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# Net Energy Balance and Smart Grids in Spain: Integration with PV Systems

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## 1. INTRODUCTION

Net Energy Balance Systems are interconnected installations with self-consumption purposes. With small generation systems, the installation owner satisfies its own energy demand and he only uses the grid to export or import the difference between generation and demand. In the end, he will pay the net energy consumption from the grid, which is intended to be the minimum as possible. This system can be optimized with Smart Grids and the creation of micro-grids.

Smart Grids and Net Energy Balance Systems are the newest trends in electrical energy generation and distribution. Its benefits are widely demonstrated as, for example, reduction of power losses in the distribution system, optimization of the energy resources, better monitoring of power supply and demand, etc.



## 2. THE TRADITIONAL GRID SYSTEM

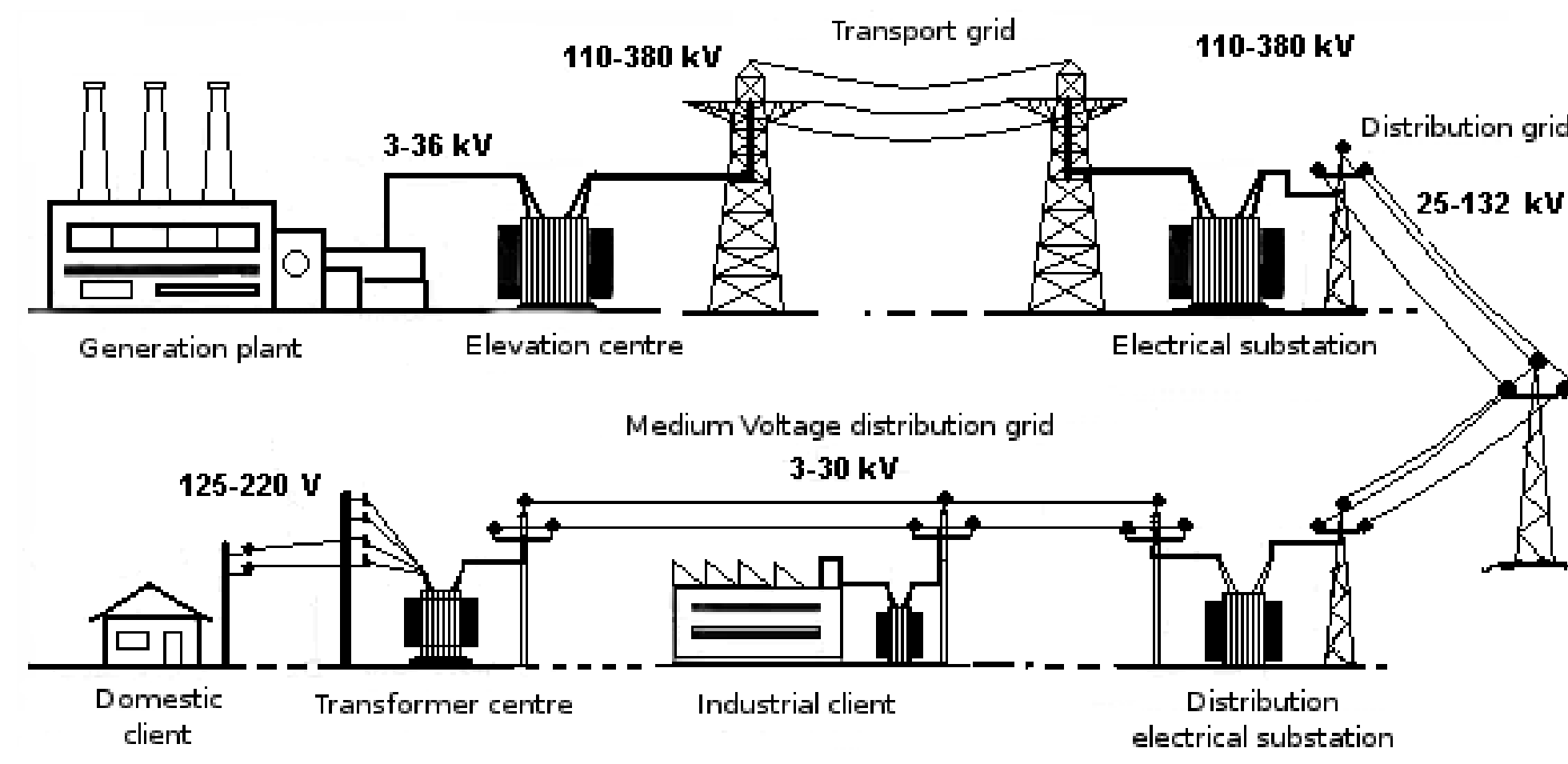


Figure 1: A traditional grid scheme.

The first alternating current grid system was installed in 1886. At that time the grid was conceived as a centralized unidirectional system. The traditional grid system is as shown in the figure in the top. It is a fixed system where the energy is simply distributed from the generation plants to the consumption devices. It is not possible to coordinate dynamically the demand with the offer and the generation planning is just based on the historical trends. Thus, the energy associated costs can be seen on the next graph.

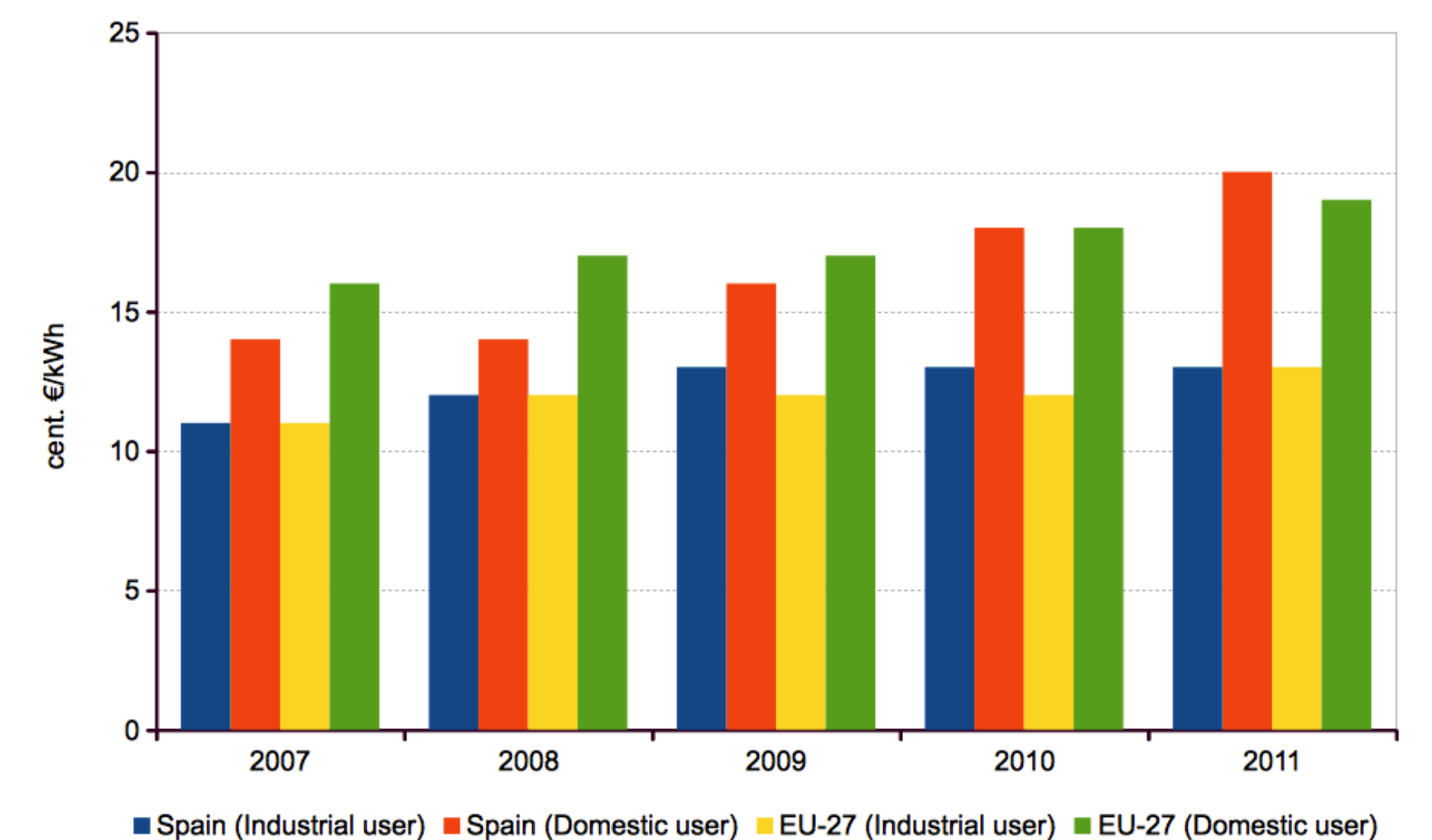


Figure 2: Electricity costs evolution.

## 3. SMART GRIDS

A Smart Grid is a electrical grid combined with information and communication technologies. Therefore, the grid can be dynamically adapted. It also allows peak curtailment or peak leveling, which means that prices can increase or decrease depending on the demand periods.

Smart Grids are based on the adequate use of smart meters and communication protocols which make possible to handle bidirectional energy flows and distributed generation systems, such as photovoltaic panels on building's roofs.

In Spain, *Red Eléctrica Española* and the main energy suppliers are joining their efforts to transform the currently grid system to a Smart Grid. However, there still not exist any specific law that regulates this kind of systems. There only exist some laws that regulate the grid conditions (Law 54/1997, Law 17/2007, RD 661/2007) and the energy meters specifications (RD 1110/2007, Orden ITC/3022/207, Orden ITC/3860/2007).

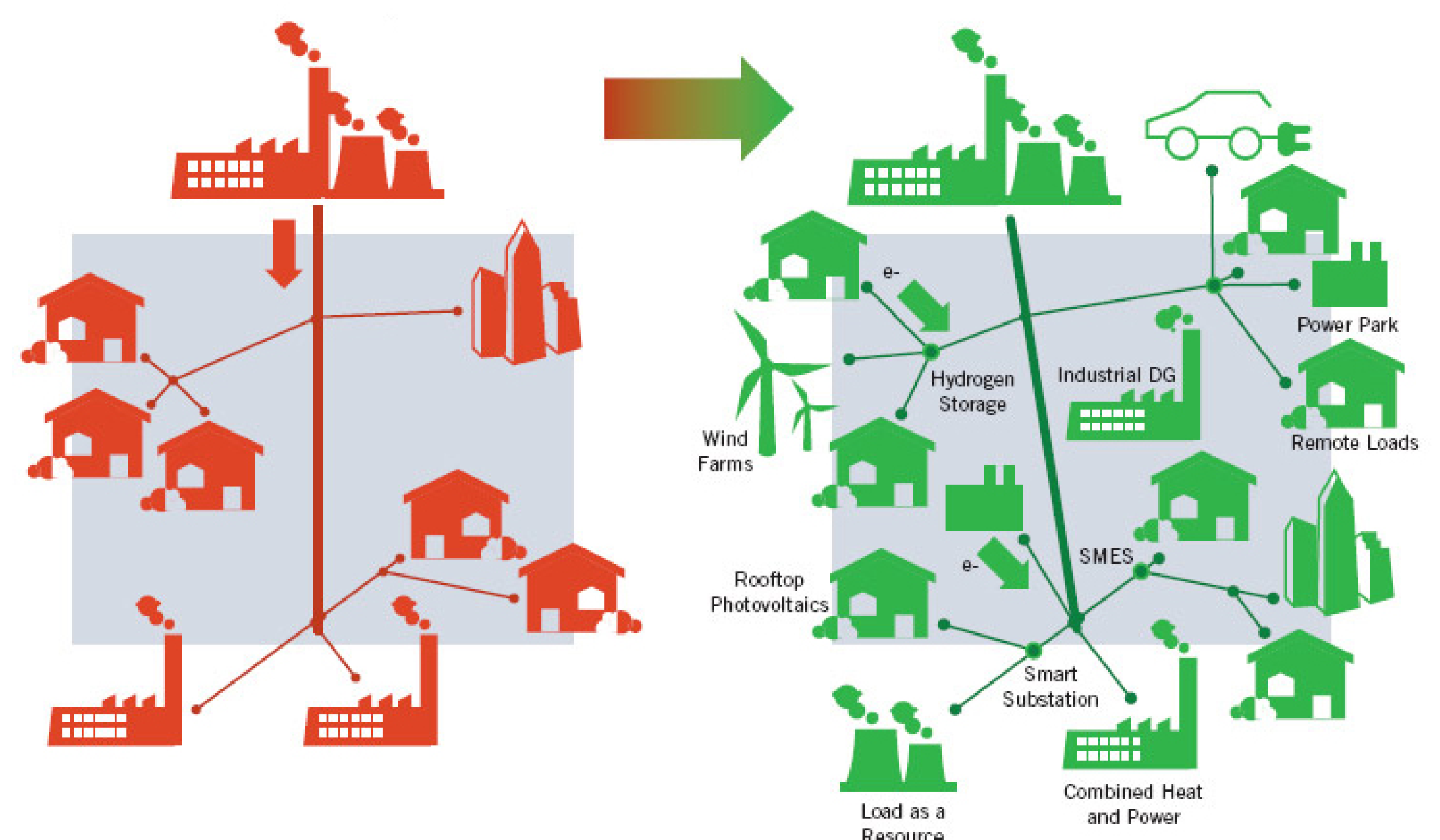


Figure 3: A traditional grid (left) and a Smart Grid (right) schemes.

## 4. NET BALANCE POLICIES

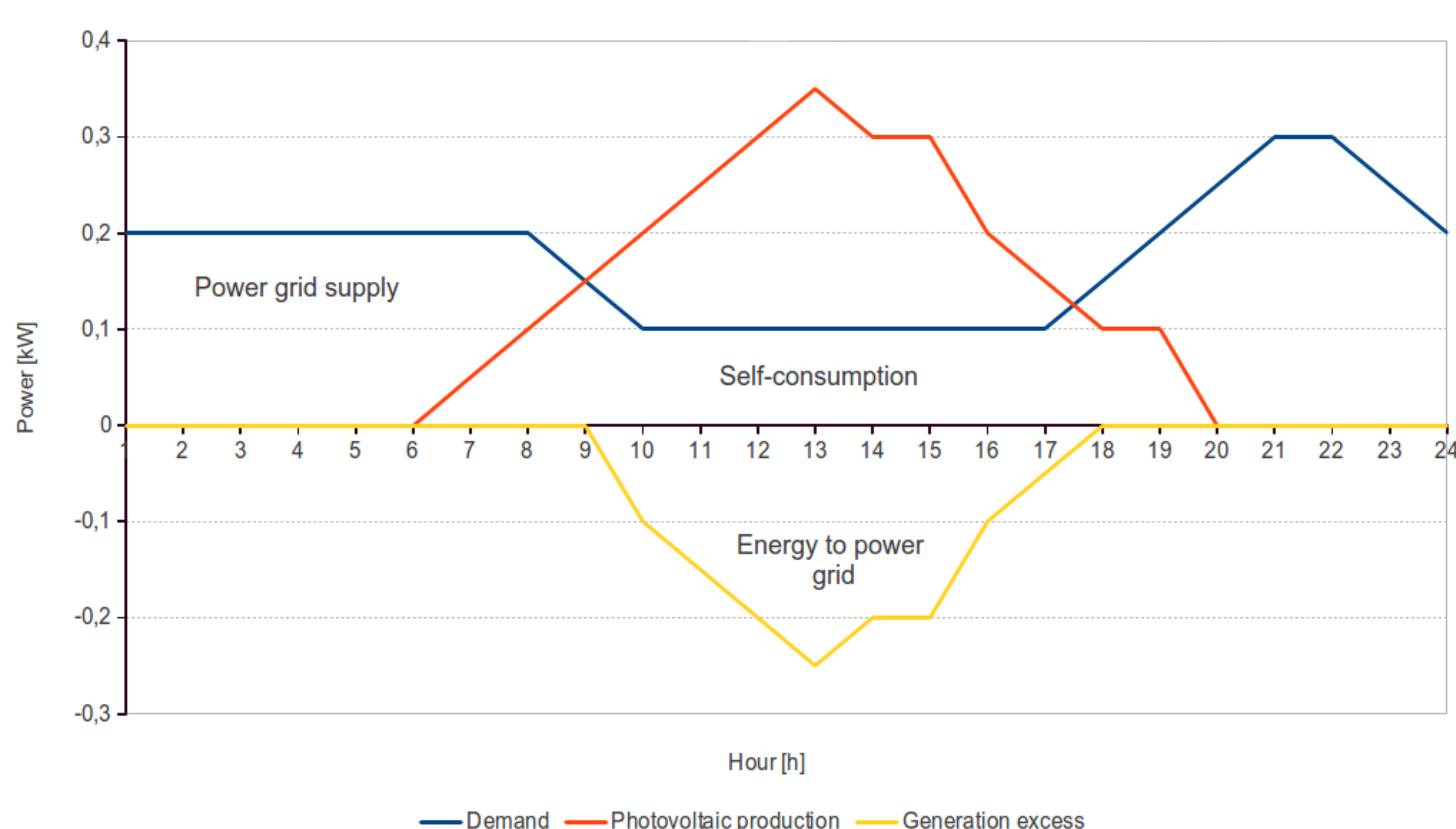


Figure 4: Photovoltaic Net Balance example.

The Net Balance Policies are intended to improve the self-generation philosophies, with the support of the general power grid. The idea consists in that a particular consumer installs a renewable power source. When he produces as much energy as he consumes he is not demanding energy from the grid. Otherwise, as he is connected to the grid, he can import the energy from there. When he produces more energy than he needs, he is able to export that energy to the system. At the end of the year, the user only has to pay for the difference between the

energy he demanded from the grid and the energy he sent to the system. No feed-in-tariff policies are necessary with this system. Moreover, with smart meters, it is possible to increase or decrease the price of the energy demanded or offered due to the general demand period.

The Department of Industry in Spain is evaluating a new regulation framework to introduce these policies, but the provisional access costs for the users are so high that make this policies unattractive and unfeasible.

## ACKNOWLEDGEMENT

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