Financial valuation of energy storage and delivery contracts
Valorisation financière du stockage et des contrats de livraison d'énergie

Internship proposal

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1 Organism, supervision and material conditions

Organism

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2 Proposal

Research domains

Mathematics, stochastic optimization, finance, energy, smart grid.

Subject

Investments in energy — production, storage — are usually made over long time spans (from a few years to a few decades). Now, the penetration of renewable energies and the technological changes (smart grids) make the investment returns especially uncertain. On top of these investment uncertainties, there are operational uncertainties resulting from the variability of the energy demand and production (wind, solar), so that adjusting supply and demand is a delicate short term issue. In this context, how can you value and finance investments in energy, especially in storage? To answer such a question, you need to connect to financial markets.

The future cash-flows generated by production or storage devices are highly uncertain and depend on several risk factors, including the spot price of electricity. Financial valuation and hedging of such cash-flows results in nontrivial stochastic optimization problems involving trades in energy futures and other derivatives. The inclusion of the derivatives markets in the model allows for better hedging of risks, adds market consistency and reduces the effect of subjective factors of the model

The internship has for object to study a generic formulation of problems of stochastic optimization with two time-scales — investment and operations — and involving financial markets. The investment (long scale) conditions the operations, in particular through the available capacities of production and storage. In return, the operations (short scale) can affect the investment by the more or less premature wear of the equipments (ageing of electrical batteries, for instance).

The student will contribute to the formulation and problem statement. He/she will study and develop decomposition methods to solve numerical instances.