ROVE

Innovative information systems for intelligent power production, energy trading and secure risk management

In year 2002 unbundling process recommended by European Union in energy sector was introduced by local government in Slovakia with goal to harmonize local legislation with EU rules. Results of unbundling were:

- Transmission System Operator (TSO) was created but to provide System operator functions immediately they inherited National Power Production Planning and Dispatching Centre.
- Main Generation Company - Slovenské elektrárne a.s. were pushed to build new Production Planning and Dispatching Centre departments to follow new liberalized market model. There was additional task in front of them – need to build modern energy trading system, able to operate on liberalized local and international

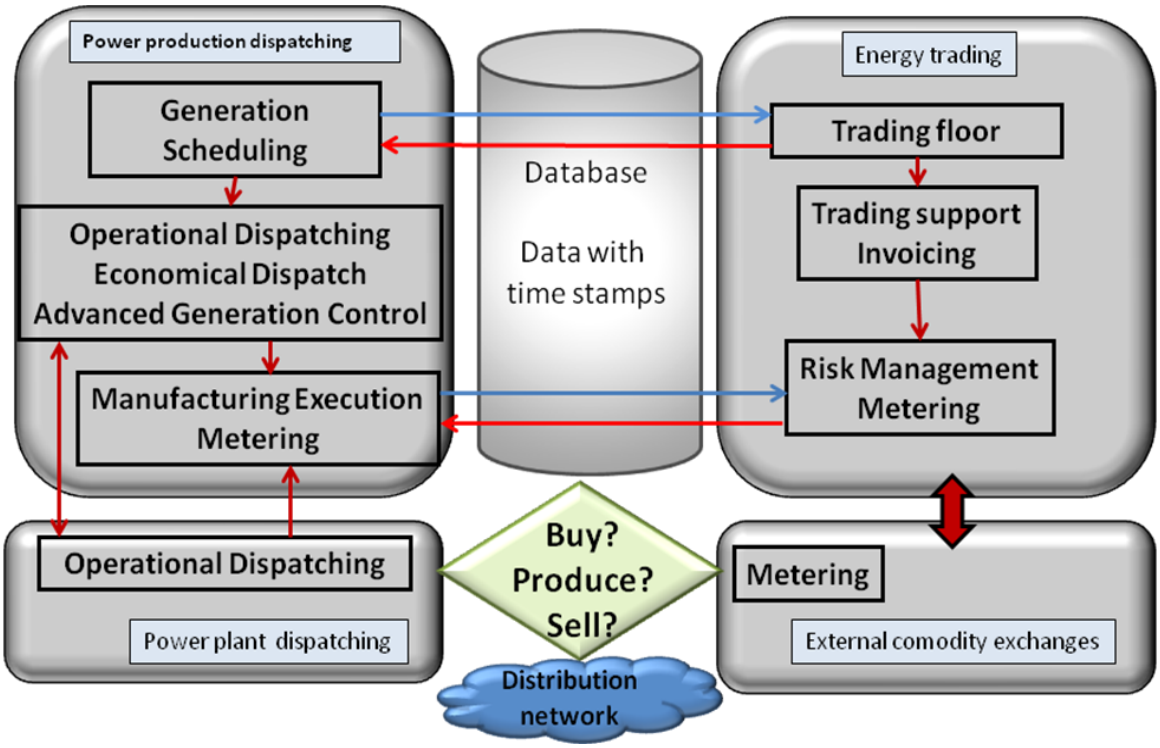
market. The goal was to operate all listed systems from 2003 because EU rules adoption.

Slovenské elektrárne, a.s. (SE, a.s.), , decided to build new modern system as green field project to deliver three main goals – new methodology, new processes and new technology which have to support their future business in European Economical Area.

The official goal for newly established company taskforce for innovation was defined as:

> ***"Guarantee of processes and tools supporting SE a. s. business activities on liberalized electricity market with efficient usage of production capacities and growing benefits from electricity production and trading".***

Together with IPESOFT and other partners SE a.s. decided to built most modern modular system supporting main company business processes.



State of the art Energy Trading and Management system in nutshell

Generation Scheduling Module

Main task of this module is to cover trading diagram by allocating particular power units setpoints, counting all economical variants as an alternative approach and based on the results actively propose optimal production mix in real time.

- Planning on various time levels – from year-ahead to intra-day planning - with multiple scenario support (day, hour, 15, 1-min period supported)
- Load forecast algorithm based on artificial intelligence and neural networks methods
- Ability to coordinate requirements for net power delivery and regulating reserve or ancillary services allocation
- Power surplus or deficit calculation and interchanging this with trading system
- Possibility to allocate own regulating reserve to control power imbalance later in real-time
- Main optimization goal of unit commitment algorithm is to minimize overall production costs
- Automatic connectivity to external (TSO) and internal (SCADA, MES, Trading) systems

The most important part of the Generation Scheduling Module is complex mathematical algorithm which is able in semi-real time calculate all possible operational scenarios and propose to the dispatchers the safest ones.

Basic characteristics of the algorithm are:

- Nuclear units are allocated first in base range according to their current available power
- Peak hours are covered by hydro units with retention ability (with reservoirs, pumped storage reversible)
- Hydraulic coupling in complex hydro power plants systems is taken into account
- Detailed internal model of pumped storage power plants and their reservoirs, with water level visualization is part of the system
- Thermal units are allocated according to their variable production costs respecting all fuel, technological and legislative limits
- Model for combined electricity and heat production is available
- Very flexible mechanism which allows for manual corrections made by expert user is the corner-stone of the system
- Algorithm internally uses modern methods of mixed linear and integer programming (MLIP – branch-and-bound with revised simplex)

Generation control – SCADA

This module has been used by dispatchers during daily routine operations for Power plant unit's supervision. System has built-in Historian functionality which allows track back any event in time of predict future from history.
This module is executing chosen plan validated during **Generation Scheduling** process by controlling Power Units set-point control. Economic dispatch processes (AGC / ED) supported by this module are ones on which is dependent company profit and loss. For maximizing company income there are supported functions of Ancillary services control in coordination with TSO system and Balance area control (real-time imbalances settlement).

Acquiesced data and all processes are in real time logged into alarm and logging subsystem and pre-processed for Manufacturing Execution System level.

View to the Control room of Slovenské elektrárne a.s. where dispatching and trading information panels are located side-by-side showing real time data for all dispatchers and energy traders in the same time.

Manufacturing Execution System

Present major part of data stored in the system to broad audience of users but with no control functionality.

This module is processing data generated by SCADA with following outputs:

- Deviation and imbalance calculation for every Generation unit
- Key Performance Indicators (KPI) calculation– outages, failures, availability
- Ancillary services metering (availability, regulation energy, quality)
- Complete calorimetric balance of production cycle – fuel consumption, net electricity delivery, heat production, losses, specific consumption
- Variable production costs calculation in real time

Energy Trading and Risk Management System

Trading system supports data acquisition from various resources (energy exchanges, weather forecasts, currency rates), various complex contracts registration, trading position monitoring

(open/closed, short/long) and supports buy-or-sell decision making process by optimization of trading position and market situation.
Back office functionality supports counterparties management, contracts confirmation and clearing plus invoicing.
Very strong functionality is covered by Risk Management module. This module supports contract evaluation, balances and analysis; provide market forecasts and wide variety of risk management processes, Value at Risk for example.

ROVE of SE, a.s. is operating longer than five years and this most modern very reliable modular system is key tool for support of company operational processes.

Fast facts about ENEL Slovenské Elektrárne a.s. today:

Slovenské elektrárne, a.s. is the largest power generating company in Slovakia. After completing the privatization in April 2006 Enel S.p.A. owns 66% of the company and the remaining 34% is owned by the National Property Fund of SR, with its shareholders rights executed by the Ministry of the Economy of the Slovak Republic. Slovenské elektrárne increased its green-house gas free power supplies to 87.9% in 2009 from nearly 86.5 % reached in 2008. At the end of 2009 the company employed 5,335 people.

- Installed capacity is approx. 5 000 MW (29% TPP, 34% HPP, 37% NPP), Slovenské elektrárne, a.s. operates 5,693.24 MW of gross capacity under control of SCADA in real time.
- In 2009, Slovenské elektrárne generated almost 21,392 GWh of electricity in total. Net of own consumption of its power-plants, Slovenské elektrárne delivered almost 19,891 GWh of electricity into the power-grid (less than 60% of Slovak republic demand). The generation share on net power output was as follows: 65.6% nuclear facilities, 22.3% hydro power plants, and 12.1% thermal power plants. Company is operating 56 different power plants.
- Hundreds wholesale customers, thousands contracts annually (without retail segment)
- More than 1.5 millions time-series in central EDA Historian database
- Thousands electricity metering points measured with 1 min and 15 min period
- Trading on more than 10 foreign market
- Total amount of contracts managed by ROVE exceeds 2 billion EUR annually
- Total amount of electricity traded approx. 30 TWh annually
- More than 100 ROVE end users in SE, a.s.

About IPESOFT
IPESOFT spol. s r.o. holds the position of a groundbreaker and leader in production information systems. Company history shows successful projects focused on production plants of various types with strong know-how in monitoring and controlling production processes in real time. Added value is smooth integration with external resources planning and financial systems. The solutions from IPESOFT helps customer to grow and easily find areas of potential improvement.