The impact of the energy efficiency on the Iberian Electricity market

Juan Manuel Roldán-Fernández [(1)], Manuel Burgos Payán [(1)],

Jesús Manuel Riquelme Santos[(1)], Paula Páramo Balsa[(1)]

[(1)] *Department of Electric Engineering. Universidad de Sevilla, Spain*
+34954487283
jmroldan@us.es, mburgos@us.es, jsantos@us.es, pparamo@us.es

1. Introduction – The integration of a certain amount of renewable generation in the wholesale market right-shifted the merit-order generation curve, which produces a noticeable reduction of the clearing price while slightly increases the traded energy. This mechanism is the well-known merit-order effect of the renewables. However, evaluations of the merit order effect of energy efficiency are still scarce. The promotion of energy-efficiency plans (industry and domestic) by policy-makers is expected to yield a reduction of the demand more or less intense. As a result of the decrease of demand bids, the merit-order demand curve experiences a left-shifted displacement, which produces a reduction of both the clearing price and the traded energy. Consequently, the total cost of the traded energy also diminishes. This work aims to extend further current knowledge of the effect that the energy efficiency would produce in the day-ahead electricity Iberian market. The day-ahead electricity Iberian market is reproduced under different scenario of energy efficiency for the year 2017. This methodology is based on using hourly market data. Firstly, market data is extracted for the analysed period so that generation and demand curves can be developed. This base scenario is modified considering that part of the consumers would apply for energy efficiency programs. Consumers expect to save in the electricity energy bill, mainly due to the energy saving. Consequently, the demand undergoes a reduction produced by the market agents responsible for providing electricity to the domestic consumers. These agents are located in the flat part of the curve (with the maximum price of 180.3 € / MWh, maximum price allowed in the Iberian market). The market have been analysed with a reduction of 2% of the total demand. Fig 1 shows the typical hour generation and demand curves. The method used modifies the demand curve by reducing the flat part of the curve by a certain amount of energy (ΔE_L). The clearing point is calculated obtaining the intersection of the existing generation and modified demand curve.

2. Results and Discussion

The magnitude of the effect that energy efficiency can produce in the market is shown in Table I. As can be seen, the hourly mean price and the total traded energy is reduced. The energy reduction is somewhat less than the energy withdrawn from the demand.

Table I. Mean values of the variations of the yearly traded energy, hourly clearing price and yearly cost of the traded energy

Year 2017	**Units**	**Efficiency ΔE_L = 2% Load (3.7 TWh/y)**	**Base Case**
$\Delta W(\Delta E)$	TWh	-2.7	W = 243
$\Delta p(\Delta E)$	€/MWh	-1.0	p = 52.23
$\Delta C(\Delta E)$	M€	-151	C = 12883

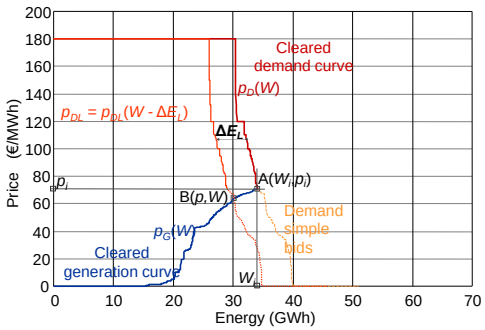

Fig. 1. The effect of efficiency in the day-ahead electricity market

4. Conclusions - The downward pressure of load saving and energy efficiency tools on the clearing price is mainly due to the fact that the displacement to the left of the demand curve produced by the reduction of demand bids. The energy efficiency manages to leave out more expensive and more polluting technology being the intensity of this effect quantified in this study for the year 2017.

5. References

[1] Roldán Fernández, Juan M., et al. The voluntary price for the small consumer: Real-time pricing in Spain. Energy Policy. 2017. Vol. 102. March 2017. Pag. 41-51.