Cleaning Technologies for Waste to Energy Boilers-

Solutions for the Convective Pass

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Contents

- Introduction
- Situation & Consequences
- “On-load“ cleaning systems for Waste-to-Energy / Biomass
  - ➔ Challenges & Solutions
  - ➔ Optimisation
- Summary

Situation & Consequences

Situation

- Combustion of **municipal / industrial waste** and **refuse-derived fuels**

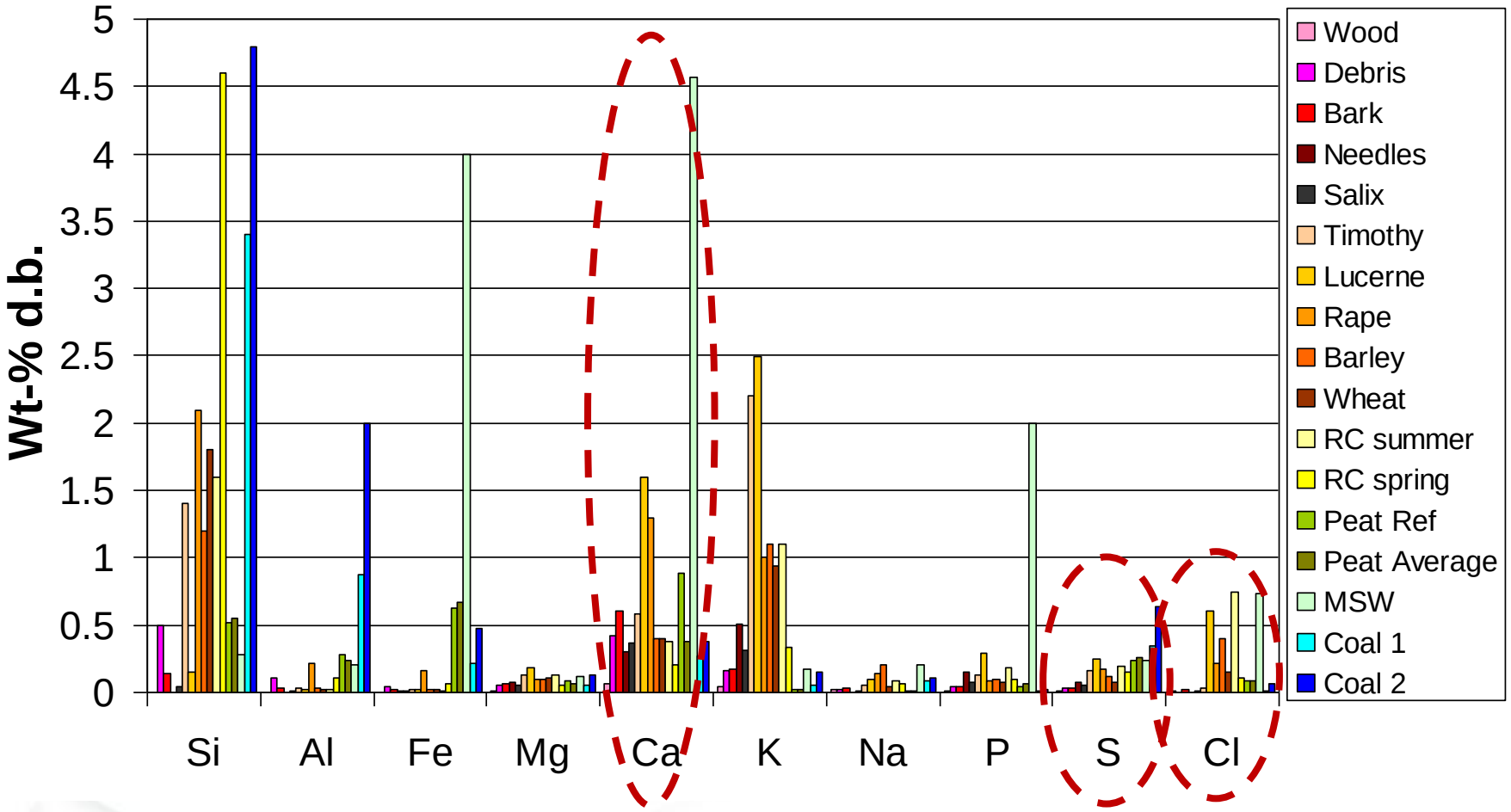
➔Inhomogeneous nature of the fuel and temporarily high calorific value leads to modified fouling behaviour in the radiation pass

➔Rough, sticky ash particles on the boiler wall

➔Corrosive properties of certain fuels are usually highly pronounced

Situation & Consequences

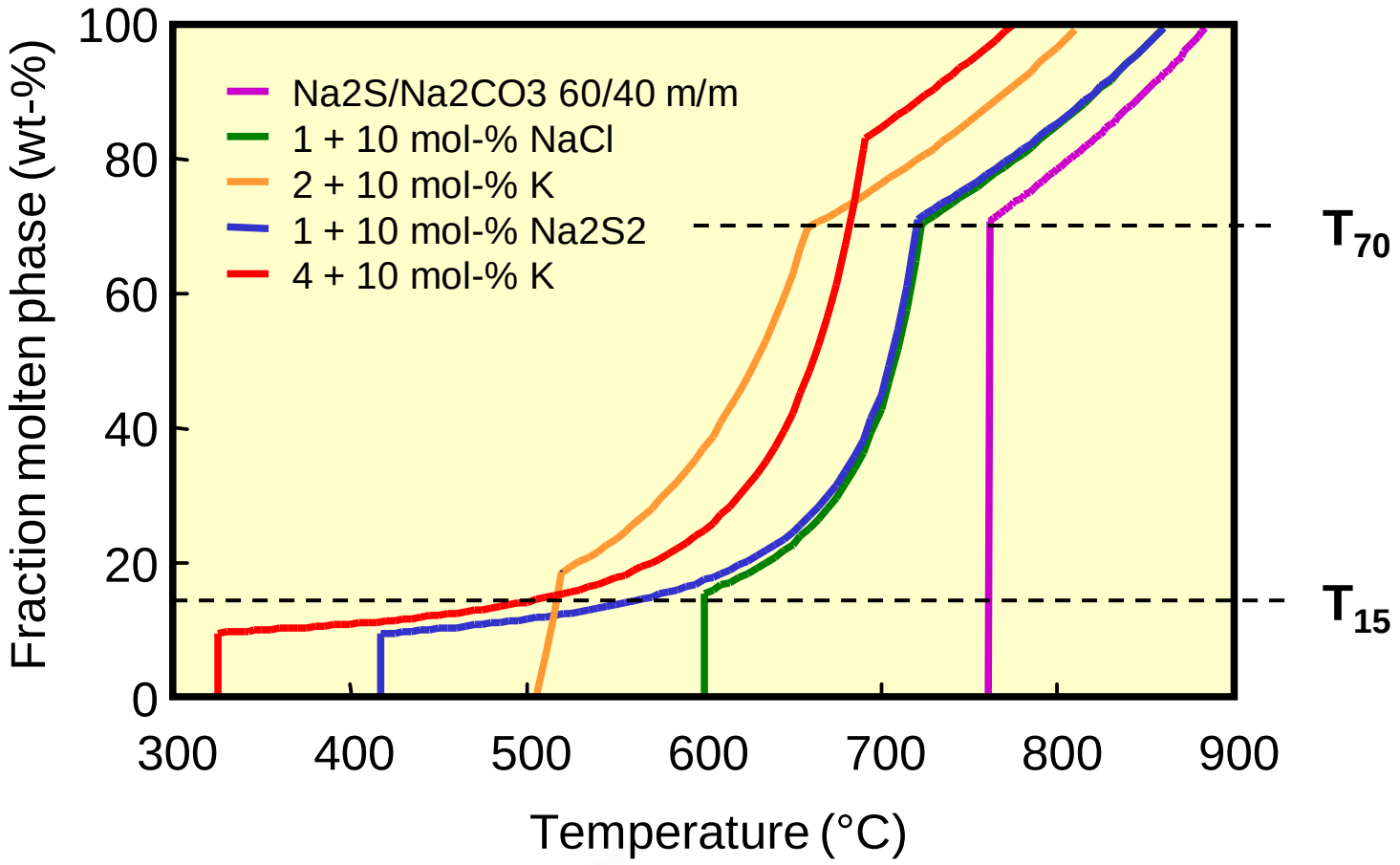
Fuel specific Ash forming elements



A. Nordin (1994) Biomass and Bioenergy, Vol.6(5), 339-347

Situation & Consequences

Melting curves for alkali salt mixtures



R. Backman (2004), Abo Akademi

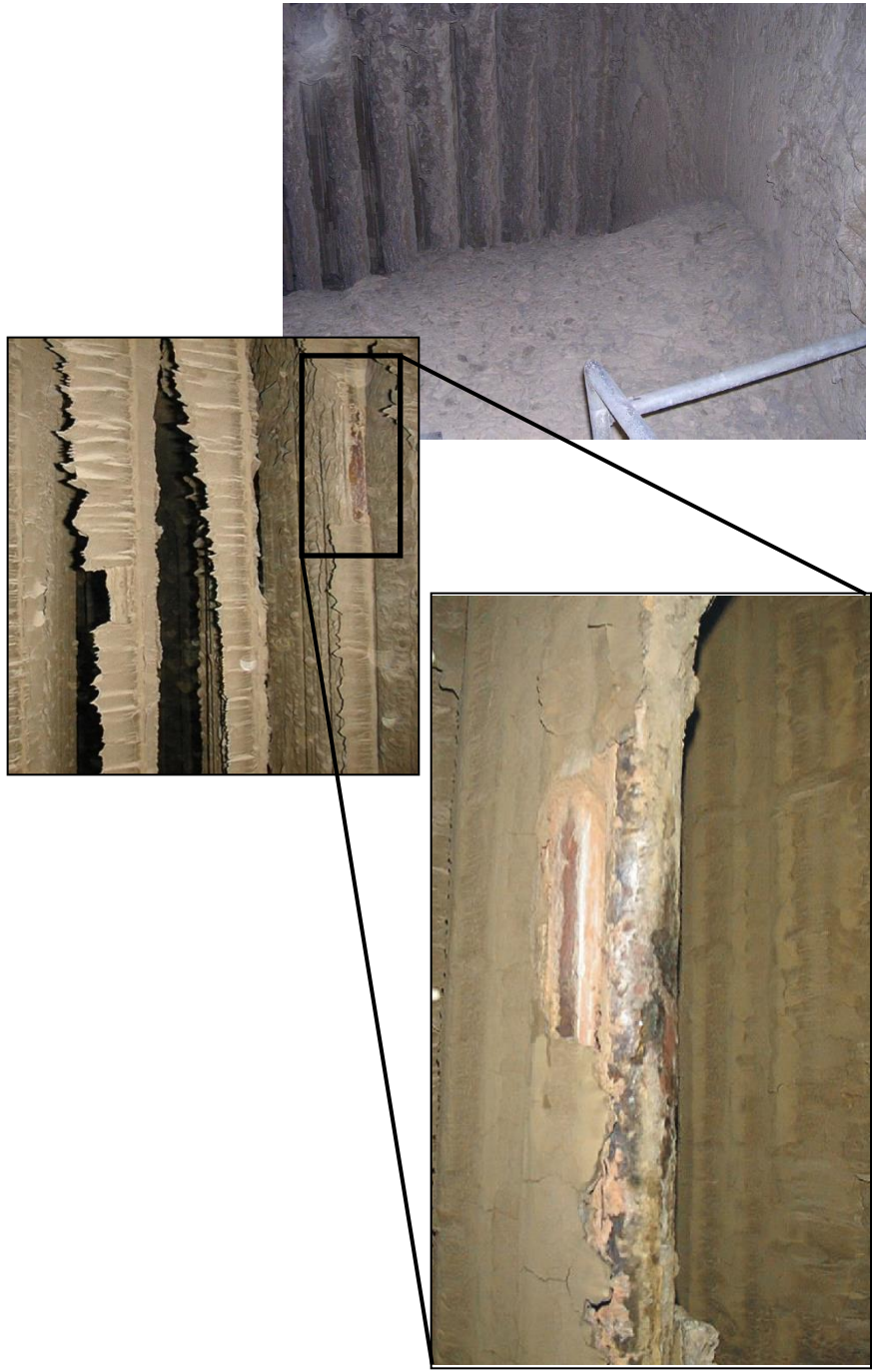
Situation & Consequences

Consequences

- Reduced boiler efficiency and unplanned shutdowns caused by the deposit build up on the heating and reaction surfaces

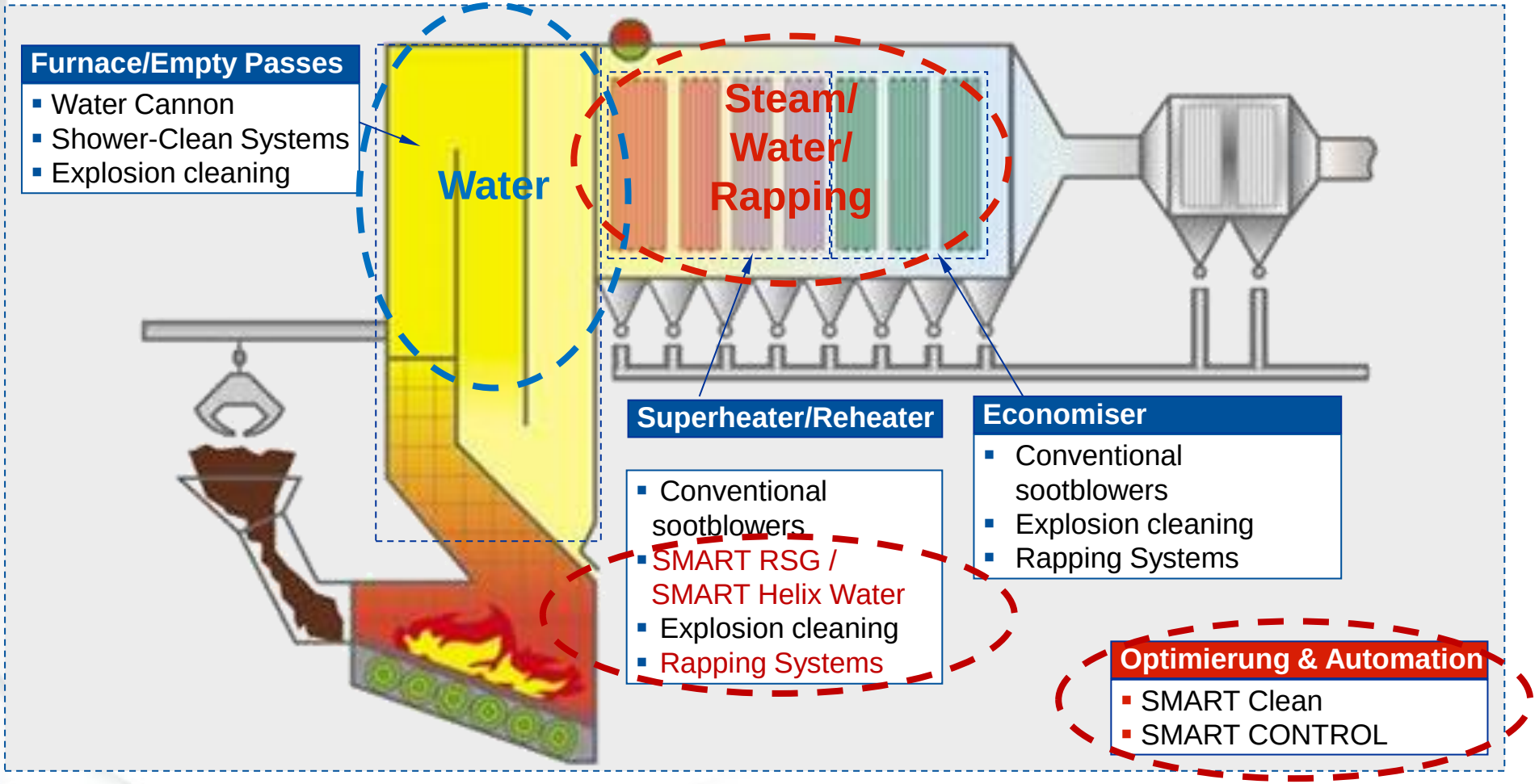
- Deposition build-up leading to corrosion related shut-downs

- Insufficient cleaning of badly affected areas due to the non-optimal cleaning strategy



On-line Cleaning Solutions

An overview

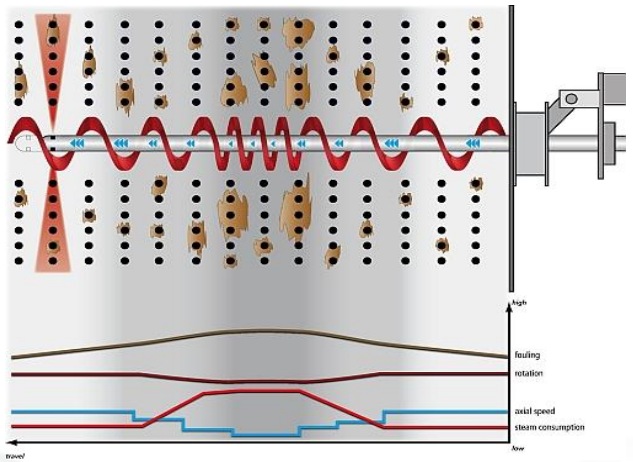


On-line Cleaning Solutions

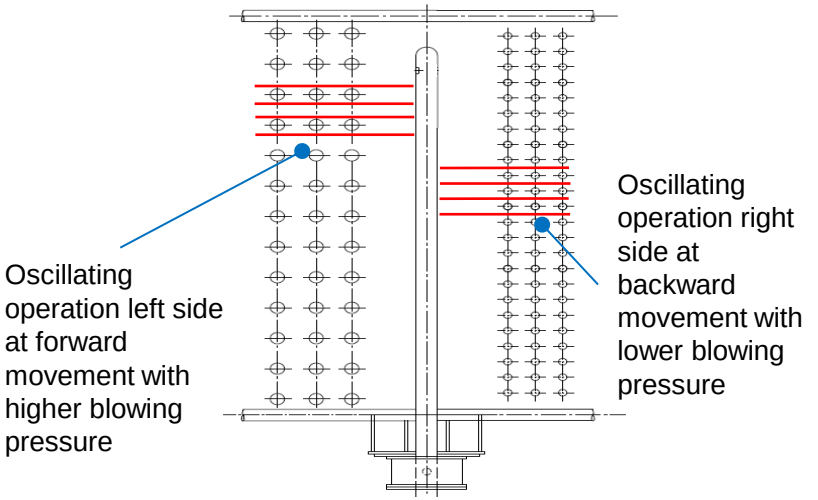
Special steam & water sootblowers

Functional principle

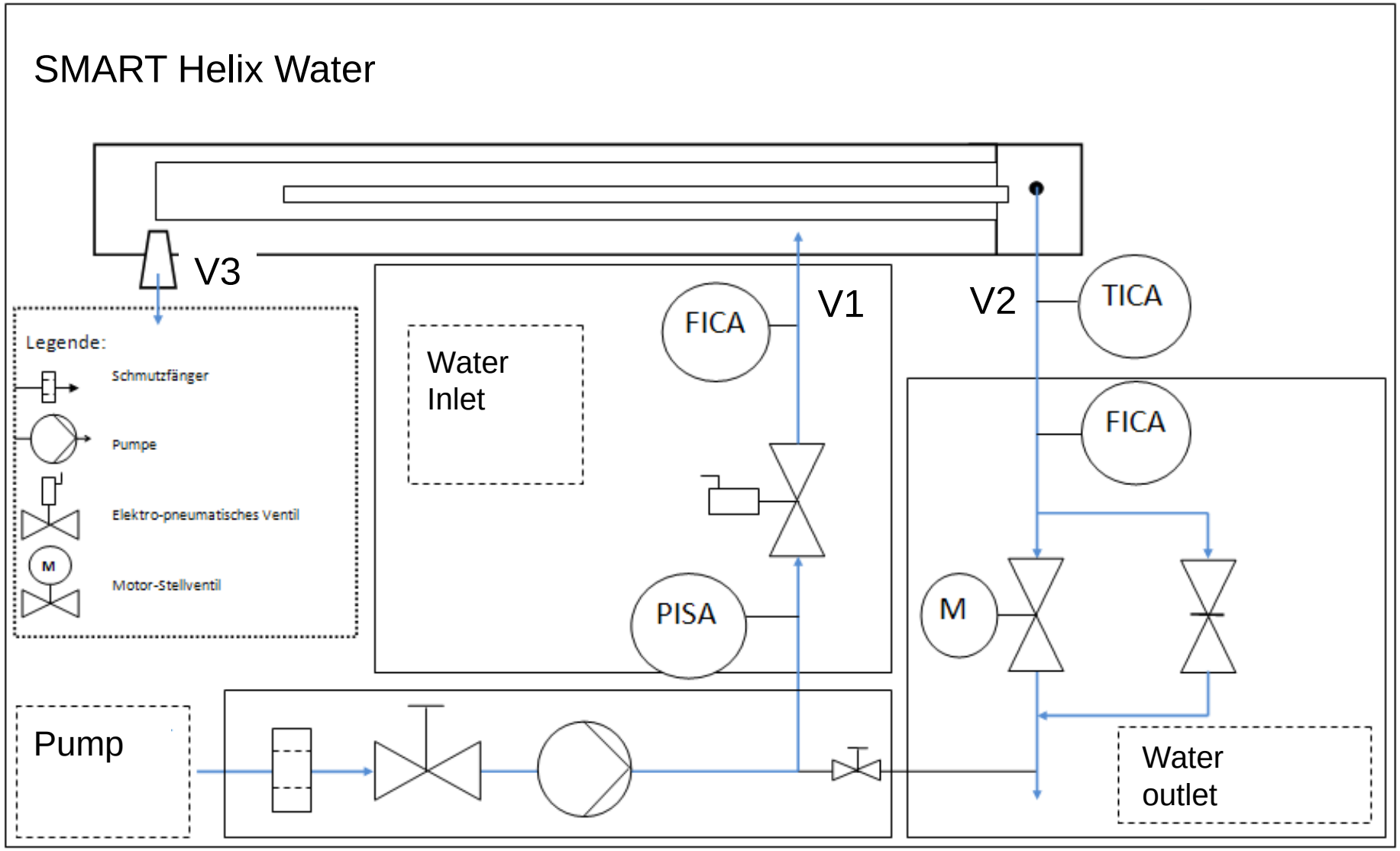
- The unique dual-motor design for variable traversing and rotational speeds
- Intensive cleaning is performed reliably by continued rotation in places with severe deposits by “Go-Stop-Go” or “Go-Stop-Clean-Go” mode
- Flexible setting of cleaning parameters such as traversing speed, rotational speed and blowing angle



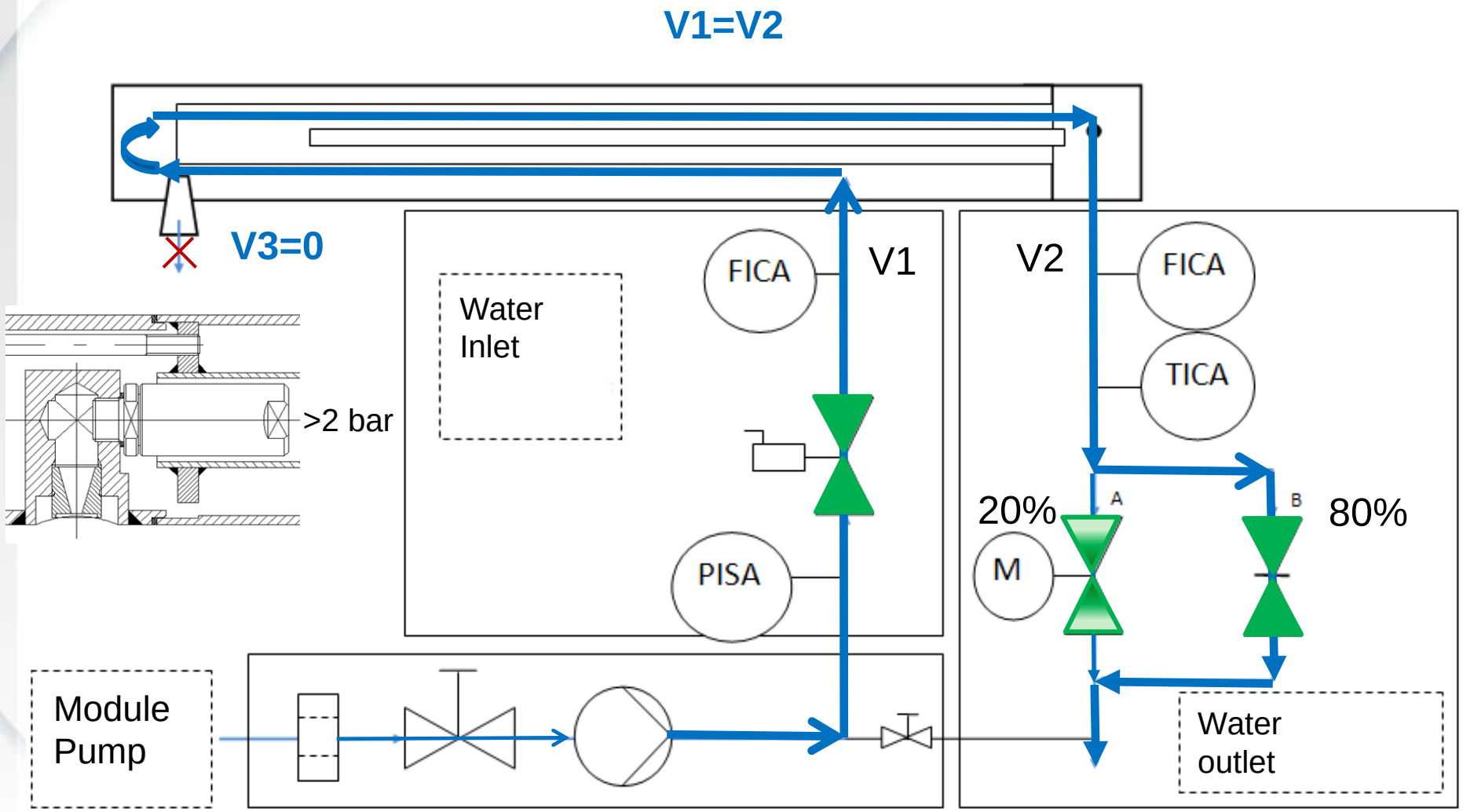
Cleaning between tubes to avoid blockage



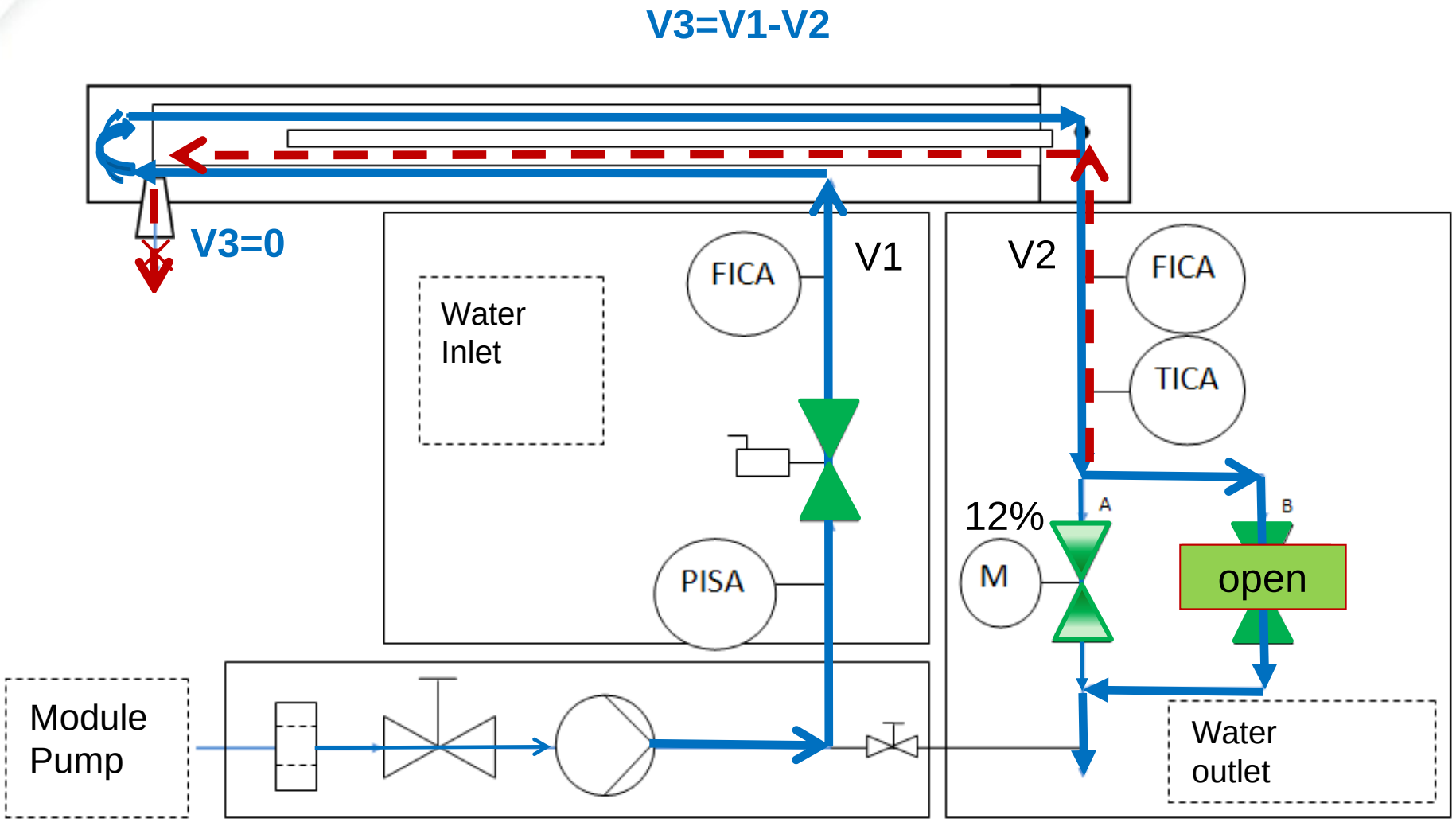
On-line Cleaning Solutions: Modules



On-line Cleaning Solutions: Cooling circuit



On-line Cleaning Solutions: Cleaning circuit



On-line Cleaning Solutions

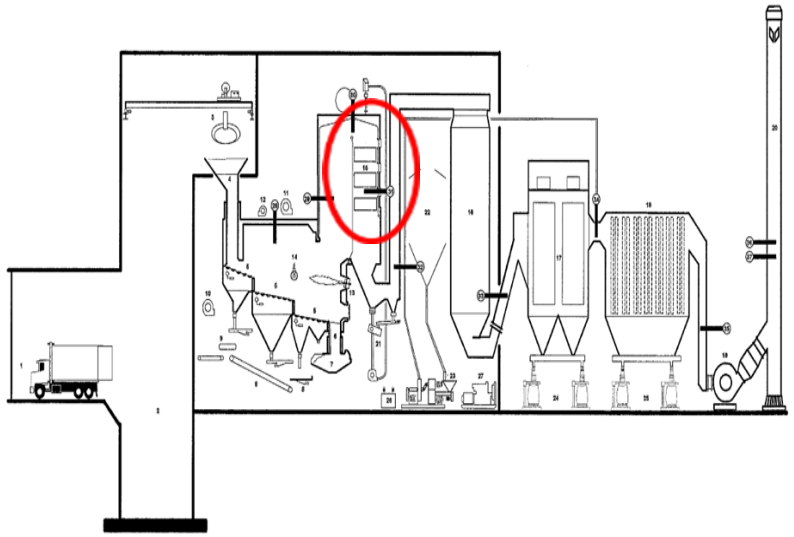
Reference Plant

Situation

- Unfavourable fuel composition
- High flue gas temperature before entering the evaporator
- Very heavy fouling in the super-heater
- Boiler travel time only 2000 h (Boiler blockage)

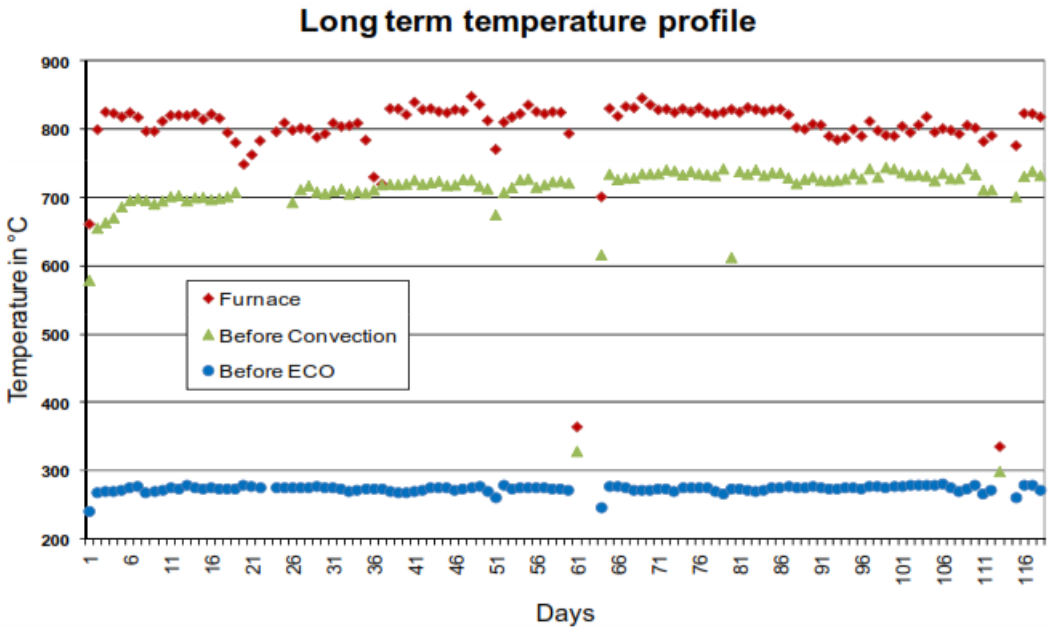
Solution

- Installation Shower-Clean System SCS in the 2nd empty pass
- Operation of existing Retractable sootblowers/ SMART Helix Water / twice daily



On-line Cleaning Solutions

Reference Plant



Sustainable flue gas temperature development after the installation of the SMART Helix Water

A region of the superheater before and after the installtion of the SMART Helix Water Sootblower

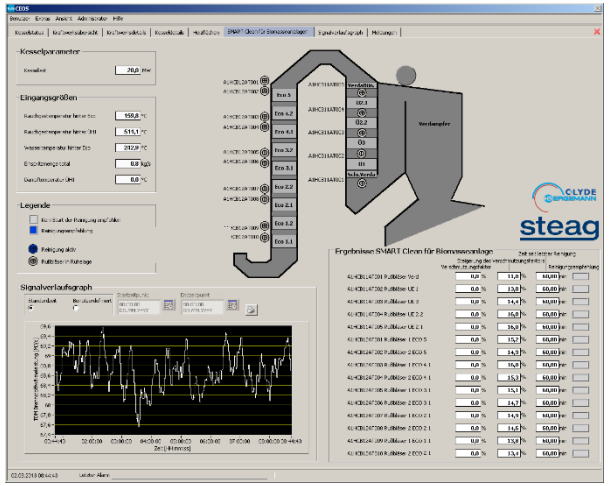
Cleaning Optimisation

Situation – Typical customer challenges

- **Cleaning** equipment is used on **time-based criteria**
  - ➔ Cleaning of the **complete** sections (furnace, convective sections)
  - ➔ **Same time criteria** for all the convective heat exchangers
    (one sequence for the complete boiler)
- **Cleaning** is **not or partly** based on the **demand driven** approach
  (cleaning when it is necessary), **operator experience** has a **big influence** on cleaning success

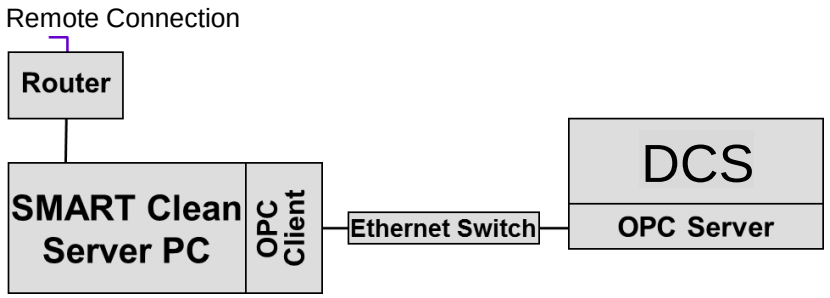
Cleaning Optimisation: Modell-based steam cleaning – SMART Clean Compact

Solution & Functional principle



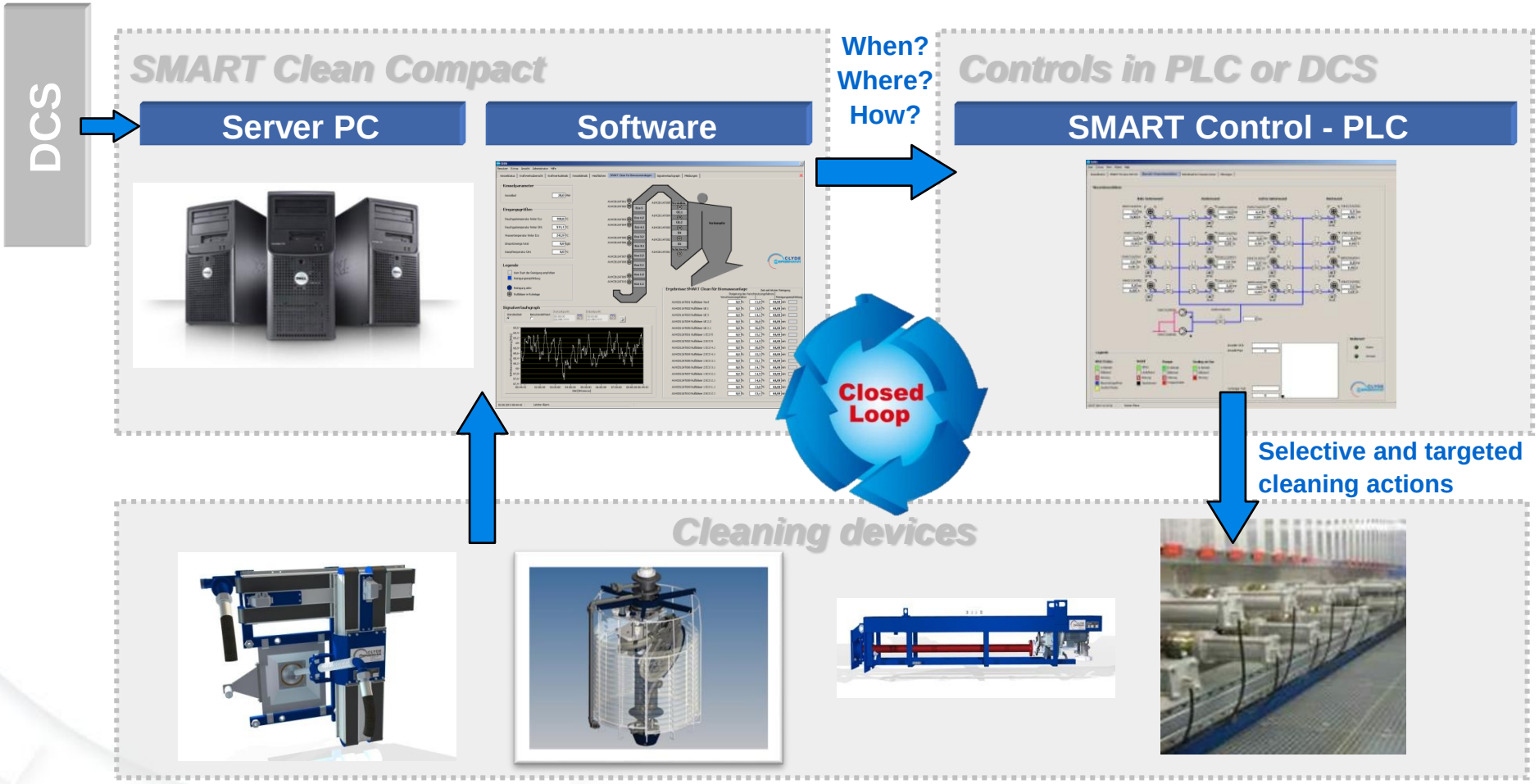
- Uses existing steam, water and flue gas measurements from the DCS
- Boiler is divided into different cleaning areas/zones, key process values are defined.
- Monitors and records the effectiveness of each cleaning action acc. to the process values
- Optimises the cleaning actions
  - ➔Analyses effectiveness of cleaning actions (process values)
  - ➔Calculates continuously how much a each cleaning action would benefit the process to get the best performance from the boiler

Hardware:
Server PC incl. monitor, which is connected to the DCS



Cleaning Optimisation: Modell-based steam cleaning – SMART Clean Compact

Interface Connection principle



Summary

- A large range of „on-load“ cleaning systems are available for the different cleaning requirements within a boiler by applying various cleaning methods and cleaning philosophies
  - ➔ Optimisation of cleaning effect with special cleaning solutions can be conducted much effectively through cooperation with plant operators

- Model-based boiler cleaning
  - ➔ **Continuous monitoring** of the key **process measurements**
  - ➔ **Determination** of the plant specific **optimum cleaning strategy**
  - ➔ **Selective activation** of single **cleaning devices / groups**

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