SELF-CONSUMPTION: CORNERSTONE OF THE PHOTOVOLTAIC REVOLUTION

AleaSoft, February 19, 2019. The increase of self-consumption in Spain is an opportunity for the expansion of the photovoltaic energy, but it also entails certain risks if its implementation is not carried out in a planned manner.

The most widespread public opinion is that the **self-consumption of electricity** is beneficial for the consumers and for the electrical system in general. Thanks to the outreach of organizations such as **UNEF** and **APPA**, self-consumption has a good public image. The proposal for a new Royal Decree to regulate self-consumption, which was made public a few weeks ago, has been received as positive news and is perceived as a step in the right direction, and so **AleaSoft** welcomed it then.

Currently, self-consumption also has a central role in the energy sector due to its good growth prospects in the coming years, favoured by the new regulation. So much so, that this year's GENERA 2019 fair has it as the central theme: "A new scenario for Self-Consumption", with several forums and technical conferences around this topic. At the fair, which will take place between February 26 and March 1 in Madrid, UNEF organizes two technical conferences on self-consumption: success cases and technological challenges. The photovoltaic association also organizes another technical conference on financing photovoltaic projects on March 1, in which **AleaSoft** will participate with the presentation "The price curve in the new reality of Solar Photovoltaic Energy projects". APPA also organizes several technical conferences during the fair, one of them on self-consumption, energy storage and electric vehicle.

Self-consumption, at least in its most popular variant of domestic self-consumption with **photovoltaic panels**, uses renewable energy sources, which is perceived as, and certainly is, favourable to the environment. The ecological transition towards electricity production increasingly free of polluting emissions is not possible, according to **AleaSoft**, without the participation and widespread introduction of self-consumption in industries and households.

At the same time, self-consumption contributes to the decentralization of electricity production and gives more prominence to the consumers, who can not only manage their electricity demand, but can also self-produce part of the electricity they need and even sell the surplus energy. Currently, the costs of a photovoltaic installation for self-consumption have reached values more affordable for some small industries, communities of owners and some individuals.

Obviously, the costs will depend on the size and power of each installation, which in turn will depend on the power and energy needs, and on the fraction of the consumption that wants to be self-produced. With a photovoltaic self-consumption installation of less than 1000 €, an important part of the consumption of the most common households can be covered. If what is wanted is to self-produce most of the consumption of a typical house, and even sell the surplus energy, the costs go up to at least 3000 €. If what is intended is to achieve a large autonomy and depending as little as possible on the distribution grid, then, incorporating a storage system with batteries and increasing the cost to 10 000 €, an autonomy of 80% or more can be achieved.

Industries can afford larger investments and usually has more surface for the installation of panels, so the cost per kWp will be lower and the investment, more efficient. In these cases, being able to sell the surplus energy and become a producer will be an option to amortize the installation more quickly.

Self-consumption properly organized collectively makes the idea of self-sufficient islands totally realistic, that is, from residential complexes to small cities that will not need to be connected to the grid to consume but, in any case, to export most of the time.

For the self-consumer, both domestic and industrial, the electricity consumed as a whole, both from the grid and self-produced, will have a lower cost per kWh, and will tend to substitute other fuels for electricity such as gas, in homes and industries, or gasoline, in transportation.

Another aspect that will significantly favour the expansion of self-consumption is the reduction of costs of energy storage systems. The storage of electricity with **batteries** is the perfect complement for a self-

consumption installation that allows matching the production curve, centred in the central hours of the day, with the demand curve, normally displaced towards the evening hours.

For larger self-consumption installations in industrial facilities, or even for photovoltaic production plants, other storage systems more suitable than batteries will gain prominence. This is the case of **hydrogen**, which can store a large amount of energy for long periods of time, and can be reconvered into energy without generating waste.

Also, from the point of view of the electrical system, self-production and self-consumption of electricity bring several benefits. Being the self-production mainly from renewable energy sources, it is a boost to the **decarbonisation** of electricity production and is a key element to achieve the goals of renewable production for 2030 and 2050. These goals imply a share of renewable energy use of the 32% by 2030 that, according to **AleaSoft**, will be difficult to reach, and without the contribution of self-production, mainly photovoltaic, they are considered unachievable.

On the other hand, self-consumption reduces the demand of the electricity grid and the **wholesale electricity market**, reduces energy imports and increases the country's **energy sovereignty**. This contributes to a lower amount of energy circulating through the transmission network, which decreases **energy losses**.

In addition, a reduction in energy demand leads to a decrease in the marginal market price. The paradox of self-consumption is that as the amount of self-consumed energy increases, the market price tends to decrease, which makes self-consumption less profitable compared to the direct consumption from the grid.

When self-consumption reaches a significant volume, the management of the electrical system becomes more complex because it is necessary to correctly predict in real time both the amount of energy that is not going to be consumed from the grid, as well as the surplus of self-consumption that is going to be fed. Poor energy management at the level of low voltage networks has greater consequences in terms of losses than in the case of high voltage networks. So, what in principle could mean greater efficiency of the electrical system due to lower losses, may end up causing just the opposite. The increase in self-consumption will lead to new ways of managing the network and surplus energy in a more dynamic and intelligent way. The technologies based on the **blockchain** are called to have an important role in this aspect. With them, the management of distributed demand and production will be carried out in a decentralized, transparent and consensual manner and in real-time.

The Iberian Peninsula has a robust electricity system that allows it to have a perfectly coupled market between Spain and Portugal practically 95% of the time. This network will be able to absorb the expected increase in self-consumption for the coming years, but photovoltaic self-consumption in the Iberian Peninsula will have a great north-south asymmetry, due to the amount of incident solar radiation and the naturally available solar resource. This asymmetry will compensate the historical asymmetry between the production of electricity, which is more concentrated in the northern part with large water reservoirs and gas and coal power plants, and consumption, which is higher in the southern part due to its larger population. This causes a flow of electricity from north to south that, when congested, can cause technical restrictions. With greater photovoltaic production in the south, due to the greater number of hours of sunlight and incident radiation, both in self-consumption facilities and in large solar power plants, network congestions will tend to be reduced and, at the same time, more wealth will be created in areas that historically have been less favoured by the lack of industrialization.

There will come a time when a point of equilibrium is reached where self-consumption means a benefit for the electricity system without increasing too much its management costs. According to **AleaSoft**, we are still far from that point and there is enough room for self-consumption to expand without problems.

Source: **AleaSoft Energy Forecasting**.

Keywords: **self-consumption of electricity**, **photovoltaic panels**, **UNEF**, **APPA**, **self-production of energy**, **energy losses**, **renewable energy sources**, **decarbonization of the electricity system**, **blockchain**, **hydrogen**, **wholesale electricity market**, **energy sovereignty**.