

Steam network management and future challenges

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INEOS Köln

All slide are INEOS confidential

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Content

- INEOS Köln Site: Steam Network Management
- INEOS Köln Cracker: Optimal Steam Distribution Application
- Personal Perspective on Development Directions

A bit about INEOS Köln

- More than 16 plants
- Connected to internal networks:
 - Electricity
 - Fuel Gas
 - Steam (30, 15, 5 bar)
 - Cooling Water
 - Boiler Water
 - Condensate
 - Compressed Air
 - Nitrogen

 - Raw materials
 - Intermediates
 - Products



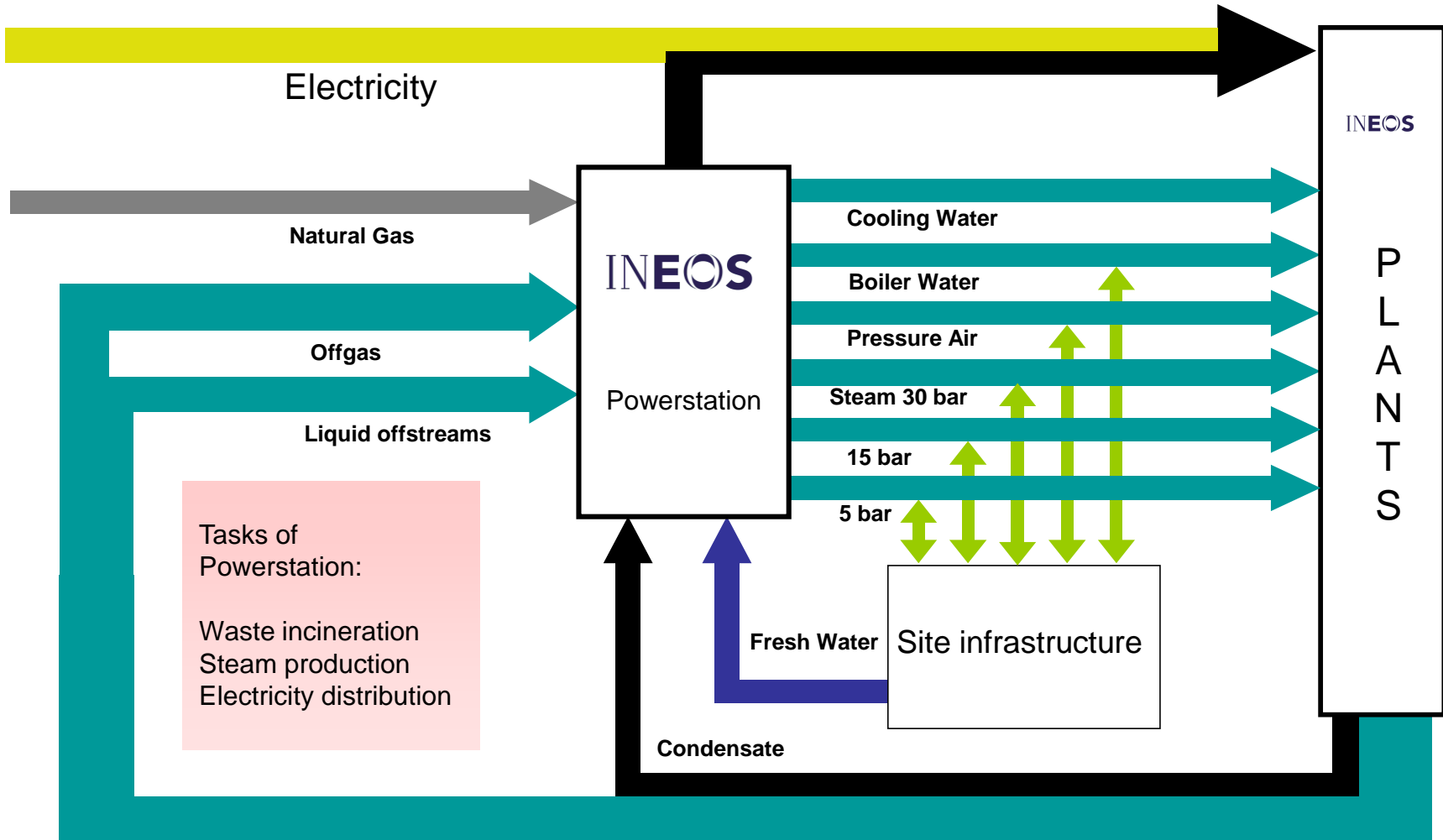
1 km

© Google maps

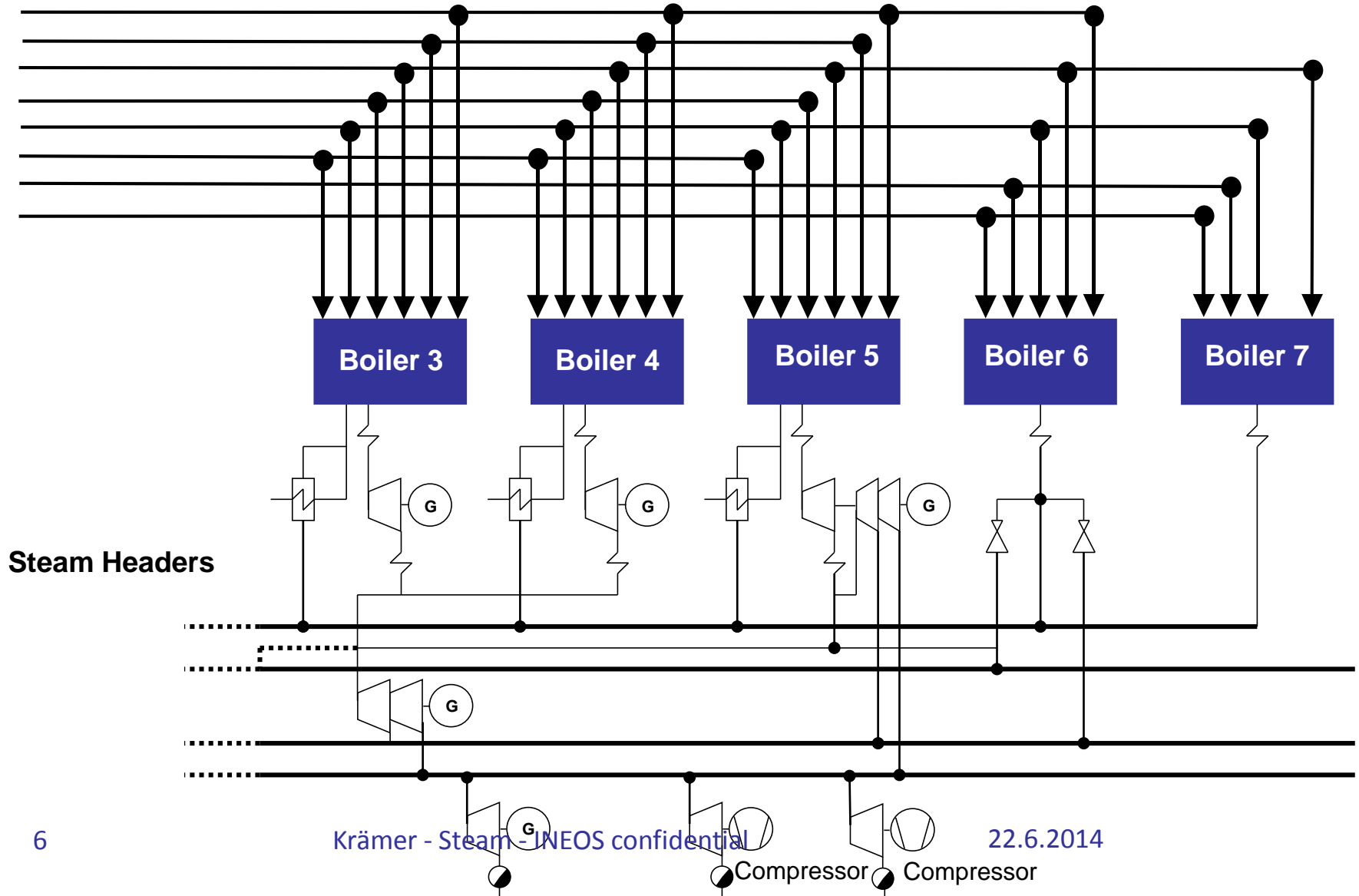
Why is it complicated?

- Power plant is the local steam producer
 - Many plants produce excess steam
 - Other plants require steam
- Power plant is also a waste burning facility
 - A large number of constraints
- Balancing the Power plant as steam and power generator and sink for offgases is necessary
 - significant benefit from optimisation expected
- Networks of different gases and steam headers need to be balanced
 - significant benefit of optimisation expected
- A large number of discrete degrees of freedom
- Discrete and continuous variables

Cologne Site Energy Network



Example: Steam and Power Generation



Application

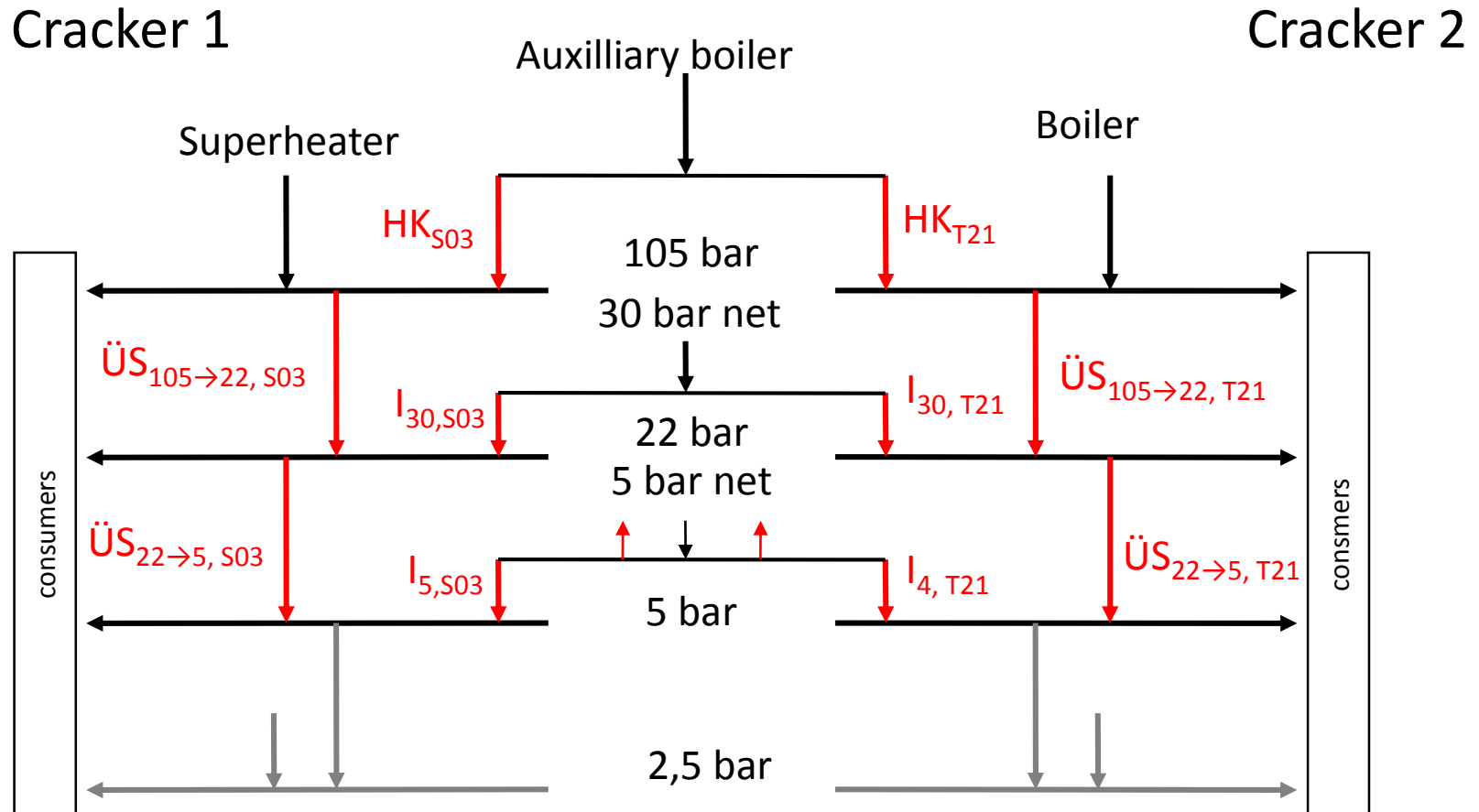
- Networks requires planning in accordance with production:
 - Long term planning – Disposition
(INEOS internal Tool exists, needs development)
 - Short term planning – Scenario based optimisation or scheduling
(Needs to be developed)
 - Online optimisation
(commercially available)
- Tackled as a case study in EU-Project DYMASOS
 - First promising results achieved


Application Example

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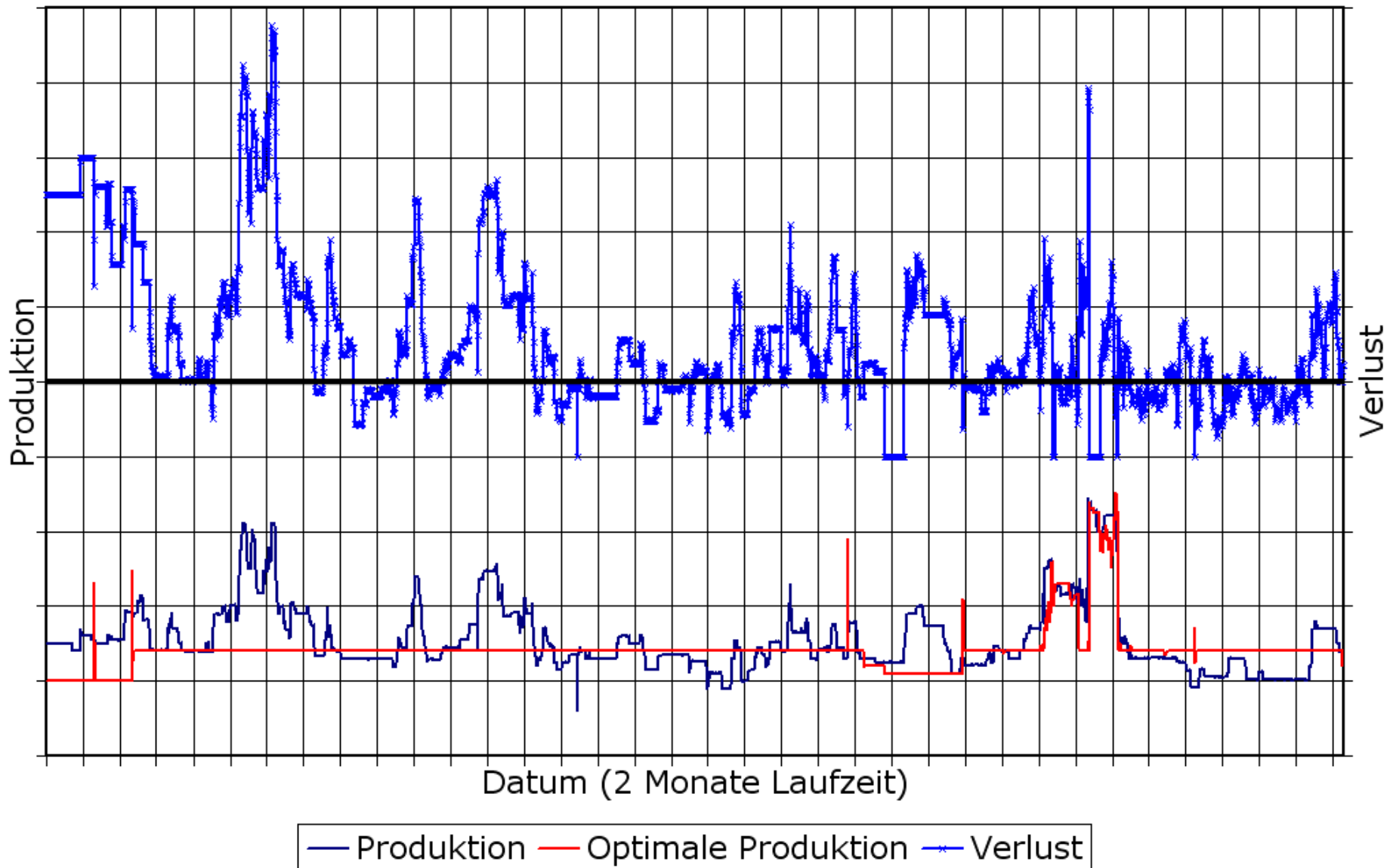
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Optimisation of Cracker Steam Headers



 Variable steam streams
 (degrees of freedom)

Long Term Results



Why do we need advanced solutions and more research?

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Expected Results in our Example

- Expected Results

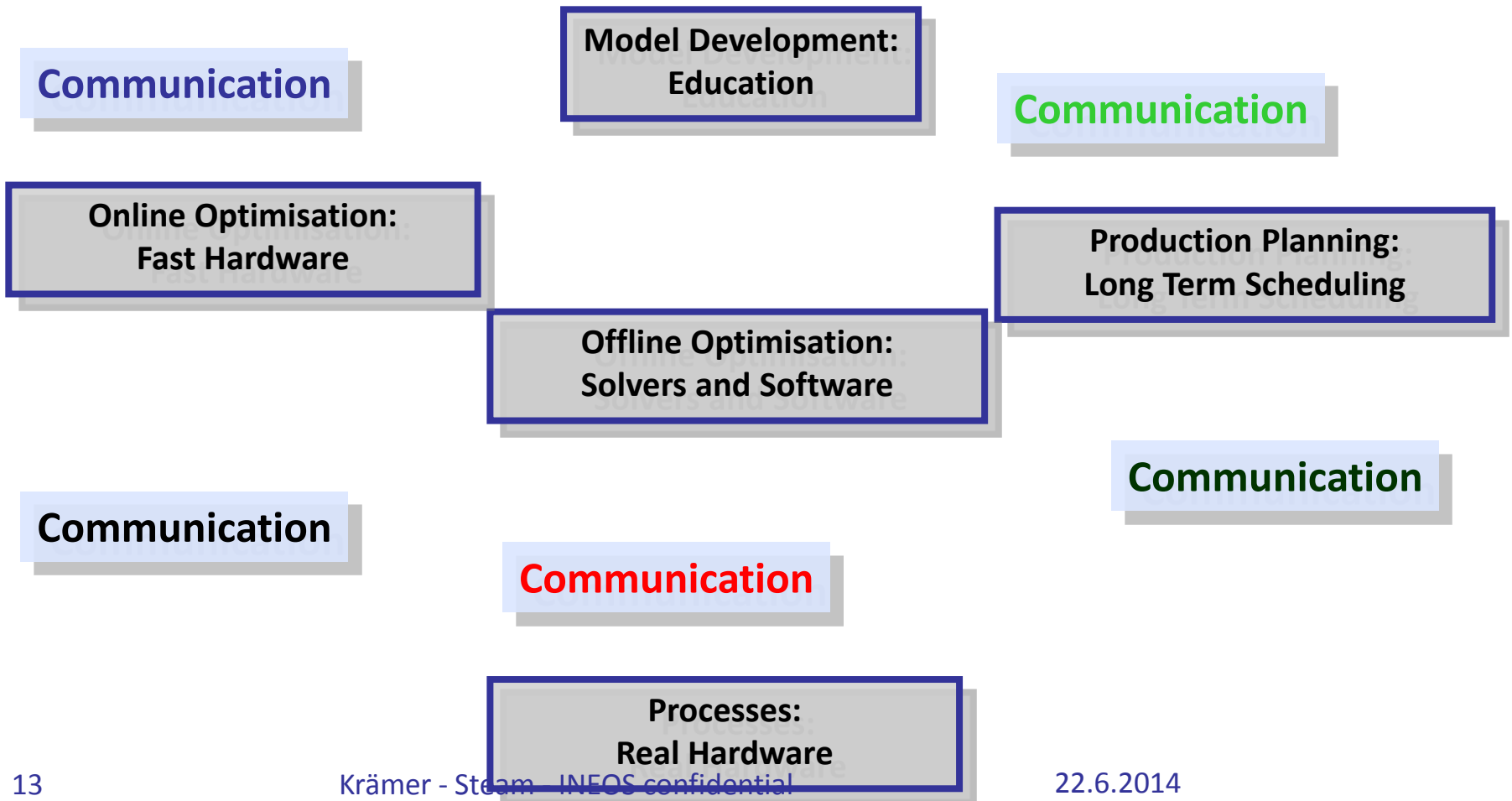
- Online advisory for operators on how to operate the plants
- Short term planning on steam and power generation possibly production load balancing for optimal energy usage
- Long term planning on steam and power generation and optimal scheduling of shutdowns

- Challenges

- Optimal choice of unit operation, incl. production balancing
- Solution on different time scales:
 - online load/demand balancing
 - hourly, daily, and monthly scale
- Compensate day and night changes, average planned production using load changes for optimal operation
- Optimal long term planning

How could this be achieved?

- A number of challenges were solved in the past:



What could be better?

- A number of challenges exist or have not arrived in practice:

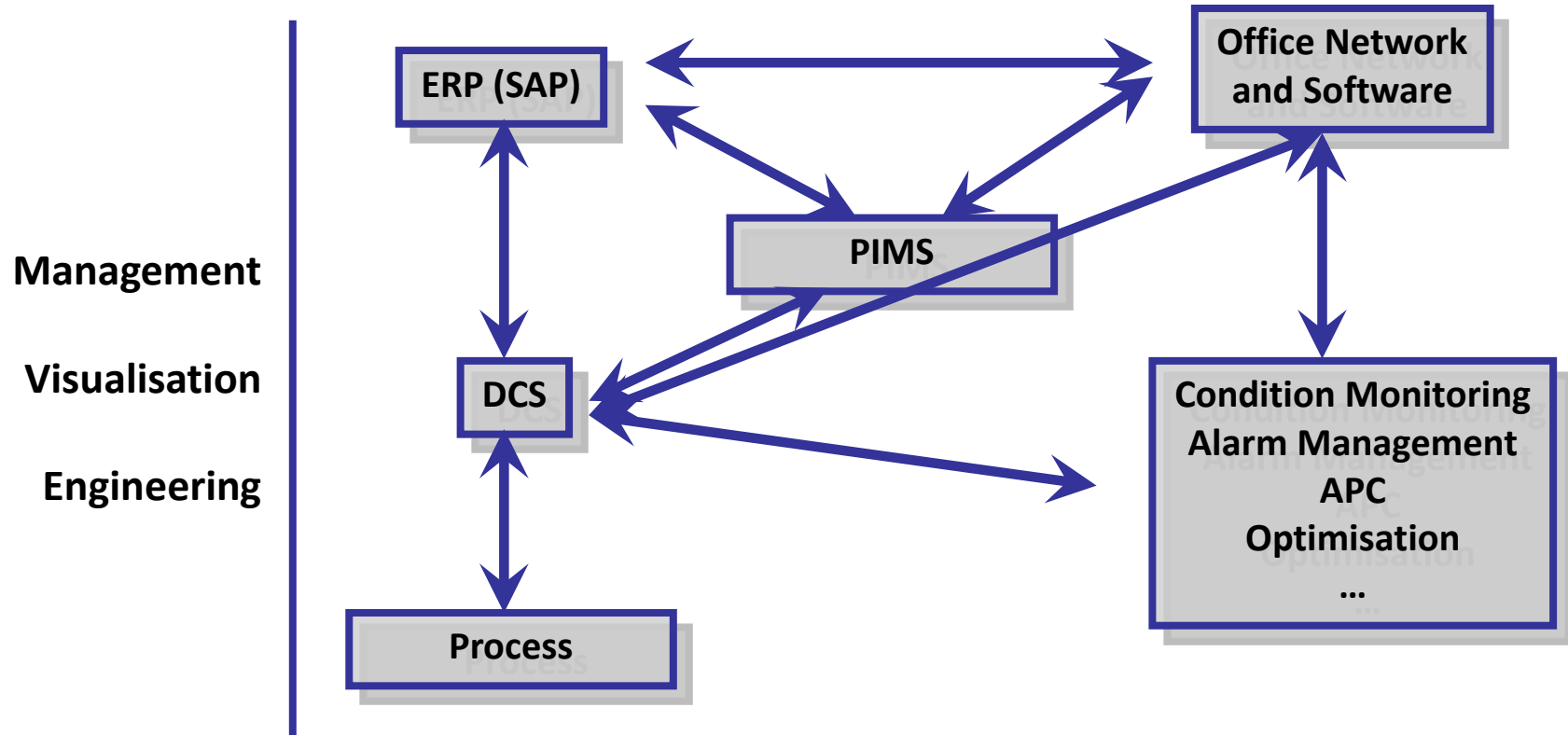
**Model Development:
Automated**

Different Levels of Optimisation Sensibly Combined (Strategy?)

Communication: Standardised and Reliable

**Processes:
Virtual Hardware**

Applications and Interfaces: The industry today



- Often communication using proprietary protocols
- Many interfaces, data exchange can be difficult
- **Are closed solutions *really* a competitive edge?**

Modelling Challenges

- Modelling is each time started from scratch, if more than simulation is required
(admittedly using good software tools with known thermodynamics, etc.)
- There is not only process modelling, but
 - Plant Modelling
 - Enterprise Modelling
 - Site Modelling
 - Model Interaction
 - Automated Model Building
- **Modelling is understood but not well utilised!**
- **Physical Models need to be built automatically from existing plant data or design specs!**