SDDP PSR

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Objective

SDDP is a stochastic hydrothermal dispatch model, with the representation of the transmission network and gas pipelines, used in long, medium and short term operation studies. The model calculates the least-cost operation policy of a hydrothermal power generation system, taking into account the following aspects:

- Operating details of hydroelectric plants: hydraulic balance, storage and flow rate limits through turbines, spillways, head effect and others;
- Detailed model of thermoelectric plants: unit commitment, take or pay contracts, fuel availability constraints, efficiency curves, multi-fuel plants and others;
- Representation of spot and energy contracts markets;
- Hydrological uncertainty: stochastic inflow model representing hydrological system characteristics such as seasonality, time and spatial inflow correlations and droughts;
- Detailed transmission network: Kirchhoff laws, power flow limits in each circuit, losses, security constraints, limits on export and import among electric areas, sum of flow constraints and others;
- Load duration curve represented by blocks either at the system level or in each bus (if transmission is considered), using monthly or weekly time steps;
- Modeling of the natural gas pipeline network with gas production and transportation constraints, production capacity in the fields, capacity, pipeline flow limits and losses. Natural gas demands in each node are given by the thermal plants' production and "non-thermal" consumption (industrial, residential, etc.)

In addition to the least-cost policy, **SDDP** calculates economic indices, such as load marginal costs in each region in case of a simplified energy interchanges model or in each bus in case of a transmission network wheeling rates, transmission congestion costs, water values in each hydroelectric plant, marginal cost of fuel constraints, etc.

Because the solution methodology is based on decomposing the original problem into smaller-size sub-problems, computational efficiency may be increased if the parallel version of **SDDP** is used. In this version, the sub-problems are solved simultaneously by several computers connected by a local network or in a multi-task

SDDP main results

The results produced by **SDDP** are in CSV-format files. These files are managed by a graphical interface (GRAPH program) which processes the desired results, graphing them in Excel files. **SDDP**'s main results are:

- System operation statistics: hydro and thermal generation, thermal production costs, energy interchanges, circuits flows, fuel consumption, risk of deficit and unserved energy;
- Locational marginal costs (for each region or bus);
- Capacity marginal costs: measures the benefit of reinforcing a resource, such as the installed capacity of a thermal plant, the turbine capacity of a hydro plant, the storage capacity of a reservoir or the capacity of a circuit. These indices are used to signal effective reinforcements for the system.

SDDP uses

The **SDDP** model has been used in valuation studies for new hydro and thermal power plants, assessment of regional markets and international interconnections in several countries in all the five continents:

- Americas: all countries in South and Central America, Dominican Republic, United States and Canada;
- Europe: Austria, Spain, Norway (Nordic region), Belgium, Turkey and Balkan region (Albania, Bosnia y Herzegovina, Bulgaria, Macedonia, Montenegro, Serbia, Kosovo, Rumania and Slovenia);
- Asia: provinces in China (including Shanghai, Sichuan, Guangdong and Shandong), Vietnam, Kirgizstan and Tajikistan;
- Oceania: New Zealand and Philippines;
- Africa: Tanzania, Namibia, Egypt, Sudan, Ethiopia and Ghana.