Optimization of the power mix and the remuneration of the electric vehicles with VGI facilites

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In the context of the *Fossil Free Island* project, responding to the challenge of energy transition and looking for energy independence, Porto Santo, a Portuguese island in Madeira region develops a strategy on electric vehicles with intelligent and reversible recharge. Recharge system forecasts would take into account the island driving conditions and drivers behaviour as well as meteorologic characteristics, since a storage system supporting the power grid service will allow to expand intermittent renewable energies sources. Nowadays, power supply is provided mainly by thermal power plants with 85% of the annual production and about 15% by photovoltaic and wind power units. Nevertheless, without specific seasonality of airstreams and without extreme variations of solar irradiation all along the year in the region, both resources, solar and wind power, may be exploited for immediate consumption when meteorologic conditions correspond to customers demand and for storage and delayed restitution when production exceeds demand.

A priori, an energetic analysis takes us to see the influence of the mix distribution between photovoltaic and wind power on the needed storage capacity. For having a considerable high renewable energies percentage on the total production, a system with a dominant photovoltaic installed power needs much more storage capacity -till it is necessary to provide electricity during the hours without sun irradiation- but with a smaller installed capacity needed -till during the daily hours the irradiation presence is rather constant-. Whereas, with a dominant percentage of wind power it is harder to predict the moments of the day with airstreams. It would be necessary to have a higher installed capacity with a smaller storage capacity.

We build an optimization model for the power system considering different remuneration modes for car owners. The integer programming model is solved for a typical period with an hourly time step and different intermittent REn production levels. In the objective function we introduce the cost of the power units and the household electricity demand is given. The car batteries can be plugged on the grid to charge or discharge according the level of local demand curve or according to a tariff signal.

Data from the local transmission system operator EEM are used for this model (year 2017). The optimal distribution of these resources involving economic, behavioral and stochastic parameters are analysed considering the level of car batteries remuneration.