HYBRID SOLAR POWER PLANT TRADING IN AN ELECTRICITY MARKET WITH IMBALANCE COSTS

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Abstract. We have witnessed the increasing development of hybrid solar power plants, i.e., battery backed solar power plants, which are part of the current effort in pursuing a complete *clean energy* generation mix in European countries. These power plants have a battery (B) which was first thought to absorb the *imbalances*, i.e., differences between real production and production forecast, of the photovoltaic panel (PV), but, from an energy management perspective, is impossible not to wonder whether the battery could, or should, be *traded* directly in the power market to maximize value capture by shifting consumption and production (due to existing price profiles). The Floating Solar Plant of Alqueva, in Portugal, is one example of such a solar plant.

Aiming at maximizing the solar power plant market margins, we provide a stochastic mixed-integer linear programming model for trading in each session of the power market. The method, which accounts for the PV imbalances, not only optimizes the energy amount we should buy (sell) in order to charge (discharge) B in each session but also decides how to best review the PV position in the power market, in face of new PV production forecasts. Remark that forecasting the PV production is a challenging endeavour from which we expect a considerable variance as we approach deliver time.

We do not deep dive in power market price modelling. Instead, we take the market sessions as a multivariate random variable (with a simple conditional variance-covariance structure). For implementation, the price structure can be modelled at user discretion to accommodate different (views of) power markets.

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