PHOTOVOLTAIC SELF-CONSUMPTION REGULATION IN SPAIN: PROFITABILITY ANALYSIS AND ALTERNATIVE REGULATION SCHEMES

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Overview

The cost decline experienced by photovoltaic (PV) technology during the last decades (IEA, 2015) has allowed it to reach grid parity in many countries (EPIA, 2011 and 2013; REN21, 2015), with grid parity referring to the point at which the cost of generating PV electricity equals the cost of buying it from the grid. This thus suggests that PV technology is set to play an increasingly relevant role in the process of decarbonizing the energy system (IEA, 2015b; WBGU, 2011). Spain, whilst being among those European countries with the highest levels of solar irradiation (Huld et al., 2012; Šúri et al., 2007) has recently passed one of the most restrictive self-consumption regulations (IEA , 2016). As a result, studying the impact of self-consumption regulation on the profitability of PV investors under the current economic and regulatory conditions is of central interest.

This paper contributes to filling the research gap identified by the European Commission regarding the effect of different regulation schemes on the financial viability of self-consumption systems on residential prosumers (EC, 2015: 11). We expand the analysis to commercial and industrial segments, considering also the economic and behavioural impact of the backup charge (i.e. a charge levied on grid-connected PV systems) and the implications for cases when the investment is externally financed. We also quantify the direct economic impact of self-consumption on both government and electricity system revenues with reference to the guidelines of the International Energy Agency

Methods

Whilst most of the studies look at PV competitiveness and grid parity from the point of view of the levelized cost of electricity (LCOE) (such as the Eclareon Grid Parity Monitor reports and EPIA, 2011), we assess the profitability of PV installations in terms of their internal rate of return (IRR). This allows us not only to evaluate whether PV systems are economically feasible, but also to quantify the specific profitability levels under both the current and alternative regulatory regimes. By estimating the IRR we can compare the impact of different regulations on PV profitability as well as the profitability across market segments. This enables us to compare PV investment with other kind of investment, regardless of the investment amount (IRR being a relative, as opposed to an absolute indicator, such as net present value), and without needing to make arbitrary assumptions about the discount rate.

Results

Under the current Spanish regulation (RD 900/2015), commercial and industrial PV self-consumers (type 2) can sell the surplus electricity to the grid at wholesale price, paying the grid access charge and the generation tax on that price, and a backup charge on the electricity self-consumed. Residential PV self-consumers (type 1) have a backup charge exemption for installations below 10kW but the surplus electricity exported to the grid is not remunerated. We find that this regulation is likely to hinder the diffusion of PV grid-connected systems for self-consumption in Spain, as it makes them economically infeasible for average users of the residential and industrial segments. While the commercial segment can gain up to 2.1% return on investment, this is unlikely to cover the opportunity costs of capital, let alone the costs of legal uncertainty and the other ‘soft costs’ omitted from our calculations.

For the residential segment, the impossibility of selling the surplus electricity to the grid, even with the backup charge exemption for systems below 10kW installed capacity, makes the amortization of the investment impossible at current installation costs. This is true because the load profile of the average domestic prosumer significantly differs from the generation profile of the PV system, and because self-producers are forced to give away for free most of the electricity generated (on average some 67%). For commercial and industrial prosumers, the backup charge significantly harms the profitability of PV self-consumption installations, which would otherwise be in the

range of between 2.6% - 3.6%. All segments, particularly the residential, can increase profitability by increasing the share of electricity self-consumed out of the total generation above the averages assumed (33%, 41% and 75% for the residential, commercial and industrial segments respectively)

To a certain extent the current regulation also creates inefficient incentives in that it makes it more profitable for the industrial segment to disconnect the PV system from the grid in order to avoid the backup charge and even to waste the surplus energy, than to exchange energy flows with the electricity system. In addition, the charge on self-consumption discourages demand-side adjustment. The absence of remuneration for surplus electricity, in combination with the backup charge, encourages disconnection from the grid, which results in overall inefficiency, as surplus electricity would be available at a production cost lower than potential consumers' willingness to pay for it, but is not supplied to the market.

Conclusions

As grid parity is achieved, net billing schemes are preferable to net metering, since net billing sends a price signal to prosumers to maximize the share of self-consumed electricity and encourage demand-side adjustment while mitigating the negative impacts of PV self-consumption on the electricity system and discouraging disconnection from the grid (since the surplus electricity is remunerated). The surplus electricity exported to the grid should be valued somewhere between the wholesale and the retail prices. This would provide positive profitability for all segments at minimum cost to the system. Since such surplus electricity is then sold to other consumers at retail price, the difference between these two prices (i.e. between the remuneration paid for surplus electricity and the retail price received) would contribute to covering the costs of the electricity system. Finally, charges on self-consumed electricity should be avoided , since they reduce the price signal and encourage disconnection from the grid. For these reasons, grid and backup costs should rather be imposed on the surplus electricity exported to the grid as PV penetration increases.

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