Importance of breaking down electric consumption when designing photovoltaic plants

Diego Carmona-Fernández [(1)], Diego Rodriguez-Méndez, Miguel A. Jaramillo-Morán, Pedro Martín de la Vega

[(1)]School of Industrial Engineering, University of Extremadura, Spain
dcarmona@unex.es

1. Introduction – Usually the design of photovoltaic (PV) systems for self consumption, which are linked to the electric distribution grid, was carried out by taking into account the customer's monthly consumption data, which were fitted with the mean expected production of the system to be installed. Therefore it was not necessary to consider more accurate data. Nevertheless changes in legal requirements [1] have imposed the need of taking into account what has been named surpluses. Nowadays when a system provides excess production of electric energy it is paid to a higher price than that which is charged to customer that consume energy form the grid. This is why it is necessary to study the influence of analyzing disaggregated customer´s consumption data in order to fit them to the production of the system to be installed.

2. Results and Discussion – In this work production data obtained from solar radiation values gathered with the online tool PVGIS have been fitted to consumption data from a customer's system. Hourly and quarter-hourly data have been compared. In Table I hourly data from a 1.6 kWp (which should not provide excess energy, as assumed with this aggregation of data) are compared with quarter-hourly data from another plant with the same peak power. A comparison of the plant providing the greatest savings when hourly data (9.9 kWp) were considered and that with the greatest savings (8.25 kWp) for a time horizon of 20 years is also provided.

Tabla I.

Scenario	Savings in 20 years (€)	Overall consumption (kWh)	Consumption in grid (kWh)	Surpluses (kWh)	Amortization (years)	Cost without using FV (€)	Grid consumption cost (€)	Monthly saving (€)	System cost (€)
Hourly 1.6 kWp	2053.22	1185.64	1057.17	0.00	8.76	140.65	125.42	15.22	1600.00
Hourly 9.9 kWp	8149.95	1185.64	551.07	160.30	10.97	140.65	65.44	75.21	9900.00
Quarter - Hourly 1.6 kWp	1496.70	1185.64	1076.75	19.58	10.33	140.65	127.74	12.90	1600.00
Quarter - Hourly 8.25 kWp	3559.07	1185.64	770.63	247.39	13.97	140.65	91.44	49.20	8250.00

3. Conclusions – When analyzing the 1.6 kWp system with both hourly and quarter-hourly data it may be seen that savings in a 20 years horizon is 1.37 times higher (2053.22/1469.7) when hourly data are considered. In addition it takes 1.57 years more to write off investments. Finally it is worth noting that if quarter-hourly data had been used the maximum saving in 20 years had been achieved with a 8.25 kWp PV system instead of that of 9.9 kWp, so that the customer's installation costs could have been reduced.

4. References

[1] RD 244/2019 April 5, regulating administrative, technical and economic conditions of electric energy self consumption. From https://www.boe.es/diario_boe/txt.php?id=BOE-A-2019-5089.