

The impacts of photovoltaic electricity self-consumption on value transfers between private and public stakeholders in France

Jonathan Roulot^{a,b,*}, Ricardo Raineri^a

^a Pontificia Universidad Católica de Chile, Av. Libertador Bernardo O'Higgins 340, Santiago de Chile, Región Metropolitana, Chile

^b Ecole Centrale de Nantes, 1 Rue de la Noë, 44300 Nantes, France

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ABSTRACT

Between 2016 and 2017, the French Government made significant advances in shaping the new legislative structure in order to support photovoltaic electricity self-consumption, which is a growing challenge for many countries developing renewables close to the grid parity. By analyzing all the main financial flows linked to the electric bill, the sales of electricity and the investment in photovoltaic systems, this study aims to identify the stakeholders that benefit or suffer the most from value transfers caused by photovoltaic electricity self-consumption compared to full injection. The results suggest a shortfall of revenue for the distribution system operator. An increase in the electric bill of other grid customers will undoubtedly offset this shortfall. Simultaneously, the French State would make savings for individual self-consumption projects below 100 kWp. The new policy also incentivizes the self-consumption for big consumers for whom it is more profitable and competitive. Self-consumption projects tend to be economically more attractive than projects in full injection when the photovoltaic system is not oversized for the electric demand. The policy may consequently imply risks for the equalization of electric grid charges among consumers, the sustainability of the current business strategy of utilities and the security of supply.

1. Introduction

1.1. Electric self-consumption as a universal revolution

A growing number of countries partly rely on photovoltaic installations to fulfill the requirements of greenhouse gas mitigation, to reduce their fossil fuels imports, and to decentralize their energy industry. Since the beginning of photovoltaic deployment in the first decade of the twenty-first century, the cost of photovoltaic systems has been tremendously reduced. Even though the economic context and the electric system are different in each country, the powerful reduction of costs already led countries to review their photovoltaic support policy. Of course, the photovoltaic installations did not already reach the grid parity everywhere and the pace to reach it will be different according to the country. Nevertheless, when the grid parity is reached or about to be reached, governments should consider the development of electric self-consumption. Consuming and also producing electricity is characteristic of a new class of consumers, which are called “prosumers” (Green and Staffell, 2017; IEA PVPS, 2016b). The growing number of producer – consumers is at the origin of this study. Several countries

have already built an economic and legal structure for it (IEA PVPS, 2016a; 2016b). Different self-consumption business models are implemented and they rely on one of the five main schemes: Pure Self-Consumption with Constraints, Pure Self-Consumption with a Feed-in-Tariff for the excess electricity, Net-metering, Net-billing, and Pure Self-Consumption with a premium. This policy diversity depending on the national context does not necessarily mean different challenges among countries, but a policy shift may have probably different impacts among private and public stakeholders. Therefore, this shift from a policy supporting full injection towards a policy supporting self-consumption may raise questions. Who benefits and who loses from the reorganization of value transfers? It is important to answer such question because, depending on the magnitude of changes and on the stakeholders concerned, this self-consumption policy would consequently lead to a structural change for some stakeholders.

Basically, prosumers' photovoltaic self-consumption may be viewed according to two different perspectives. First, it may provide electricity access to populations in remote areas. Secondly, it may contribute to the decarbonization and decentralization of an electric system already developed through a grid system. This second perspective is the context

* Corresponding author at: Pontificia Universidad Católica de Chile, Av. Libertador Bernardo O'Higgins 340, Santiago de Chile, Región Metropolitana, Chile
E-mail addresses: roulot.jonathan@gmail.com (J. Roulot), raineri@ing.puc.cl (R. Raineri).

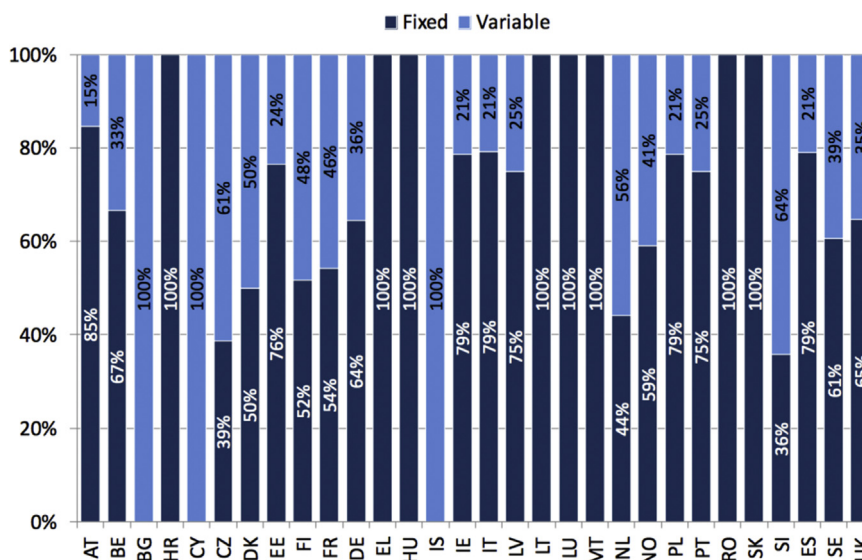


Fig. 1. Breakdown of tariff types (fixed rate and variable rate) in 2015. Source: European Commission (2016).

in which this assessment has been set up. It aims to produce results able to provide some elements about the different consumers' electricity demand in a context of renewable electricity self-consumption. Changes in the electric load do not necessarily imply a modification of the transmission and distribution system since the peak load sizes the infrastructure, but certainly, imply changes in the pricing of the wholesale electricity along the day. When the dispatch is made through a merit-order model, with must-run status for intermittent renewable power systems, the utility may reconsider the way it invests and also the economic profitability of some power plants. Furthermore, the structure of the electric bill may also be questioned by the consequences of the self-consumption policy. These questions are at the heart of concerns in many countries facing the challenge of developing more and more photovoltaic capacities that reach the grid parity in a context of decentralization.

This paper uses the on-going policy transition in France but, even though each country has its own specificities, the conclusions of this impact assessment will provide reflection elements for the self-consumption policy design and implementation in some countries. In fact, photovoltaic installations may be economically attractive for big electric consumers or for high-income consumers, and their electricity self-consumption may also affect the financial contributions that the different consumers made within their electricity bill to support the electric grid. After several years of self-consumption deployment, marginal impacts for utilities may become crippling effects for a given business strategy as previously mentioned. In fact, electric self-consumption may be viewed as a step toward a deep reorganization of the way an electric system produces, transports and consumes electricity.

Different policies adapt to different contexts but often target a similar goal. For some elements, they may consequently lead to the same results. Self-consumption policy often aims to provide an economically attractive photovoltaic installation, with public policy support to an easy household access at a lower cost, implying fewer payments for the grid. Nevertheless, a policy that only focuses on the self-consumption may neglect for instance security of supply or the fair distribution of grid charges. By working on the French case, this paper highlights on possible implications of a new self-consumption policy, and also raises questions on the long-term implications for the financial viability and development of the national electric system.

1.2. The electricity tariff structure: a common context between France and other countries

One of the main policy implications discussed at the end of this study is the suitability of the self-consumption policy with the structure of the electric bill. Therefore, it seems interesting to have a quick look at some European countries that might share some similar features as the French model.

First of all, one characteristic to keep in the mind is the relative high share of the variable tariff in the overall electric bill (Fig. 1). In 2015, this share was 46% in France, but other countries were in a similar situation like for example Finland, Denmark, Slovenia, the Netherlands or the Czech Republic. It is interesting to look the Spanish case because the State decided, between 2010 and 2015, to drop the variable tariff from 48% to 21% of the bill (European Commission, 2016; IEA, 2015). Additionally, the other characteristics to consider are the grid charges which are embedded in the consumer's electric bill. In the second semester of 2014, it reached almost 0.06€ in France, and it was around the same value in many other countries as illustrated in Fig. 2. Consequently, it seems that other countries are also in a situation where PV self-consumers have the possibility to make savings on the volumetric grid charges. The EU observed this overdependence in volumetric grid tariffs (European Commission, 2015), and noticed the growing interest in increasing the share of the grid tariffs based on the capacity component of the bill.

Given such tariff structure, the changes that have been brought by the self-consumption require a reform of the electricity tariffs as advocated by Yu (2017) and mentioned by Green and Staffell (2017).¹ This exposure to the consequences of self-consumption could be solved by an overall reform of the electricity tariff or by including measures in the self-consumption policy. Nevertheless, many countries such as Finland or Denmark did not include charges to finance the transmission and distribution system on the self-consumers (IEA PVPS, 2016b), whereas Belgium (Flanders) and Italy respectively implemented a capacity based fee and charges for systems above 20 kW in self-

¹ Green and Staffell (2017) judiciously mentioned the example of US utilities that increase fixed charges for PV users to avoid the “utility death spiral” while also reducing the volumetric charges.

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