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The impact of regulation on demand-side generation. The case of Spain

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ABSTRACT

Photovoltaic demand-side generation (PV-DSG), defined as the production of electricity by means of panels or arrays which are installed on the customer's side of the meter, has received much attention lately by academics and policy-makers all over the world. Some countries have promoted this form of generation, whereas others have lagged behind. This is the case of Spain, where PV-DSG has not taken-off. The aim of this paper is to provide a critical overview of the Spanish regulation for PV-DSG, approved in 2015, and its impact on demand-side generation in this country. The impacts of the new regulation on PV-DSG are calculated with real data from a household PV installation. It is found out that the current regulation is highly unfavourable for the adoption of PV-DSG, given the small savings for investors (consumers) for the adoption of PV-DSG compared to buying the electricity from the grid.

1. Introduction

Photovoltaic demand-side generation (PV-DSG), defined as the production of electricity by means of panels or arrays which are installed on the customer's side of the meter, has received much attention lately both by academics and policy-makers all over the world. Some countries have promoted this form of generation, whereas others have lagged behind in this regard. This is the case of Spain, where PV-DSG has not taken-off. The aim of this paper is to provide a critical overview of the Spanish regulation for PV-DSG and its impact on demand-side generation in this country. The perspective adopted is the one from a PV-DSG plant investor and not from an electricity system point of view. In particular, we do not aim to answer the difficult issue of the extent to which PV-DSG is beneficial to the Spanish power system.

Spain is a case worth analyzing. It is a country with very high irradiation levels in Europe and well-known for the boom of solar PV commercial installations in 2007/2008 (del Río and Mir-Artigues, 2014), followed by substantial cuts in the remuneration (Mir-Artigues et al., 2015). The latter have been deemed retroactive by many investors and the government has been taken to court (see the recent judgement of the International Centre for Settlement of Investment Disputes, ICSID, 2017). Therefore, regulation of demand-side generation was issued in a non-favourable context (Mir-Artigues, 2013). The process has been slow, given that five years have passed since the early normative steps up to the current regulation, enacted in 2015. Once the details of the regulation were known, it was criticized for the technical and economic restrictions that it contained. The result is that, after two years of the enactment of the new regulation, distributed (small-to-medium plants) and demand-side generation (< 100 kW), all of them connected to distribution grid (whether in commercial or in residential premises) has not taken off (Fig. 1). Moreover, according to the Spanish PV association, the number of on-site installations within the distributed PV generation category is zero or close to. Unfortunately, specific data on demand-side generation have not been published yet. The Spanish regulation is, thus, a relevant case worth analyzing since it is an example of a regulation which obstructs rather than encourages demand-side generation.

Previous contributions have focused on the analysis of PV-DSG in Spain. Aragonés et al. (2016) provide a theoretical analysis of the Spanish self-consumption regulation (the Electricity Law and Royal Decree (RD 900/2015). Dufo-López and Bernal-Agustín (2015) adopt a similar perspective as this paper. They analyse the impact of regulation on the profitability of a residential self-generation plant, without focusing on system costs. However, those authors assessed two drafts of regulation on self consumption, i.e., not real regulations. Talavera et al. (2014) also adopt a plant owner perspective. They analyse the impact of a draft regulation on a PV-DSG plant in the University of Jaén Campus. Ramírez et al. (2017) provide a model to evaluate the profitability of PV systems with different combinations of FIT and net-metering support schemes in several scenarios with different hypothetical PV plants. The authors also take into account experimental data of a real PV plant located in Spain with an installed capacity of 12 kWp. The model

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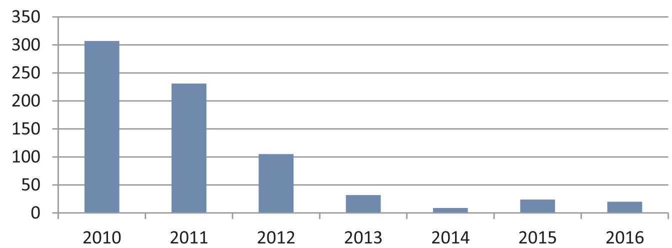

Fig. 1. Annual distributed PV generation capacity installed in Spain (MW).
Source: Spanish Solar PV Association (UNEF).

"performs the economic analysis using the main drivers determining the profitability of the investments: legal (support schemes and energy policy), economical (price of electricity, inflation), financial (cost of capital), technological (PV system, PV module, efficiency, tracking system), related to the location (solar irradiation), maintenance and repair costs, insurance and others" (Ramírez et al., 2017, p.442). However, the authors considered data on radiation and yearly power generation coming from different databases, while the economic and financial data they used were collected and adjusted from previous literature. Therefore, no data came from specific real plants. In addition, the details of the self-generation regulation in Spain are not taken into account in the analysis. Different support policies for residential PV systems in Europe are compared in de Boeck et al. (2016). With respect to Spain, it is highlighted that this is the only country without support measures to prosumers. As a result, the payback period spans for almost the entire installation's lifetime, with a minimum rate of return for plants located in the south of the country. However, the combination of high levels of solar irradiation and high retail electricity prices results in a strong incentive for self-consumption. Finally, López-Prol and Steininger (2017) analyse the impact of the Spanish PV-DSG regulation on the profitability of potential residential, commercial and industrial investors, as well as the impact of PV self-consumption on government revenues and the electricity system. They find that this regulation hinders the diffusion of PV self-consumption applications by making them economically unfeasible. Compared to our short communication, their article has some similarities regarding the perspective adopted (investors, although the authors also focus on impacts on the electricity system) and the results. However, it differs in the focus (not only on residential installations as ours), data (they do not rely on real data, as ours) and method (they carry out simulations, differently from this short communication, where calculations are provided). Furthermore, their analysis of the regulatory expectations is relatively weak, since the authors compare different hypothetical regulatory schemes. In one of them, the regulator will pay the exported electricity to the grid. Therefore, our paper contributes to the literature on the empirical front by analyzing the impact of a real (current) regulation on a plant with real PV data taking into account more realistic considerations of regulatory expectations. Past contributions are either previous to RD 900/2015 (and, thus do not take into account the impact of this regulation on the profitability of the plant), or use another methodology (simulations, instead of calculations with real data), or are merely theoretical (without a quantitative analysis such as ours) or have a different approach (focus on the system level, rather than on the investor as in our paper). This paper focuses on a small residential PV-DSG plant, The reason for this choice in this short communication was that 1) there is a widespread view and many reports (for example, IEA-RETD, 2014 and IEA-RETD, 2016) which indicate that residential consumers will play a critical role in the energy transition through their involvement in DSG; 2) real data from a small residential PV plant were available. The aim has not been to analyse all possible modalities in RD 900/2015 (i.e., not commercial and industrial plants).

This short communication is structured as follows. The next section provides a description and a critical assessment of PV-DSG regulation in Spain. A calculation of the impacts of regulation on PV-DSG is provided in Section 3. Section 4 concludes.

2. PV-DSG regulation in Spain

The aim of this section is to provide a critical overview of the vicissitudes and a critical assessment of demand-side regulation in Spain. We distinguish between the regulatory initiatives passed before 2015 and the 2015 regulation.

2.1. The pre-2015 regulation

Although Spain's RES-E support policy, which included PV generation, took its first steps in the early 80s and gained momentum in the mid 90s, it had no discernible impact on PV deployment. The turning point was the Law of the Electricity Sector enacted in 1997 (LSE, 1997), which established preferential prices for the kWh fed into the grid, but it didn't make any reference to self-generation. It was not until June 2010 that the National Renewable Energies Action Plan (PANER) mentioned self-generation, together with the banking of excess energy (PANER, 2010, p. 50). A few weeks later, the Renewable Energy Plan 2010–2020 (PER, 2011) envisaged that a PV-DSG regulation would be based on some kind of compensation for the surplus energy. However, the detailed regulation of on-site generation had actually started some months before: in March 2010 a decree draft simplifying the grid connection of RES-E plants ≤ 100 kW was released. Unfortunately, it took two years to transform this draft into a legal norm: the Royal Decree (RD) 1699/2011, which was published on 8th December 2011. Some days before (18th November 2011), a decree draft specifically regulating on-site generation had been issued (Draft 1, 2011). This proposal never came into force. More than a year later, in July 2013, a new decree draft (Draft 2, 2013) was released (see a summary of the content of RD 1699/2011 and the two decree drafts in Box 1). An administrative registry of electricity self-consumption was created in 2013, and the Law 24/2013 of the Electricity Sector (LSE, 2013) defined self-consumption as the consumption of electricity in plants connected to the internal grid of a consumer or through a direct electricity line associated to one consumer (see also Talavera et al., 2014).

2.2. The new regulation

The current legislation was implemented in RD 900/2015 in 2015. Its aim was to set the administrative, technical and economic conditions for the different types of self-consumed electricity, which are defined on an hourly basis. All self-consumption plants are affected by this RD, even the zero-injection ones, i. e., those which do not have the technical possibility to export electricity to the grid. Off-grid installations and emergency power systems are excluded from the RD 900/2015 regulation (Article 2.2).

2.2.1. Management of the electricity produced and consumed (economic regime)

There are basically two self-consumption types:

- Type 1: This is the modality called "supply with self-consumption". The plant is connected to an internal grid and production is basically intended for self-consumption. Its capacity will be equal or lower than the capacity contracted by the consumer. It can never exceed 100 kW and cannot be owned by third parties. Therefore, the plant does not appear in the registry of electricity producers.
- Type 2: This is the modality called "production with self-consumption". The plant is recorded in the registry of electricity production installations. They are connected to the internal grid or through a direct line to an associated consumer. The installed capacity cannot exceed the contracted capacity. This modality is envisaged albeit not exclusively for cogeneration with self-consumption