night, but this has now changed. In particular, in this system it was possible to pump at times when the cost of electricity is cheaper (P6 period hours)
With self-consumption, we must try to consume when we have production, as much as possible. The figure 10 shows the new consumption curve in the re-pumping system, so that we ensure the same amount of water pumped but in a similar way to the photovoltaic production pattern.

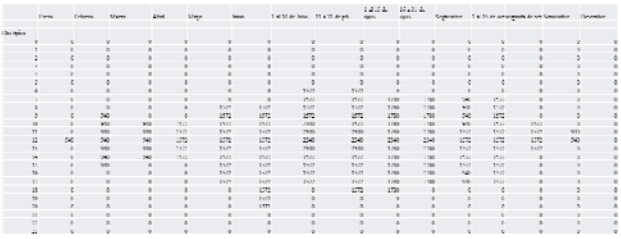

Fig. 10. Load curve of Repuming system adjusted to resource

In figure 11 the rescheduled load curve in the re-pumping system and energy generation of a single axis tracking system of 3MWp the 1st July is shown.

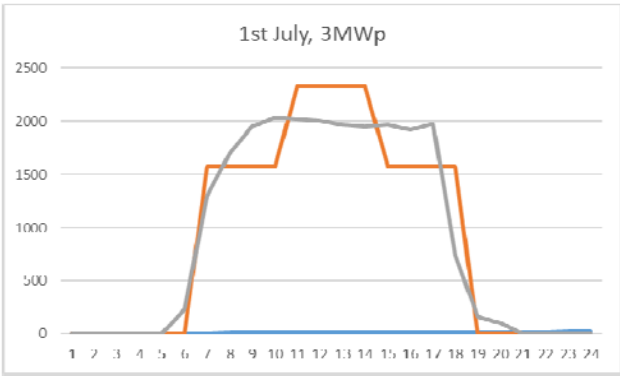

Fig. 11. Rescheduled Load curve in Re-pumping system and energy generation of a single axis tracking system of 3MWp the 1st July

With the rescheduled load curve, and the simulation of the hourly generation, an annual analysis of generation, grid purchase and surplus (kWh) is carried out for different nominal powers of the photovoltaic plant.
For the economic analysis, the following hypotheses are established:
Investment cost:
-0.85 euros/Wp in 1-axe horizontal solar tracking
-0.75 in fixed system with an inclination of 5 degrees
Electricity price, 0.1-0.3 euros/kWh
Production depreciation: 0.7% per year.
Maintenance costs: 15 Euros/kW and year
The most unfavorable case will be considered, which is that no income is obtained from the surplus energy that may be produced.
In what follows, the case of solar tracking to a horizontal axis is shown.

Fig. 12. Profitability based on size, single axis tracking system

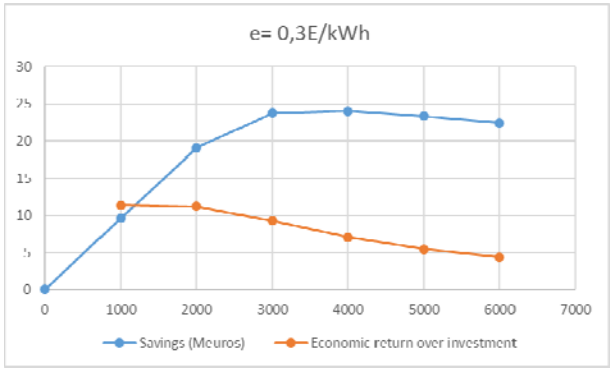

Fig. 13. Monetary savings (MEur) and Return over investment for several sizes of PV (kWp), single axis tracking system

From the figure 13 it can be deduced that if the cost of electricity is 30 Euros/MWh, the most convenient size of photovoltaic power to install is 3MWp, recovering the investment in just over two years and with a profit of 9 times the investment at the end of 30 years. About 5,5 hectares of land are required
Similarly, the study can be carried out for an electricity cost of only 10 Euros/MWh, although this case is considered unlikely. Again, the size that optimizes savings is 3MWp. In this case, the investment takes longer to recover (7 years), with a profit of the order of 2.
With a photovoltaic system with fixed panels inclined by 5 degrees, the power that maximizes savings is 4MWp, higher than in the previous case (with monitoring). The economic investment is recovered 7 times over the 30 years considered.

4. Conclusion

Several scenarios resulting from different photovoltaic technologies and demand management are designed, finally providing recommendations on the size of the most appropriate photovoltaic plant, as well as the associated economic profitability. The best option is the installation of PV system with one-axis solar tracking.

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