ABB ABILITY™ ENERGY MANAGEMENT AND OPTIMIZATION

OPTIMAX® for Steam & Power

Superior management of steam network complexity

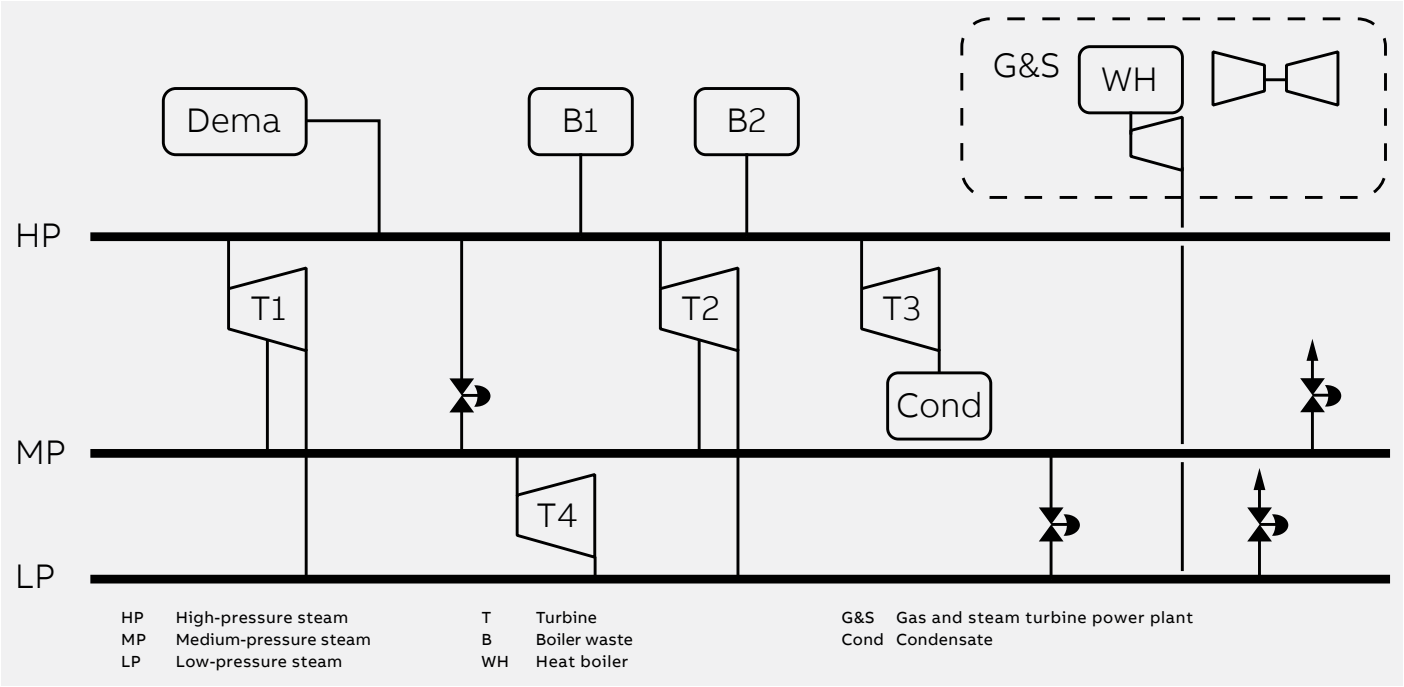
- Increased energy efficiency, reduced carbon footprint
- Minimization of production costs
- Active energy market participation (more profit or lower costs)
- Savings of 3-5% of total steam and CO^2 costs, without taking energy market participation into account

Take advantage of asset flexibility to reduce production costs while improving steam supply reliability.

By using OPTIMAX® Steam & Power Optimization, you can achieve savings of 3% to 5% on steam costs with an ROI of less than one year.

OPTIMAX® for Steam & Power

A complex optimization problem



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01 Example of a complex steam network

Controlling and optimizing steam networks in industrial sites is a complex, technical challenge. You must manage conflicting objectives, and the slow dynamic responses caused by traditional process control system strategies are a major challenge, leading to a significant deterioration in control compared with digital ABB solutions.

With OPTIMAX® for Steam & Power, you implement the coordinated real-time control of boilers, steam and gas turbines while taking system efficiency and energy prices into account.

Challenges

- Pressure control for multiple headers
- Several boilers for steam generation – with different fuels, efficiencies, dimensions and dynamic behavior
- Several turbines for steam flow and power generation with different efficiencies, dimensions and dynamic response characteristics
- Alternative redirection through pressure reduction stations
- Possible use of condensation and ventilation depending on energy prices
- Many conflicting restrictions, including boiler limits, turbine limits, generator limits and power limits
- Dynamically changing scenarios:
  - consumer needs fluctuate and can change significantly (e.g., in the event of system failures and start-ups)
  - Variable pricing for energy consumption and grid feed-in
  - Changing load plans, e.g., due to energy market participation
- For large industrial sites: complex automation systems and separate control rooms for regulating the steam network
- Participation in the energy market

OPTIMAX® for Steam & Power
The solution

In such a complex and demanding environment, the use of dedicated optimization software modules has increased over the years and especially in this decade.

The benefits of using comprehensive optimization software to determine ideal operating conditions are:

- Efficiency modeling of equipment e.g., turbines and boilers
- Modeling fuel costs and inherent non-linear factors, such as natural gas fuel blocks
- Estimation of energy prices
- Estimation of consumers' future heat and steam requirements

Process optimization using Advanced Process Control (APC)

Proper management of a complex steam network with multiple interacting systems and different dynamics requires the use of APC based on Model Predictive Control technology. The most immediate benefit is significantly improved process stability.

The standard deviation of the live steam pressure is greatly reduced, and similar improvements are observed in all headers.

The algorithm ensures smooth transitions, be it when opening pressure reduction stations, closing vent valves or regulating the steam balance of the low-pressure boilers when the high-pressure boilers are maximized.

Since APC is a multivariable algorithm, all required operating modes, for example, in relation to active boilers, are achieved with a single APC configuration. The overall design is greatly simplified as no alternative process control configurations or complex override schemes are required at the basic control level for boiler sequence, turbine sequence, pressure reducing valves and other such modes.

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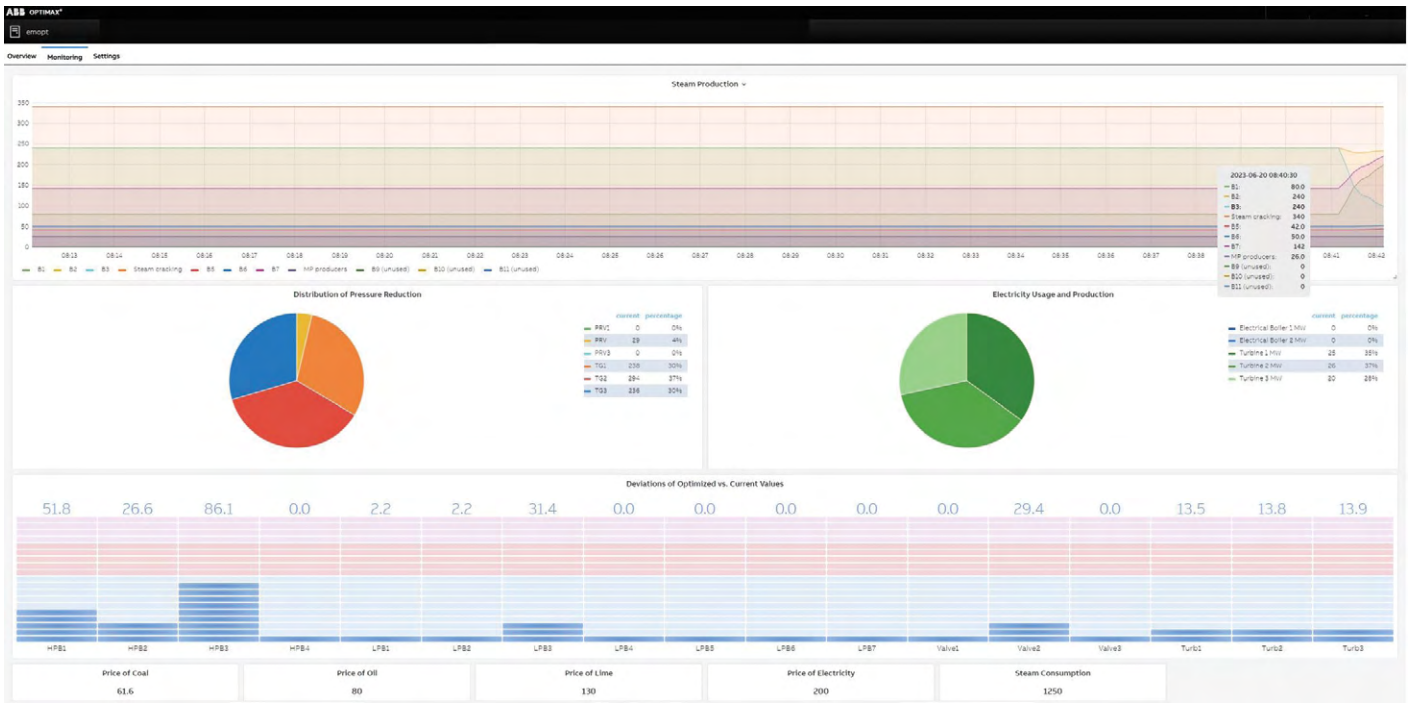
02 User-friendly dashboards offer important insights into the efficiency and profitability of the steam network



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03 Forecasting dashboard

Higher-level optimization through Real-Time Optimization (RTO)
Real-time optimization decisions for steam rail networks include the distribution of steam production between boilers to minimize production costs, taking into account the costs for the individual fuel types and at the same time the specific efficiencies of the boilers.

The efficiency of a boiler is determined by the boiler type and the design parameters, but is also influenced by the boiler load.

The efficiency of the turbine also depends on the specifications and type of turbine, as well as the load. It can be assumed that different turbines have different efficiencies and also have different curves in relation to the load.

Optimizing load allocation for complex steam rail networks is therefore very important and is implemented through RTO.

Integration of the energy market
Power prices change constantly (in most energy markets sometimes even every 15 minutes), and natural gas prices also change daily. Therefore, the use of the larger price ranges for primary fuels and power prices is becoming increasingly important for economic operation of the plant. This means that many load changes are required for ideal operation. To make matters worse, any change in operations causes a major disruption in the power plant. For example, a rapid change from "minimum load" to "full load" results in a sharp increase in steam demand, to which the turbines and boilers must respond. It is therefore a major challenge to keep the system in optimal and stable condition.

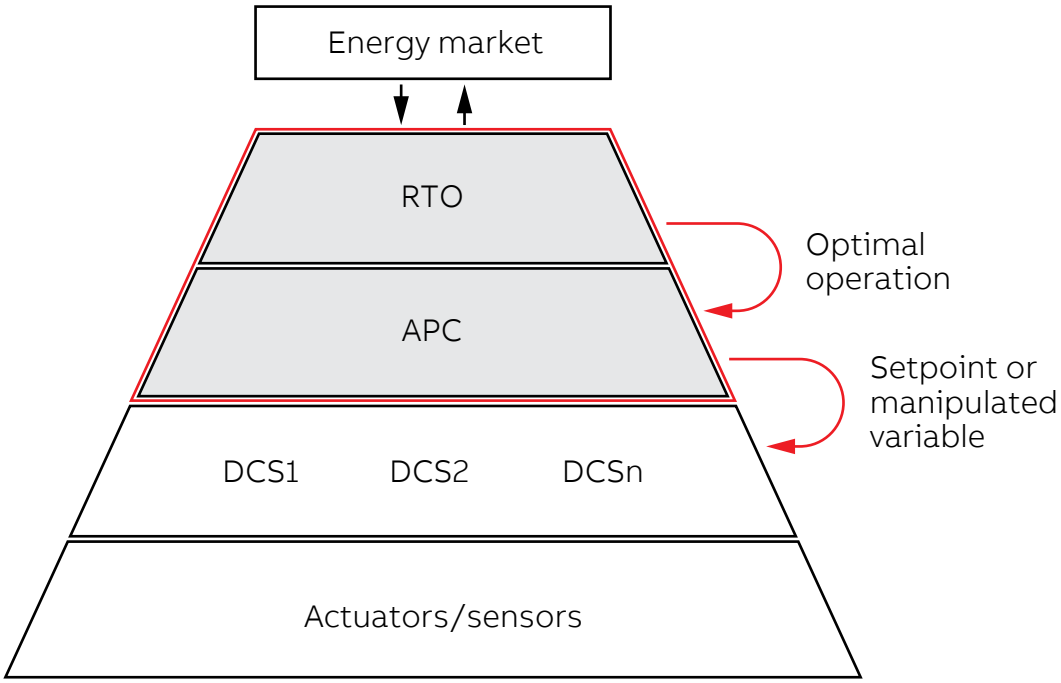
After implementing OPTIMAX® for Steam & Power, fuel and power prices can influence the configuration of the entire system. If the price of purchased (or sold) power is high compared with internal generation costs, more power should be self-generated, and vice versa. These necessary load changes are determined by RTO and implemented by APC in stable operation.

Schedules and flexibilities for trading can be communicated to the network operator.

AI forecasting

OPTIMAX® 6.4 features an AutoML module that provides an efficient and seamless way to generate forecasts that can later be used for energy optimization. The module significantly reduces day-ahead and intra-day nomination errors when feeding energy to the grid. It automatically forecasts load demand, energy generation and energy pricing without manual interaction.

OPTIMAX® for Steam & Power



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04 Automation hierarchy

Automation hierarchy
Real-Time Optimization calculates the optimal load distribution for the relevant system components, such as boilers and turbines and forwards their setpoints to the APC control level, which enables coordinated, decoupled control of pressure and power generation.

APC specifies manipulated variables to the lower-level basic control stage of the process control system. This regulates the actuators at the lowest level.

This multi-layered solution, which enables dynamic control and optimization in real time, is shown in Figure 04.

Advisory vs. Closed Loop Optimization
The greatest optimization potential is achieved with a closed-loop configuration in which the optimizer decisions are continuously implemented by managing setpoints toward the underlying automation systems. However, it is also possible to identify the ideal operating conditions with no direct implementation of decisions in the automation systems.

In a configuration like this, the dynamic optimizer works in advisory or open-loop mode by setting targets for the operators of the various control rooms, and leaving the responsibility for implementing each target to the operators.

OPTIMAX for Steam & Power – optimal coordinated control and regulation of steam and energy generation in industrial sites.

Click here to talk with an expert.

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