Digital Solution to Increase Flexibility of Coal Fired Power Plant

October 29th , 2020

Anil Kurbanoglu

Atlas Enerji Iskenderun Power Plant

2 x 600 MW Supercritical CFPP

Omnivise Performance Plant Optimizer

- Atlas Enerji Iskenderun “Super Critical Thermal Power Plant” was commissioned in 2014 and generates approximately 8.5 billion kWh of electricity annually.
- Atlas Enerji is one of the strategically important power plants in Turkey due to its installed capacity of 1.200 MWe and its geographic location.
- According to average consumption data, Atlas Enerji meets the energy needs of approximately 2.5 million people per day.

source : https://atlasenerji.com.tr/

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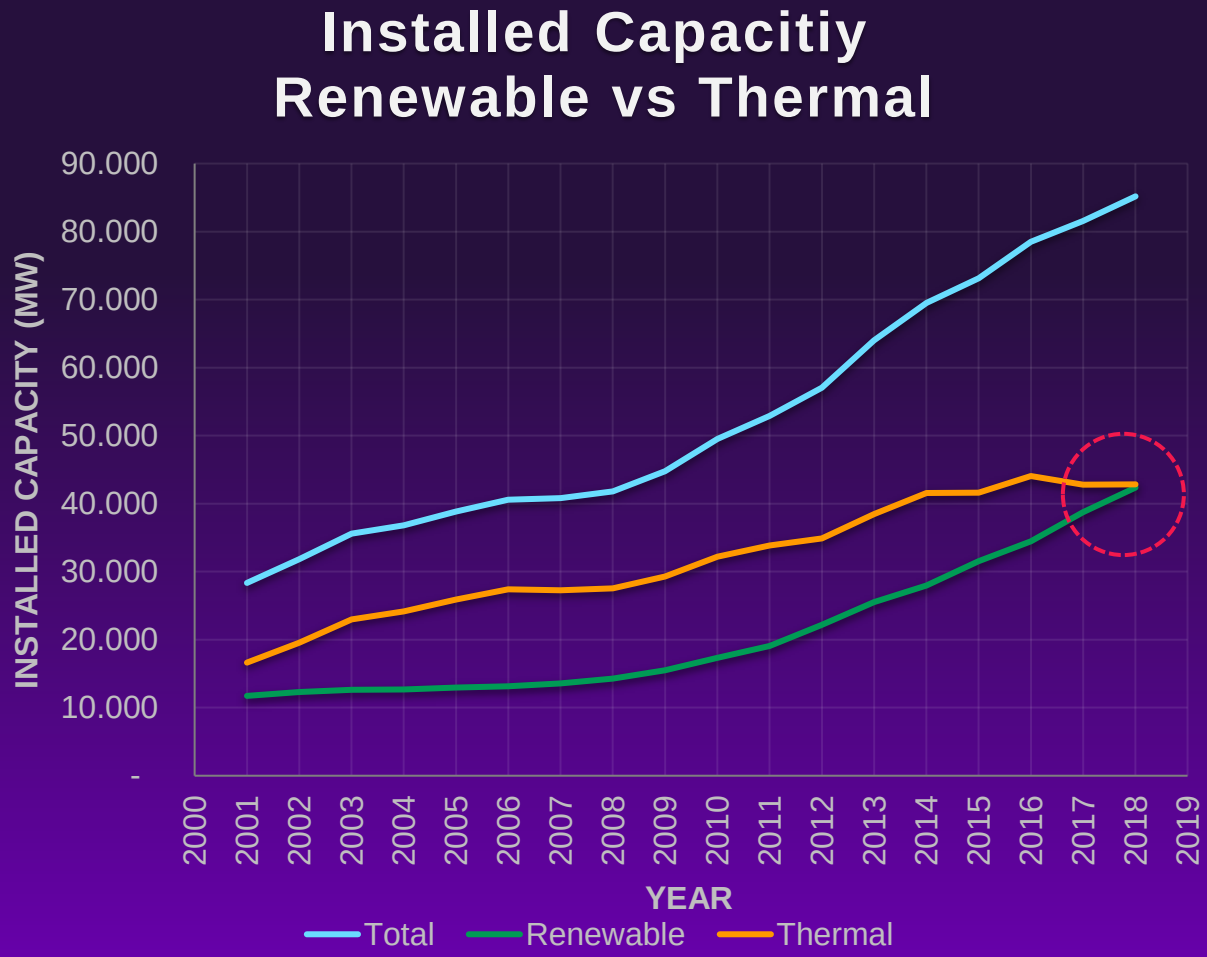
Favorable Factors Facilitating Optimization Decision

The Atlas Iskenderun thermal power plant was designed to start up and operate at base load, meeting the generation requirements at the date of construction.

However, with the increase of renewable energy, the desired load profile of the plant has changed. Operating a plant at full capacity for 24-hours a day, seven days a week is comparatively expensive – especially when you're relying on imported coal for fuel.

In order to become more profitable, Atlas required more flexibility. They wanted to be able to reduce the current stable minimum load level to save fuel costs.



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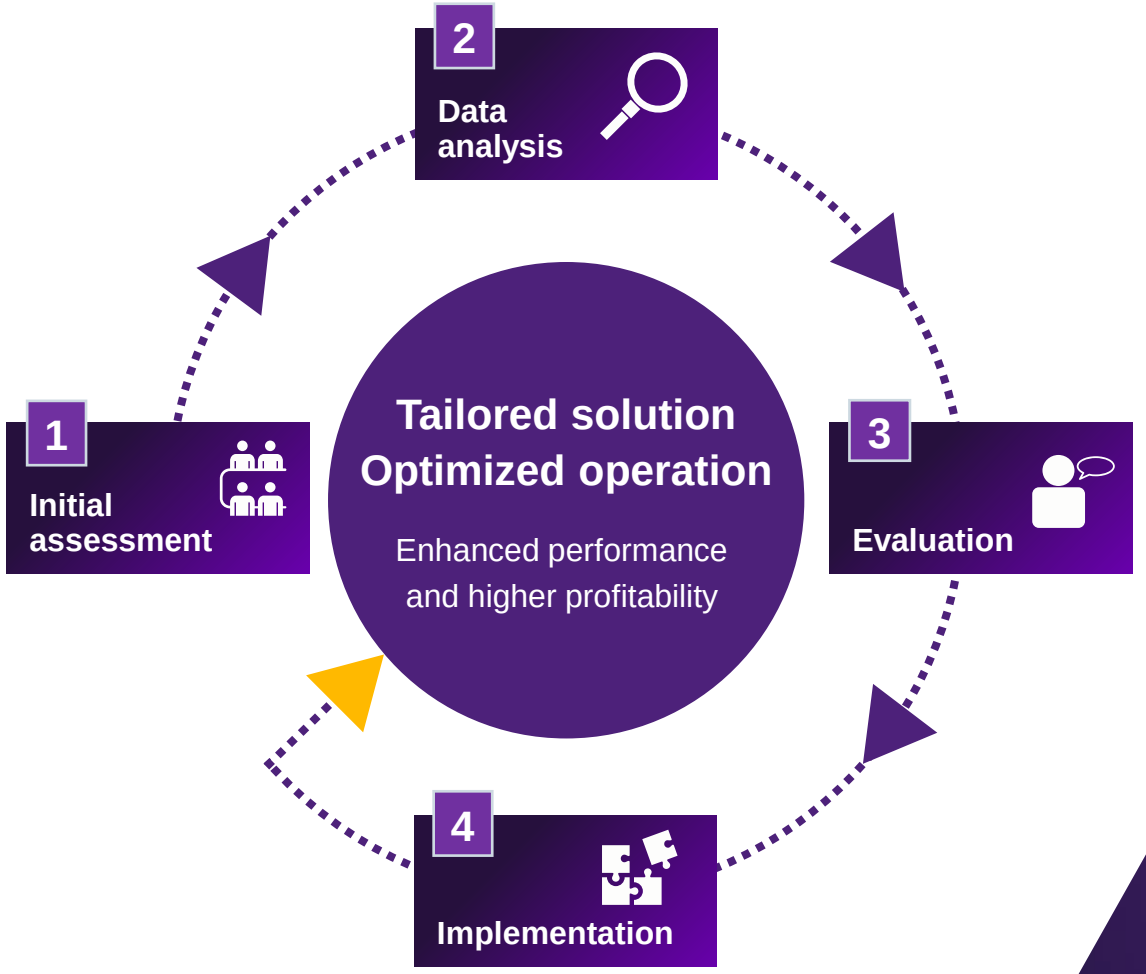
Concept Development of Optimization Project



1. Siemens Energy team created a plan to modernize the coal plant through upgrading only the control system with Plant Optimizer solutions.

2. A site survey was done to identify and quantify potential by analyzing operational data

3. Presentation of expected results including estimates of potential return on investment (RoI) was done.

   Atlas Enerji decided to implement
   - Dispatch Control
   - Minimum Load Reduction
   - Temperature Optimizer

4. Engineering and commissioning was done based on comprehensive power plant know-how. Project completed in less than 1 year.

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Dispatch Control
Larger load window for grid dispatcher

Task

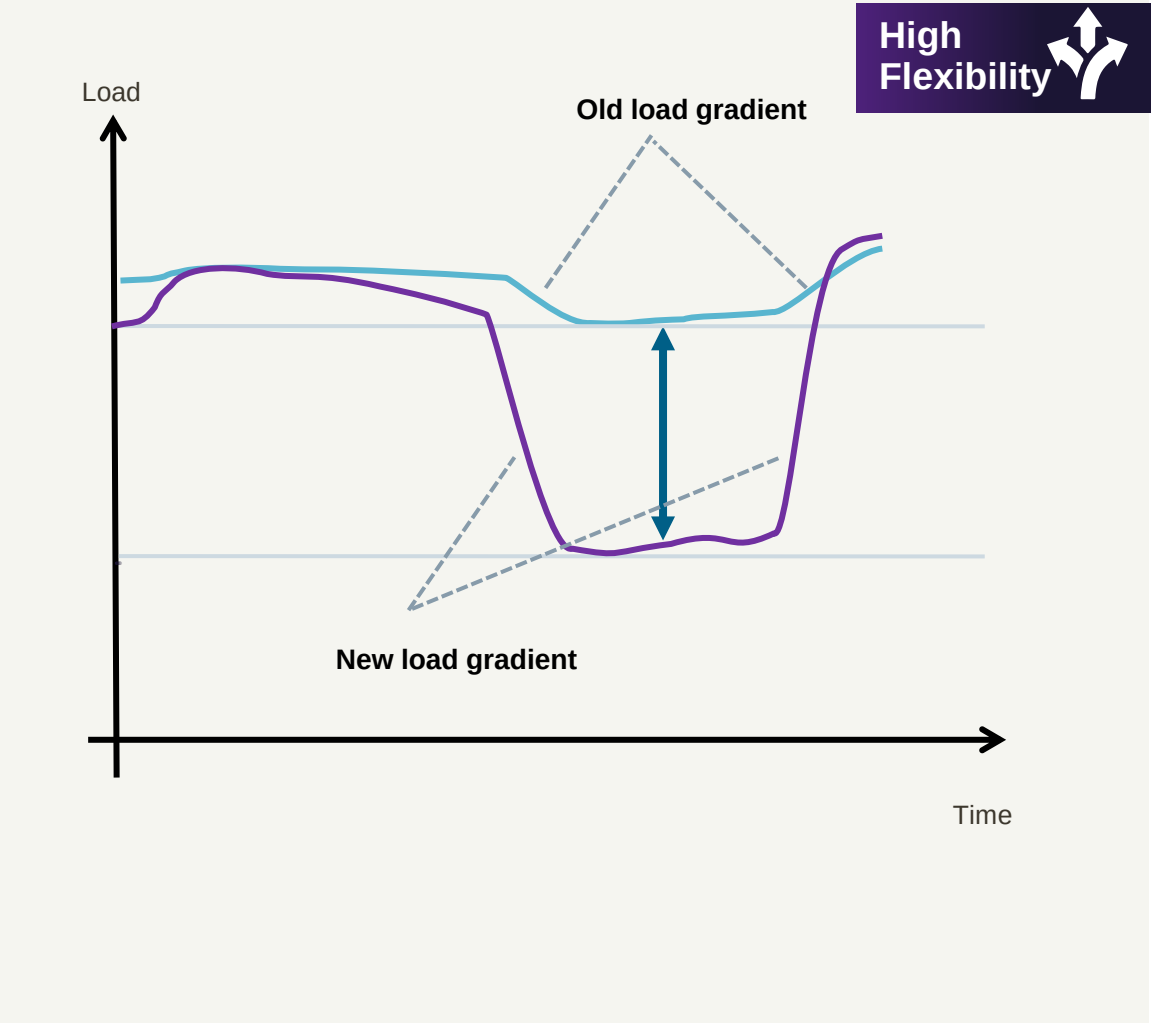
To upgrade the unit so that it can provide increased secondary frequency control capability (AGC). Implementing faster load change rates will open up a larger window for high-return secondary frequency control services.

Solution

- Use of robust state space controller for unit control
- Use of HP feed water heaters, adjustment of grinding pressure, etc. to accelerate unit dynamics
- Optimization of lower-level control loops crucial to unit dynamics

Result

- The ramp-up and ramp-down speed of the power plant is now up to four times faster than it was before
- Boiler delay for ramp-up and ramp-down is down to 30 seconds according to requirements of grid authority



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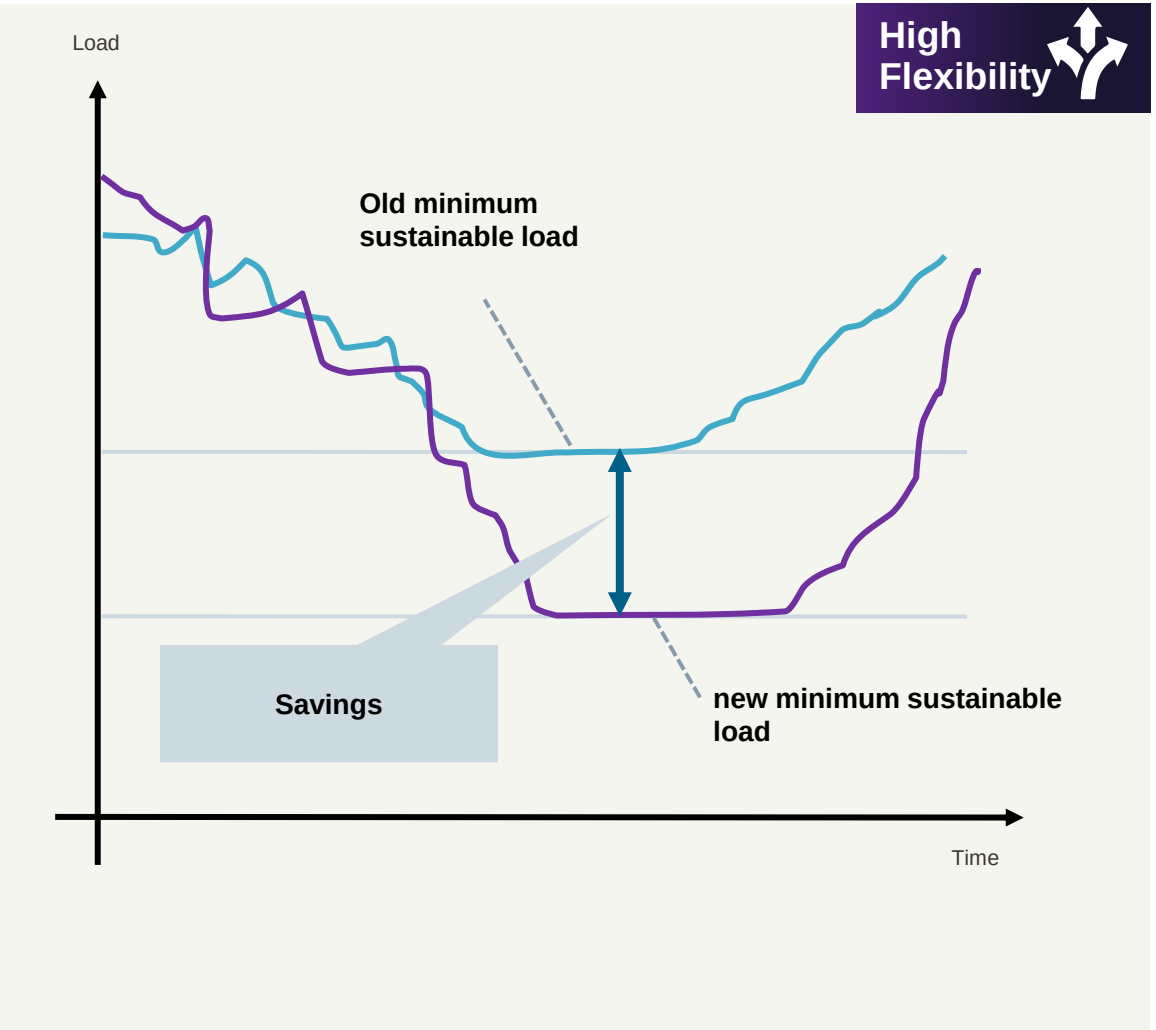
Minimum Load Reduction
Reduced minimum load level

Task
To upgrade the plant so that the specified minimum load level can be reduced and to make the plant capable of fast and low-stress load increases on demand in accordance with market requirements.

Solution
- Use of robust state space controller for unit control
- Adaptation, optimization and setting of lower-level controls for new minimum load level
- Adaptation or addition of control sequences, burner and mill scheduler
- Provision of additional instrumentation where necessary

Results
- New „Minimum Stable Load“ of the unit is 30% less than previous minumum stable load
- Load decrease and increase operations are automatic



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Temperature Optimizer
Increased steam temperatures

SIEMENS energy

Task

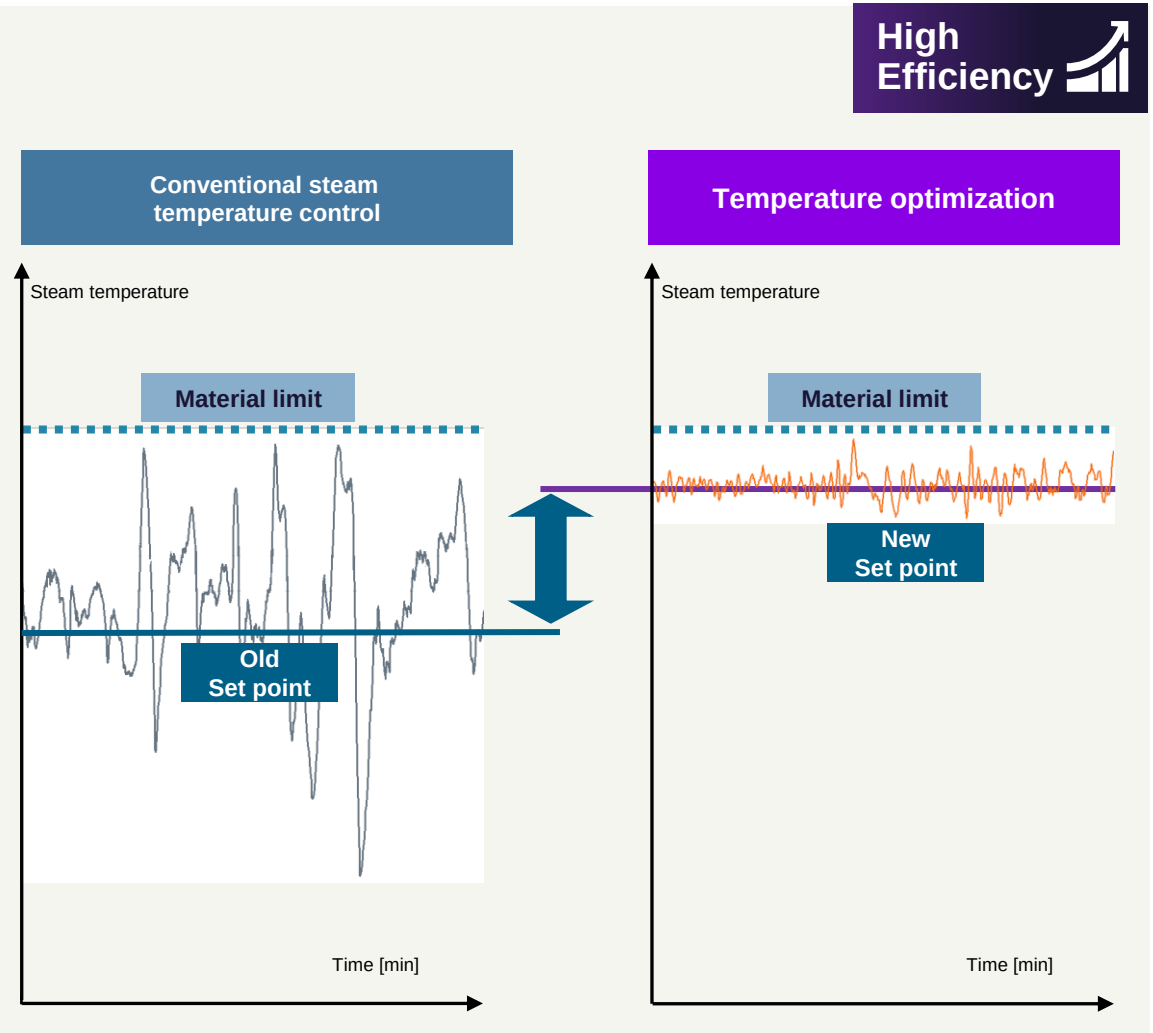
To achieve maximum steam temperature without violation of material limits

Solution

- Robust, easy to parameterize and adaptive state space controller with observer
- Where needed, use of entire control range through to injection into saturated steam
- Use on startup/shutdown and over the entire load range
- Use of flue gas recirculation and biflux or triflux valves to control reheat steam temperature

Results

- Superheater steam temperature is 4 K higher than before
- Reheater steam temperature is 6 K higher than before



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Concrete Results of the Project
At a glance

Without any Mechanical Modification

Plant Optimizer delivering higher flexibility and efficiency

Min. Load Reduction
-30%

Less fuel consumption during low demand times

Load Gradient Increase
up to 4 X

Increased Dispatch Control (AGC) Capability

Steam Temperature Increase
4 to 6 K

Increased thermal efficiency

**Values cannot be published to protect customer data confidentiality.*

Customer value across all assets

Decreased Fuel Consumption

Increased Flexibility

Increased Efficiency

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Coal flow control avoids imbalances in coal flow, homogenizes combustion and improve emission

Task
Imbalance of coal flow between burners cause poor combustion and wall corrosion that means
- Lower efficiency
- More emissions
- More material stress

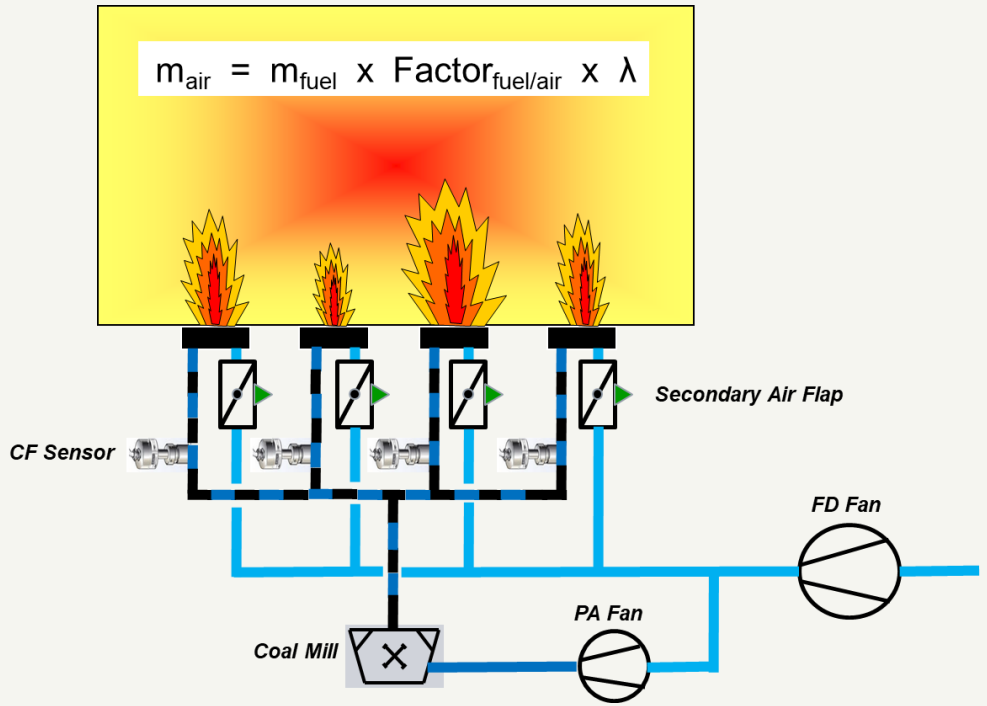
Solution
- Applying a microwave sensor system for coal flow measurement
- Air dampers controlled via SPPA-T3000 adjust air flow to coal flow
- Imbalances are equalized within a few minutes

Benefits
- Less CO at boiler walls, prevents boiler corrosion
- Less NOx,
- Higher efficiency

NEXT STEP

High Efficiency

Low Emissions



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