

## MAXREV – Revenue maximization in hydrothermal systems under hydrological and spot prices uncertainty



### Objective

MAXREV is a stochastic revenue maximization model for hydrothermal systems with the representation of the transmission network suitable for long, mid and short-term studies. The model calculates the operative policy that maximizes the revenues of the company, which owns a set of hydro and thermal plants that can sell and buy energy in the spot market.

As an SDDP add-in, MAXREV has all the characteristics and functionality of this model, such as:

- detailed operation of hydro plants (water balance equations, storage limits and limits on the turbined, spilled and filtered out-flows etc) and system topology;
- detailed modeling of thermal plants (unit commitment, concave or convex efficiency curves, fuel consumption constrains, multi-fuel thermal plants, etc);
- detailed transmission network: Kirchhoff laws, power flows limits in each circuit, losses etc;
- demand per load block and bus;
- monthly and weekly time-steps;
- hydrological uncertainty: uses stochastic models for inflows prediction, which capture the hydrological regime (seasonality), time and spatial (among hydro stations) dependence, severe droughts, etc.

Furthermore, MAXREV considers the uncertainty on the spot prices, which are represented as user-defined scenarios.

The model determines the optimal production scheduling of hydro and thermal plants as well as the corresponding sales in the spot market.

Bilateral contracts of energy sale can be defined as system demands. The energy of these contracts will be supplied either by the company's self production or by energy purchases in the spot, which might take place if the company's physical assets are short on energy due to droughts, fuel availability constraints etc.

### MAXREV results

All model detailed results are written in CSV (comma separated values) formatted files. These files are managed by a user-friendly graphical interface that allows the creation of Excel workbooks with the desired results and plots. The MAXREV main results are:

- operative statistics: hydro and thermal generation, thermal operative costs etc;
- sales and purchases in the spot market;
- revenues per plant in the spot market.

### MAXREV uses

MAXREV has been used as a decision under uncertainty support tool for hydrothermal systems in competitive environments, besides international interconnection studies:

- analysis of a Brazil-Uruguay-Argentina interconnection;
- hydro generation assets evaluation, hydro plants flexibility (storage) analysis and contracts pricing in France.