

POWEL OPS

Powel OPS is an One-area Power-market Simulator for best possible long- and medium term exploitation of hydropower resources and contract access in relation to uncertain inflow, market prices and delivery obligations. Powel OPS is a tool for managing and evaluating hydropower generation system in complex watercourses. The model can generate water-values and boundary conditions for the short-term optimizer Powel Shop.

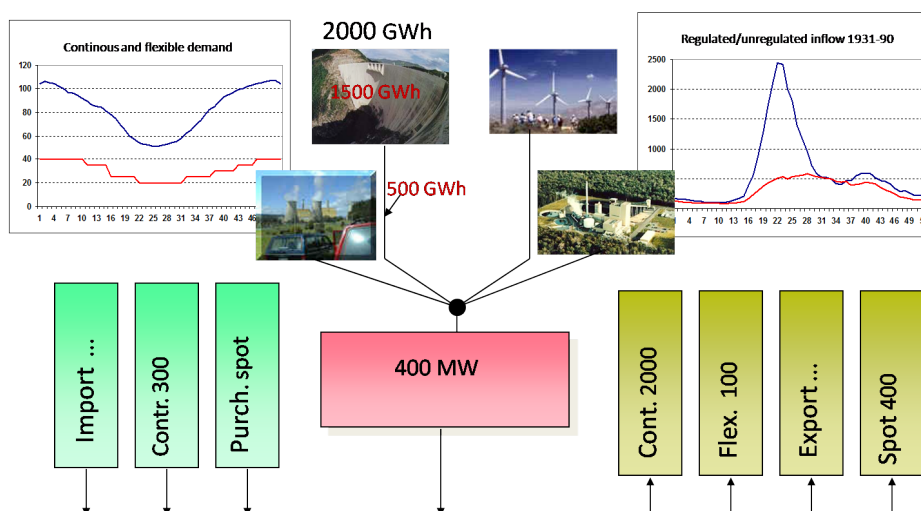
Powel OPS is especially suited for long- and medium term hydro-power scheduling. It is also applicable in expansion planning where there are no major transmission constraints within the area and hydro power plants in the area has some degree of homogenous hydrological characteristics.

POWEL OPS CALCULATES OPTIMAL USE OF HYDROPOWER IN RELATION TO:

- Uncertain future inflow
- Uncertain purchase and sale contracts
- Uncertain prices in the spot market
- Thermal power

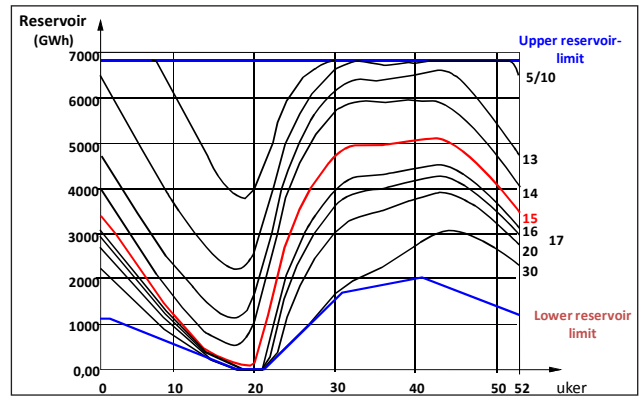
SOME TASKS POWEL OPS MAY PERFORM:

- Long-term operational scheduling of hydropower
- Expansion and upgrading of hydropower plants and systems
- Maintenance planning
- Calculate probability distribution of production
- Calculate thermal power generation
- Analysis of energy shortages
- Calculate benefits of investing in flexible demand (e.g. dual fuel boilers)
- Calculation of market clearing prices in isolated systems
- Risk management
- Cost analysis of random outages of generators or power stations
- Analysis of production, reservoir operation, diversion flow and flood loss on a detailed level

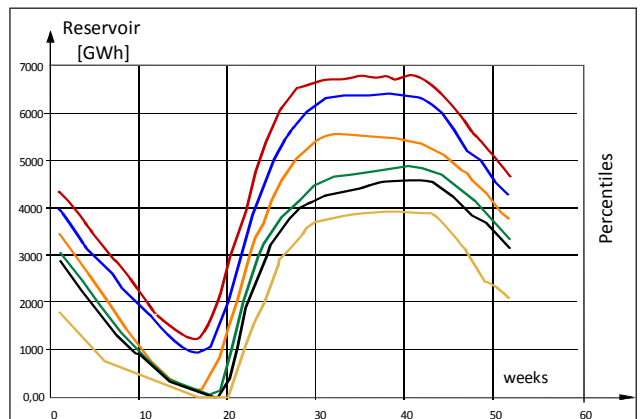


FACTS ABOUT POWEL OPS:

- Optimization in this model is obtained through the calculation of incremental water values using Stochastic Dynamic Programming
- Using the water value and surrounding market, Powel OPS calculates optimal production and market exchange for different load levels
- Powel OPS calculates the best distribution of water storage in the reservoirs in the period of analysis
- The studied system is attached to an external power market. Forecasted spot prices in this market may be calculated by Powel MPS or it can be fetched from other sources
- Powel OPS may have an analysis period of up till 10 years
- Even though Powel OPS basically seeks maximal expected value of income, without regarding risk, the user may modify the strategy by introducing penalty functions during water value calculations
- Powel OPS may include a seasonal model which generates a water values and boundary conditions for the short-term optimization software Powel Shop



Water values as a function of time.



Simulated reservoir storage

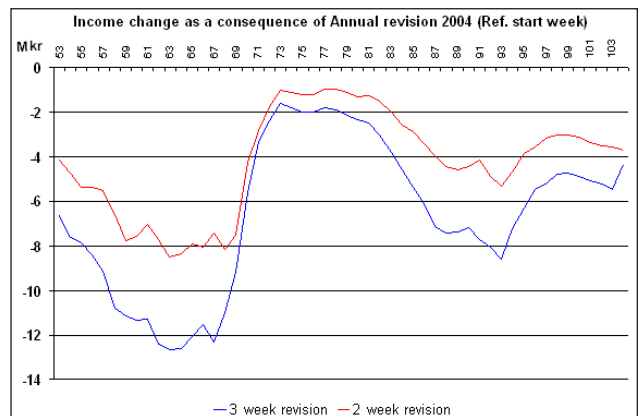


Illustration of the calculated economic consequence of revisions.