PRODUCT FACT SHEET

POWEL MARKET ANALYZER V.8

Powel Market Analyzer (PMA) is a long-term power market analyzer for hydro-thermal systems with interconnections.The model is a unique tool for price formation enlightenment, energy economics, energy flow, environmental consequences and power delivering quality. By using PMA it is possible to simulate the exploitation of local and national energy resources and the interaction between different hydro-thermal systems.

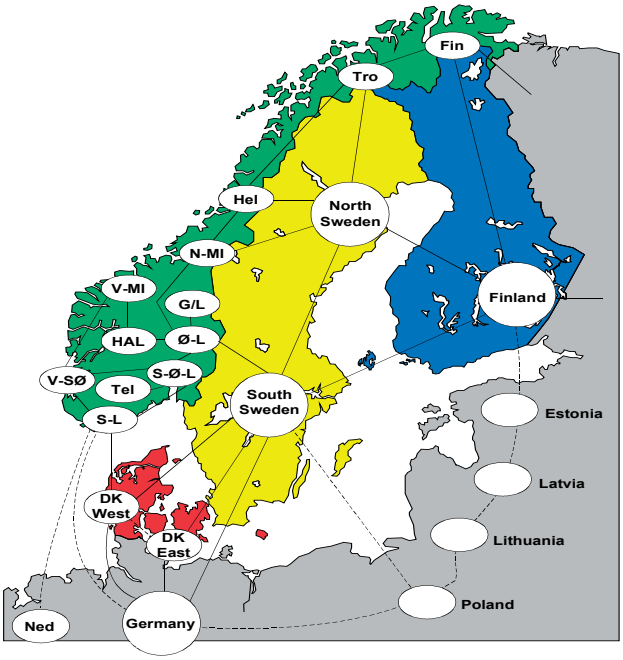
A WELL SUITED AND WELL USED TOOL FOR ANALYSIS OF THE POWER SITUATION

Powel Market Analyzer (PMA) is a multi-area model with interconnections. It has been developed for optimizationand simulation of production and transmission in deregulated power markets. It takes into account transmission constraints and hydrological differences between major areas and regional subsystems.

PMA aims at optimal use of hydro resources, in relation to uncertain future inflows, thermal generation, power demand and spot type transactions within or between areas.

Some tasks performed by the PMA:

- Spot price forecasting in deregulated power markets
- Long-term operational scheduling of hydropower in
- large interconnected systems
- Analyze economical consequences of planned maintenance
- in transmission or production
- Calculate probability distribution of hydropower production
- Calculate distribution of thermal production
- Analyze overflow losses
- Calculate reservoir operation
- Calculate energy transmission and interaction between
- regional subsystems
- Calculate the economy in system expansion alternatives
- Analyze demand flexibility
- Calculate probability distribution of production and
- consumption surplus within each area



The Nordic countries modeled in PMA with transmission lines between the different areas

POWEL AS
Klæbuveien 194
NO-7037 Trondheim
NORWAY
Tel: +47 73 80 45 00
Fax: +47 73 80 45 01
info@powel.no
www.powel.no

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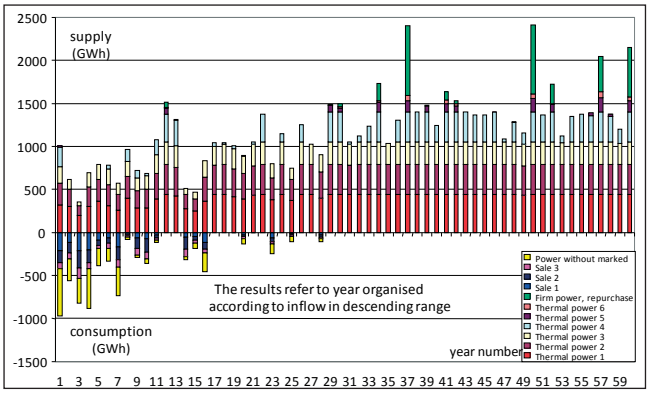
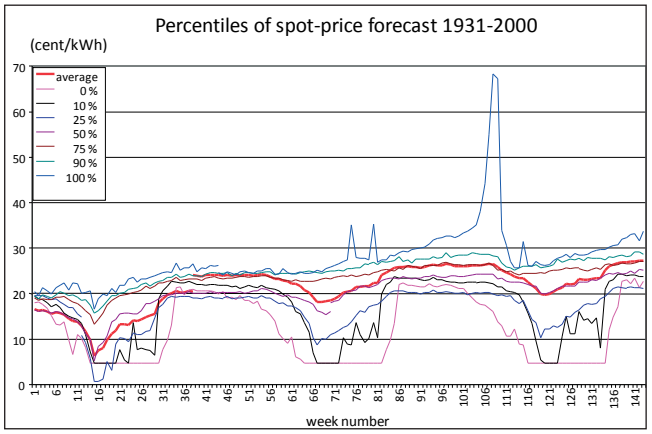
FACTS ABOUT PMA:

- The concept behind PMA is based on water value calculations using Stochastic Dynamic Programming, followed by a detailed hydro-power production and market simulation
- For water-value calculation and simulation, the system is divided into regional subsystems depending on restrictions in transmission capacity.
- The different regional subsystems may contain local hydropower, wind power, thermal power and price dependent and price independent load.
- Electrical connections to other areas are defined with transmission capacity, energy loss and (optional) transmission fee.
- User defined datasets may contain any number of regional subsystems.
- In PMA it is possible to model hundreds of production units within each area.
- Historical observed inflow creates basis for stochastic analysis of hydro-power utilization.
- PMA has a period of analysis up till 10 years ahead in time.
- Calculated market prices for regional subsystems in PMA are used as foundation for trade in the spotmarket in Powel OPS simulation (See separate Product Fact Sheet).
- PMA includes a mid-term optimisation module which generates water values and boundary conditions for use in the short-term hydropower optimization software Powel Shop (se separate Product Fact Sheet).
- An essential result from PMA, especially in deregulated markets, is the simulated market clearing or spot price. This is often used as a statistical spot price forecast.

An easy-to-follow installation guide and manual on PMA are provided as part of the product. Powel AS offers support and tailor-made courses on the subject.



Simulated values from the price-elastic market



Percentiles of spot-price forecast 3 years ahead

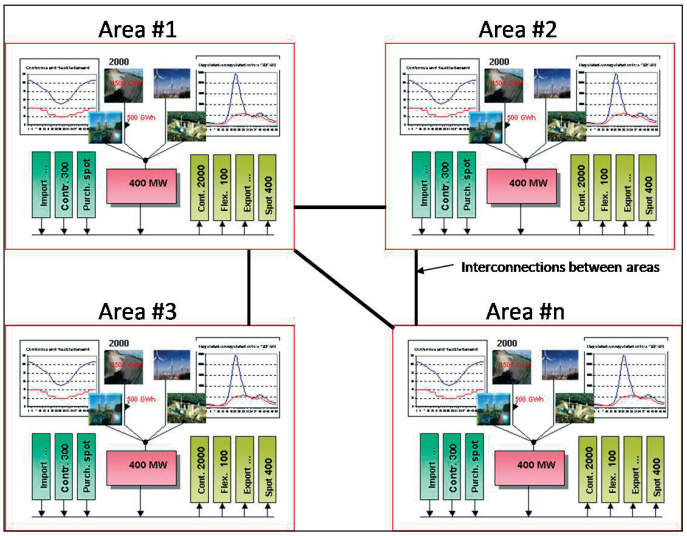


Illustration of the modeling in the multi-area Powel Market analyzer

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