

BonEffice

UNIT Unit efficiency and
management problems

EFFICIENCY AND

MANAGEMENT PROBLEMS

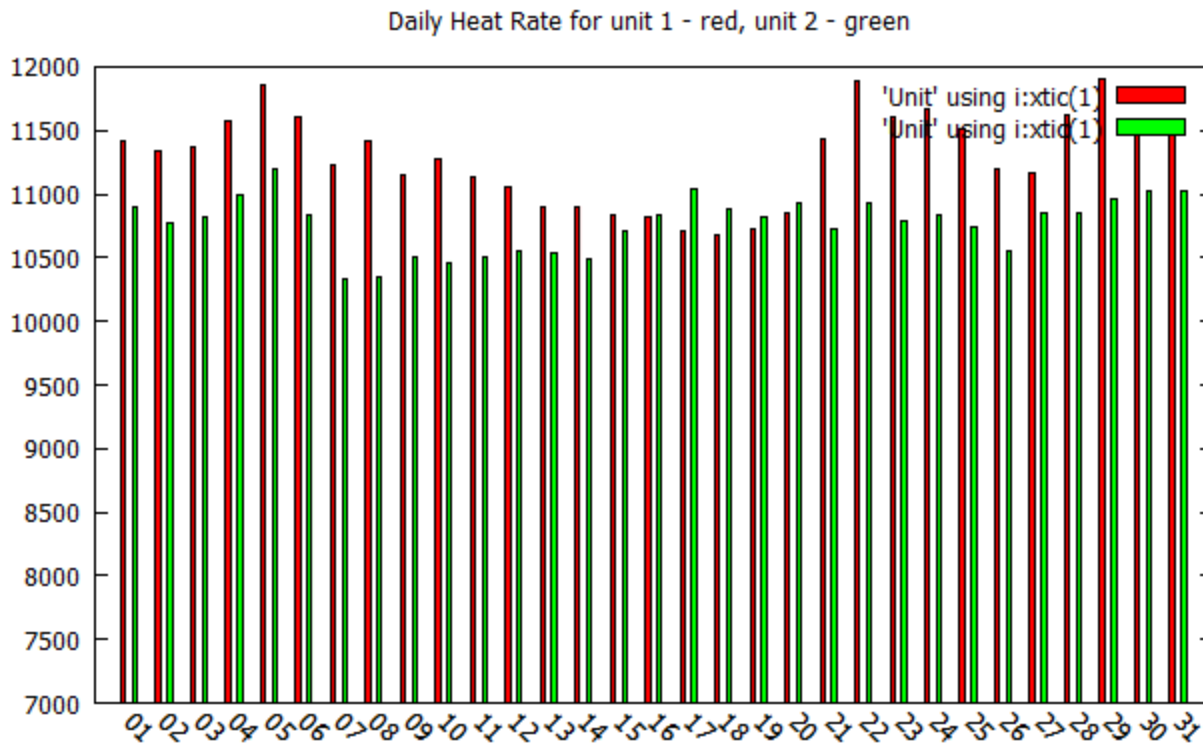
Reality of everyday operation

The scope of considerations

- Is there any room to improve the efficiency of thermal power plants?
- **EPRI: Thermal Performance Engineer's Handbook** – as the main prescription for power plant performance improvement.
- Commercial solutions to performance improvement – ETAPRO
- Irreversibility parameter measurements and day-to-day unit management issues.

Is there any room to improve efficiency of thermal electric plant?

Histogram for HR by unit



Is there any room

- Histogram on previous page shows day to day variation in HR for two Units under consideration from a real plant.
- What is the reason for that?

Thermal Performance Engineer's Handbook

- There are number of reasons listed for various causes of Heat Rate deviation and possible losses
- From the handbook: „An effective thermal performance program is the focal point for plant performance data, analysis, and reporting”.

Commercial plant performance data analysis and reporting

- GP's EtaPRO™ is a time-proven, world-class monitoring and
- Optimization system that *turns process data into performance information*, and puts that information, both real-time and historical, on the PC desktop

Irreversibilities and parameter measurement issues

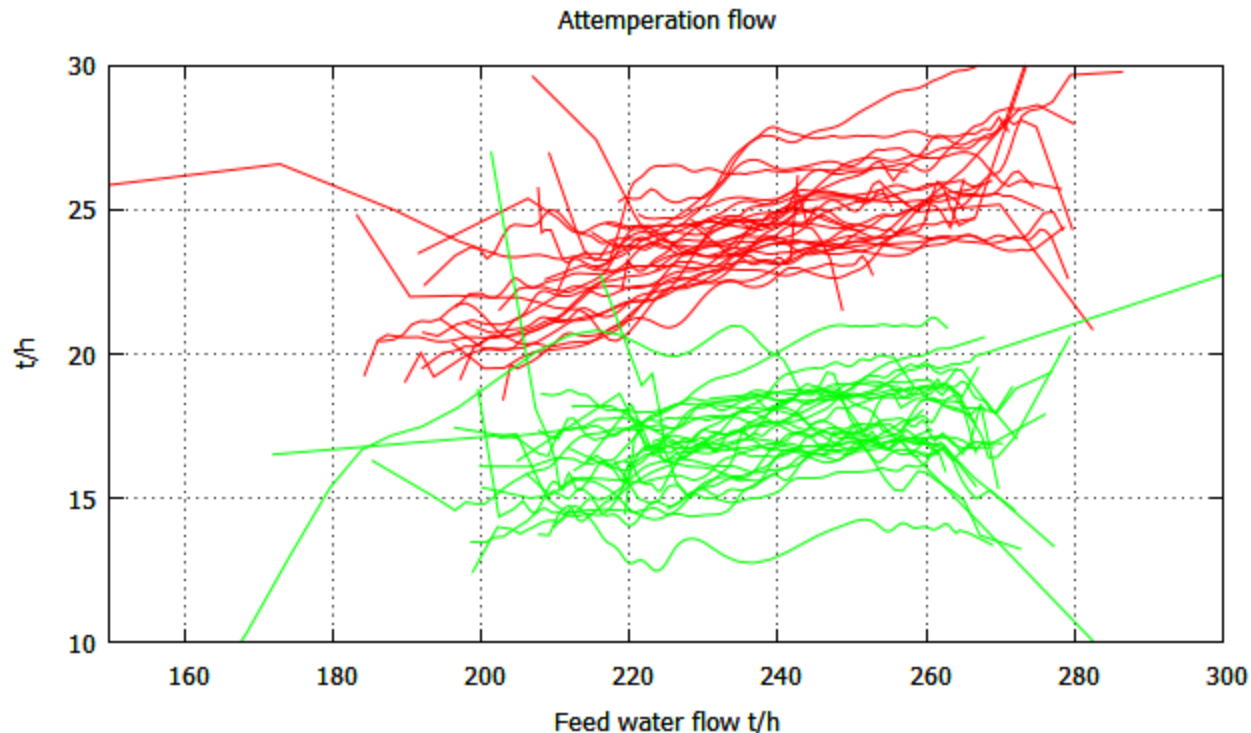
- Real world problems:
 - Lack of process data for thermodynamic modeling
 - Poor data quality
 - Process irreversibility problems: exergy destruction issues
 - These issues must be addressed first

What are the other conventional thermal plant problems?

- Fuel flow measurements and air-to-fuel ratio
- Lack of methodology to conduct fuel analysis in real time
- Poor knowledge of process irreversibility issues and exergy destruction
- Lack of information for optimal parameters settings
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Irreversibility and management

- Attemperation flow vs feed water flow:
- Unit 1:red, Unit 2:green



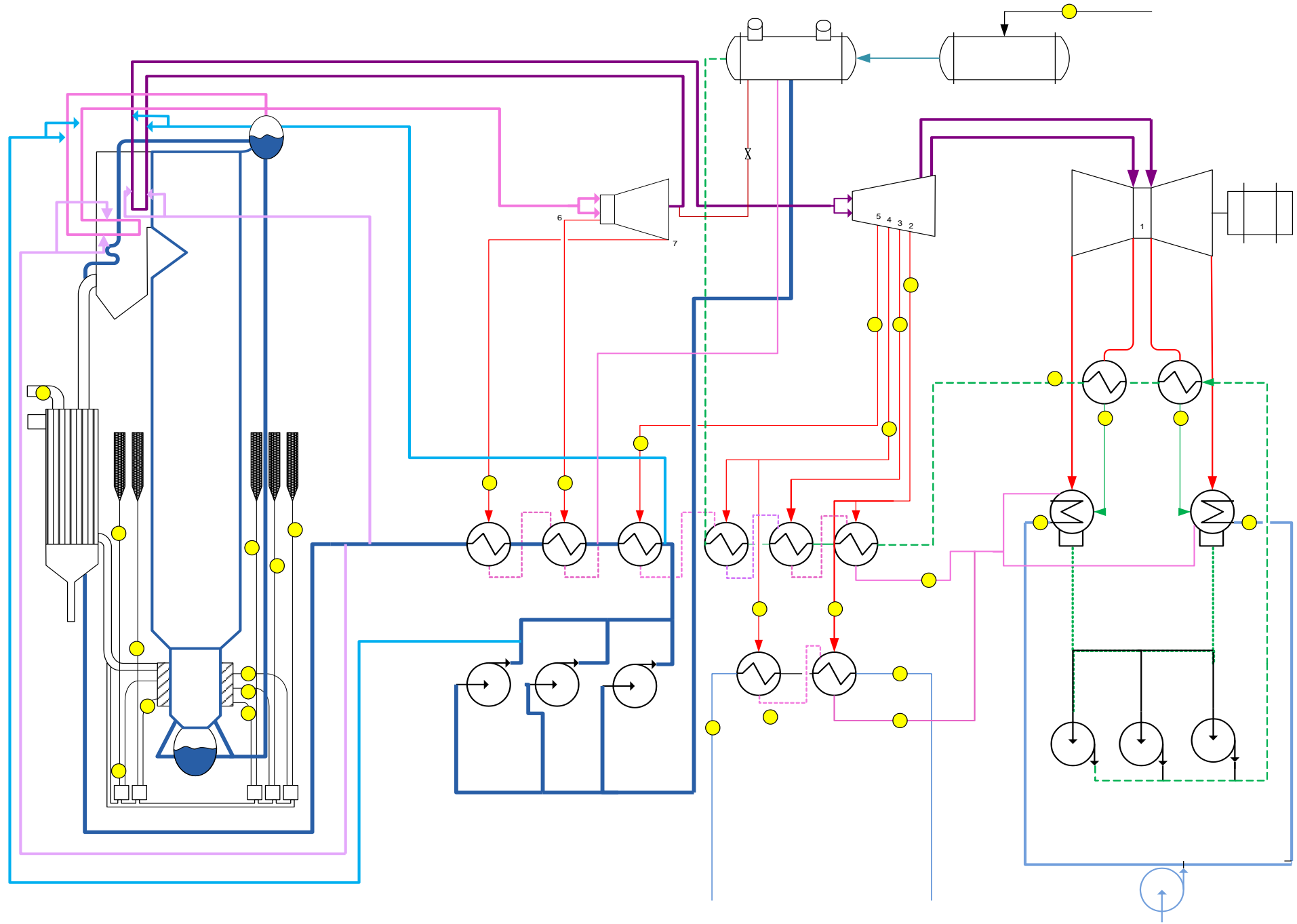
Attemperation

- Previous slide shows one of the culprits for the differences in observed HR for unit 1 and 2 (first slide). As we can see, the use of water injection to superheated steam was much larger at one unit than in the other.
- We are not sure what causes the overuse of attemperation. It does not appear that it is only a technological issue.

Other problems and solutions for unit management

- A deterministic model for Unit operation has been developed that incorporates all the discussed issues.
- With moderate investment, there is no problem with gathering all the necessary data to use the model to improve parameter measurement technology.
- It has been demonstrated that the model is an invaluable tool to provide real time problem spotting for control room engineers, thermal performance engineers, and unit operation managers.
- DCS does not provide enough information for the necessary analysis but is mainly an automation and control tool.
- All available data streams at the power plant shall be used to provide complementary information for real time calculations: DCS, CEMS, and Lab analytical data.

Unit 230 MW schema



Current development

- The previous slide shows the 230 MW Unit schema, which we are currently working on as part of the BonEffice management product.
- Yellow dots indicate missing sensors for the measurement of necessary parameters.
- One of the tasks is to provide new sensors and a Wireless Sensor Network, to improve our analytical capability and real time observations.

Conclusions

- Feasibility studies at several power plants revealed that a lack of proper management procedures and tools may be responsible for about 2% lower unit and plant efficiency. This is similar to observations indicated in EPRI reports. Some existing management software applications like EtaPRO™, also mention positive results from management software application.
- Our approach has been widened by including irreversibility analysis and a thorough review of the data collection and measurement to provide necessary data streams for deterministic model of UNIT.
- Current R&D work at existing power plants will tell us whether efficiency improvements at the calculated level and decreased emissions of greenhouse gases can be achieved through introducing proper management tools and procedures.

Thank you for the attention

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