

# cpmPlus Energy Manager for by-product gas optimization

## Improving the energy efficiency in iron and steel making



Energy constitutes about 20% of the total production cost in an integrated steel mill, and therefore energy efficiency is crucial for profitability. Energy is distributed over the mill through complex networks of electricity, steam, byproduct gasses, and imported fuels. Understanding this system and controlling it in optimal way is the key to unlocking many of the opportunities to improve energy efficiency and competitiveness while reducing environmental impact.

### A challenge of balance

Iron and steel making requires complex gas networks which can reliably supply a wide variety of grades and blends to a large number of process consumers. Due to the critical nature of production scheduling, these gases must always be available when needed. This necessitates the use of gas storage holders to compensate for temporary shortages or surpluses.

When gas demand exceeds supply, supplementary fuel must be bought at volatile - and often higher - market prices. When supply exceeds demand, excess holder gasses must be flared. This wastes energy and increases the plant's carbon footprint.

In addition to process needs, many mills have power plants whose boilers are fired with a combination of fuels, including by-products gasses from blast, coke and basic oxygen furnaces. This energy is balanced with electricity purchased from the grid to meet the total plant demand. And if the steel maker is able to predict this electrical power demand accurately, it can be purchased at a lower price.

The challenge therefore is to optimize the entire energy system throughout the plant to supply the needs of all consumers with minimum costs. This results in reduced flaring, reduced purchase of electricity and supplementary fuels, and reduced price of purchased electricity.

## Systematic solution

Since the different forms of energy generated and consumed at a steel mill are tightly interdependent, it makes sense to optimize them together. This can have the greatest benefit to a steel maker's competitiveness in terms of energy costs and carbon emissions, as well as minimizing the penalties for under- or over-estimating the demand.

ABB's cpmPlus Energy Manager (cpmPlus EM) is a software solution that models and visualizes the entire plant's energy flows. cpmPlus EM calculates optimum by-product gas distribution schedules to process consumers and power plant boilers. This optimization ensures 100% by-product gas availability while minimizing wasteful flaring.

cpmPlus EMS accommodates plant processes such as gas network and mixing station configuration as well as financial considerations, including boiler start-up costs. It can help maintain optimal energy efficiency despite unplanned production changes or energy price volatility. And, the system can even help optimize export of electricity or byproduct gases when feasible and economical.

## Efficient modelling tools

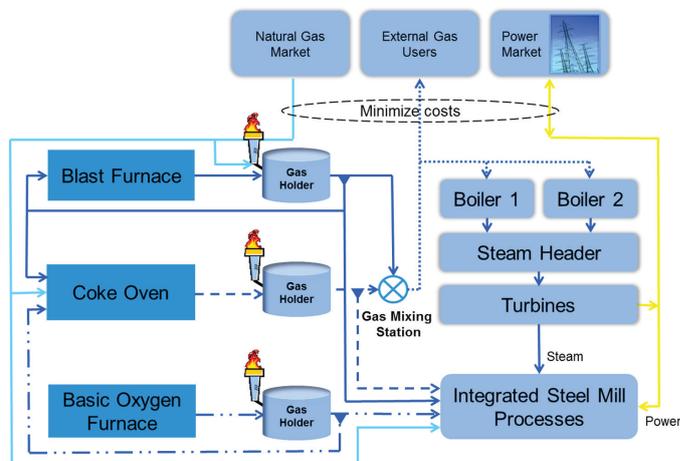
ABB's Economic Flow Network (EFN) provides tools to graphically configure the entire energy system model as an interconnected flow network, where each flow is represented with an allowed range of values and a unit price. The tool allows the specification of logical constraints upon the various process conditions. Based on the configured model the optimization problems are automatically created and solved by a Mixed Integer Linear Programming (MILP) solver.

## Dashboard for energy efficiency

cpmPlus EM provides dashboards for energy performance, from the production process level to the entire plant. This allows the monitoring and targeting of energy performance indicators, as well as analysis and reporting to verify the performance improvements resulting from implemented activities and projects.

Dedicated dashboards for each production station allow operators to act on deviations from optimum that are often hidden behind various energy and material flows. Operators will be able to validate the forecasted schedules of gas, electricity and steam demand, as well as by-product gas generation compared to the day's production schedule.

At the same time, site power plant operators can use the optimization to select the best combination of own power generation and external supply. This allows energy efficiency to be managed as a key performance indicator, alongside production quality and throughput.



The power plant and process schedules calculated by cpmPlus EM can also be implemented automatically by sending scheduled set points to advanced process control, which then coordinates the power plant control systems to run processes in an optimal way.

## Financial benefits

ABB conducted a pilot study with cpmPlus EM for an integrated steel mill to help create an optimized gas supply schedule that would meet the demands of various processes, and automate manual control systems. This resulted in a potential 50 percent reduction in wasteful flaring, which could save the mill between \$2-5 million a year in energy costs.