usinas solares centralizadas, verifica-se o crescimento da Geração Distribuída (GD), por meio da qual os consumidores podem gerar sua própria energia elétrica, tornando-se *prosumers*. As condições gerais da micro e minigeração distribuídas cria um o Sistema de Compensação de Energia Elétrica que permite que a energia excedente gerada por uma unidade consumidora

1 - É doutor em Direito pela Universidade Complutense de Madri (2002). Atualmente é professor titular e secretario do Departamento Administrativo da Universidade Complutense de Madri. Coordenador do grupo de investigação reconfigurado e financiado pela Comunidade Europeia: LEXNOVAE - Proteger os direitos fundamentais em um estado de direito mundial em mudança, papel da ciência pela Comissão Europeia Financiando e membro internacional do grupo de investigação reconfigurado pelo DGP/CNPq e certificado por UVA. É membro da AEPDA e conferencista em eventos nacionais e internacionais, com publicações no Brasil, Portugal, Espanha, Inglaterra, Estados Unidos da América do Norte, Grécia, Israel e Alemanha. Tem experiência na área de Direito Administrativo, com ênfase em Regulamentação, atuando principalmente nos seguintes temas: contratos administrativos, energia, segurança pública e internacional, drones, e regulação de tecnologia para segurança. E-mail: suricato@ucm.es

seja injetada na rede da distribuidora e posteriormente utilizada para abater do consumo mensal do consumidor. O método hipotético-dedutivo foi a base metodológica do estudo para fomentar o debate acerca de as regras atuais provocarem impactos ambientais e distributivos adversos. Conclui-se que há necessidade de equilibrar o custo da energia entre o consumidor que deseja instalar a micro e minigeração distribuída e os demais usuários da rede de distribuição e distribuidoras.

Palavras-Chave: Energia Elétrica. Geração Distribuída. Sistema de Compensação.

Introduction

In view of the concern related to sustainable development based on fossil energy resources, which are polluting, renewable energies are increasingly relevant in the world energy matrix. Energy has been used since the Industrial Revolution to achieve development, prosperity and social well-being of the population.[2] It is an indispensable input for the development of society. Since the use of the first electric powered machines, much progress has been made in the development of new technologies and energy parks. Each country has adopted an energy matrix according to its availability of sources.

In line with the Clean energy for all Europeans package, EU citizens play a key role in the achievements of the EU policy objectives, aimed to contributing to a smooth and fair energy transition while creating growth and jobs and increasing their quality of life in a modern economy[3]. As EU citizens, they should have also an active contribution in fighting climate change through the objectives and strategies following the Paris Agreement- COP 21 and other relevant instruments.

The new legislative package of May 2019 provides them with better opportunities to become more engaged in the energy transition while improving market efficiency, by reinforcing consumers' rights and also by participating in the generation of renewable energy (being household self-consumers, or Prosumers, who load their surplus production into the electricity grid). Prosumers acting proactively as energy citizens[4] have a real influence on reducing carbon emissions and its carbon footprint both, by regulating the market, taking control of household bills through smart meters, or producing and loading into the grid their own renewable energy.

But consumers in the Iberian market (or MIBEL, namely the Portugal and Spain

2 - NUNES, C. R. P., Energy Social Science as an evolution of the Inter-multidisciplinary Environment and Law and Economy. Publication on 2018/2/18 In: Anais do 23º Annual Meeting of Nanterre Network, International Studies of the Meeting of Nanterre Network. 2018.

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4 - MÖSLEIN, K. Overcoming mass confusion: collaborative customer co-design in online communities. In: Journal of Computer-Mediated Communication, v. 10, n. 4, July 2005.

common electricity market, set up in 2007) have in front specific challenges and features: (i) first, the high percentage of energy from renewable sources and the estimate surplus in the Iberian system; and (ii) secondly, MIBEL acts as an electricity island due the low level of interconnections available to sharing this excess.

Therefore, attitudes and behaviours of consumers and prosumers also influence the energy contribution to the carbon balance, and Iberian citizens shall be aware of their fundamental role. On the other side, valuable lessons can be learnt from the research when conceptualising trends and features for renewables in this Iberian context - the perfect environment to evaluate comparable win-win options against climate change and the most cost-efficient supply strategies in the context of the political, social and economic evolution on this market.

1 Difference between Centralized Electricity and Distributed Generation

The increasing demand in the number of people using electricity has caused the need to increase the scale in the generation of electric energy, which has led to the emergence of centralized generating plants, connected to consumers through distribution lines[5]

In the traditional centralized generation model, energy is produced by large plants, which are built in regions that are far from consumer centers. The electricity generated by these plants must be transported over long distances, through a complex transmission system, until it reaches its final destination. In this model, companies are, in general, predominantly state-owned and responsible for generating, transmitting, distributing and trading electricity, as well as for operating and planning the expansion of the system.[6]

This centralized model started to be questioned from the 1970s and 1980s, due to the allocation of risks to consumers; impossibility of choosing consumers; cross-subsidies between consumer groups; manipulation of tariffs for political purposes; new, more efficient technologies that found barriers to entry in regulation; lack of investment capacity by state-owned companies; exhaustion of the investment model and the need to attract private investment.[7]

Since the 1990s, several countries have restructured their electrical sectors. Brazil,

5 - KOZINETS, R. Inno-tribes: star trek as Wikimedia. In: Cova, B et al. (Eds) Consumer tribes. New York: Elsevier, 2007.

6 - TOFFLER, A, The Third Wave (ISBN 9780553246988). 2nd ed. NYC: Random House Publishing Group, 1984.

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following this global trend, has promoted a de-verticalization, with the objective of privatizing and enabling the entry of private investment in the sectors of generation, commercialization, distribution and transmission. Since commercialization and generation became sectors subject to competition and the others would remain under the state monopoly.[8]

Distributed Generation (DG) is a modality of electric energy generation that differs from traditional centralized generation, where large hydroelectric plants produce almost the entire amount of energy. Distributed Generation is a generation system made in decentralized and distributed points, through generator systems connected directly to the network or located even in the consumer unit itself (houses, companies and industries).[9]

In the case of distributed micro and mini-generation that use a solar source (photovoltaic), for example, the consumer installs photovoltaic panels in his home or business and the energy is generated during the day, when its consumption is lower than generation.[10] At night, on the other hand, when peak consumption is reached, generation is lower than consumption or nonexistent, so the consumer needs to use the electricity from the distribution network. Therefore, when injecting electrical energy into the grid system during the day, this grid acts as a kind of "battery" to be used by the consumer at night.[11]

The generation of electric energy through renewable and decentralized sources, especially solar by photovoltaic panels has become a common option among Spanish residential, commercial and industrial consumers as shown in the interactive map.

8 - BARR, Stewart. Moving from Energy Consumption to Citizenship: Challenges for the Promotion of' 'Sustainable Lifestyles' in the context of climate change. In: Seminar Series Geographies and Energy Transition at University of Leicester/UK, 20011 Disponible at https://www2.le.ac.uk/departments/geography/documents/research/seminar-series-geographies-energy-transition/seminar-3/seminar_3_barr.pdf. Accessed on March 30th, 2017.

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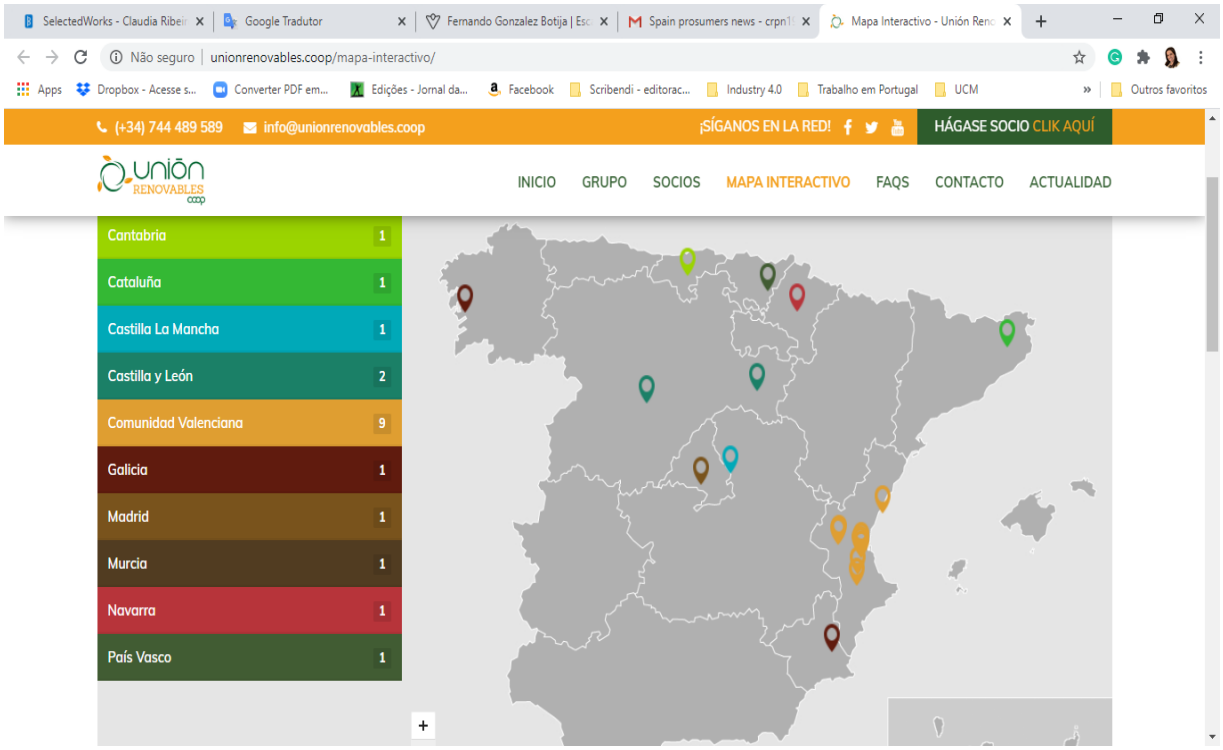
ENERGY INTERACTIVE MAP



Source: http://www.unionrenovables.coop/mapa-interactivo/

2 NATIONAL RENEWABLE ENERGY ACTION PLAN[12]

It is necessary to have a view of the National Renewable Energy Action Plans in the perspective of the dichotomy that can be established between the energy decentralisation and decarbonisation to the gradual transition away from fossil fuels towards a carbon-neutral economy.

On NREAP 2020, decentralization means dispersing generation across many smaller energy plants. It also refers to the increasing amount of embedded generation coming online, for example, CHPs on business sites or solar panels on residential properties. Decarbonization refers to eliminating carbon-based fuels for electricity generation.

NREAP 2020 is in the framework of the Renewable Energy Directive, including their legally binding 2020 targets. Forecasts for renewable energy of each EU country set down in Article 4(3) of the Renewable Energy Directive (2009/28/EC).

In the last Summary of Member states Forecast documents: “At least ten Member

12 - EUROPEAN UNION – EU - Clean energy for all Europeans package - marks a significant step towards the implementation of the energy union strategy, adopted in 2015. Available at https.//ec.europa.eu/energy/en/topics/energy-strategy-and-energy-union/clean-energy-all-europeans. Accessed on March 12th, 2017.

States expect to have a surplus in 2020 compared to their binding target for the share of renewable energy in their final energy consumption. This surplus could be available to transfer to another Member State. The quantity is estimated at around 5.5 Megatonne (Mtoe), or around 2% of the total renewables needed in 2020. Spain and Germany forecast the largest surpluses in absolute terms, with 2.7 Mtoe and 1.4 Mtoe respectively".[13]

The context of the legal-politics' study is also relevant because it is possible to understand if the legislation is well-prepared to support the commercialisation of the production of decarbonise' energy on phase of decentralised renewable energy technologies in Portugal and Spain.

Besides that, the analysis of the Iberian citizens role in the achievement of objectives of National Renewable Energy Action Plans (NREAP 2020), can be developed also from the perspective of the dichotomy between the energy decentralisation and decarbonisation to the gradual transition away from fossil fuels towards a carbon-neutral economy in this regional market - one of the greatest challenges of the New Energy Era. As an example - relevant for the research -, the Portugal forecasts for renewable energy expect to achieve an estimate of 58% sharing from renewable electricity in 2020 (with an estimated surplus of 31%) the highest percentage in the European Union (together with Sweden). Also the Spain NREAP 2020 estimates the renewables production surplus in 2.7 Mtoe in absolute terms, the highest also in the EU.[14] By outlining efficient measures for implementing the first priority of Clean Energy: "MORE RENEWABLES".

3 MIBEL - Iberian Electricity Market

Taking into account the cost-efficient supply in the context of the political, social and economic evolution on the energy market.

MIBEL results from the cooperation between the Portuguese and Spanish Governments with the aim of promoting the integration of both countries' electrical systems and it is a worldwide leader in the daily integration of electricity production from renewable energy sources into the electricity market, with part of generation depending on atmospheric dynamics.[15] The MIBEL singularity is that the system can be

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compared to an Energy Island where the transmission grid is highly meshed to balance the high contribution of renewable energy sources into the electric grid, one of the most remarkable features of the Iberian power system. From the MIBEL's creation in 2007, cooperation mechanisms based on market splitting can give rise to price volatility.[16] From 2007 onwards, it became possible to trade futures on electricity[17], affecting also the market volatility. Other systems such as that of the Iberian Peninsula (Spain and Portugal) and Denmark with high levels of variable generation. The transmission grid in Spain is highly meshed. The network is interconnected with Portugal, Morocco, Andorra and France. However, the Iberian electricity system is considered an electricity island because its commercial exchange capacity with France represents only 3% of the installed power in Spain".[18]

The first context of the socioeconomics' study is relevant to this research project because the high percentage of renewable energy sources means that the grid is more sustainable, even if renewable generation can be highly intermittent. This occurs because the weather is unpredictable, solar source and wind cannot be relied upon, what creates problems with the balance of supply and demand, and in turn, affects the frequency stability. However inconvenient these fluctuations may be, we must meet EU green goals.

Conclusions

A country's energy matrix is the supply of energy that drives all sectors of its economy. The electric matrix, in turn, is the part of the energy matrix of a country that concentrates the entire supply of energy resources destined exclusively for the generation of electricity.

It is important to highlight that the option for hydroelectricity is the result of a Brazilian geographic feature that has the largest river network in the world and, by extension, the largest hydroelectricity offer. Other countries, classified as developed, have lower or fully installed hydroelectric potential and, for historical reasons, use fossil fuels as an energy source.

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One of the ways to start changing the world energy matrix, currently based on the use of fossil fuels, such as oil, mineral coal and natural gas, which cause an increase in the emission of polluting gases and environmental damage such as the greenhouse effect and changes in climatic conditions of the planet, is the search for renewable and decentralized sources, coming from the distributed micro and mini-generation, that allow the consumers to generate their own clean and renewable energy.

However, despite the growth of the Distributed Generation market in the country, the current regulation may have a future impact on high costs for captive consumers who have not opted for self-generation, Since the costs of using the distributor's network, the charges and losses of those who use it, the system has been prorated by consumers who do not have distributed generation, configuring the so-called cross subsidy.

The possibility of a transition scenario that allows the maintenance of the rules currently in force for a few more years is being analyzed, as the changes in the rules to charge the transmission costs may hinder the return on investment or establish a barrier to entry for the insertion of new technologies in the market, in this way not making possible to distribute micro and mini generators and, consequently, the use of photovoltaic energy source. All segments of the electricity sector must act together to guarantee a future without the need for undesirable allocative subsidies, penalizing captive users.

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