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# Engineered solutions to boost the performance of your waste-to-energy plant



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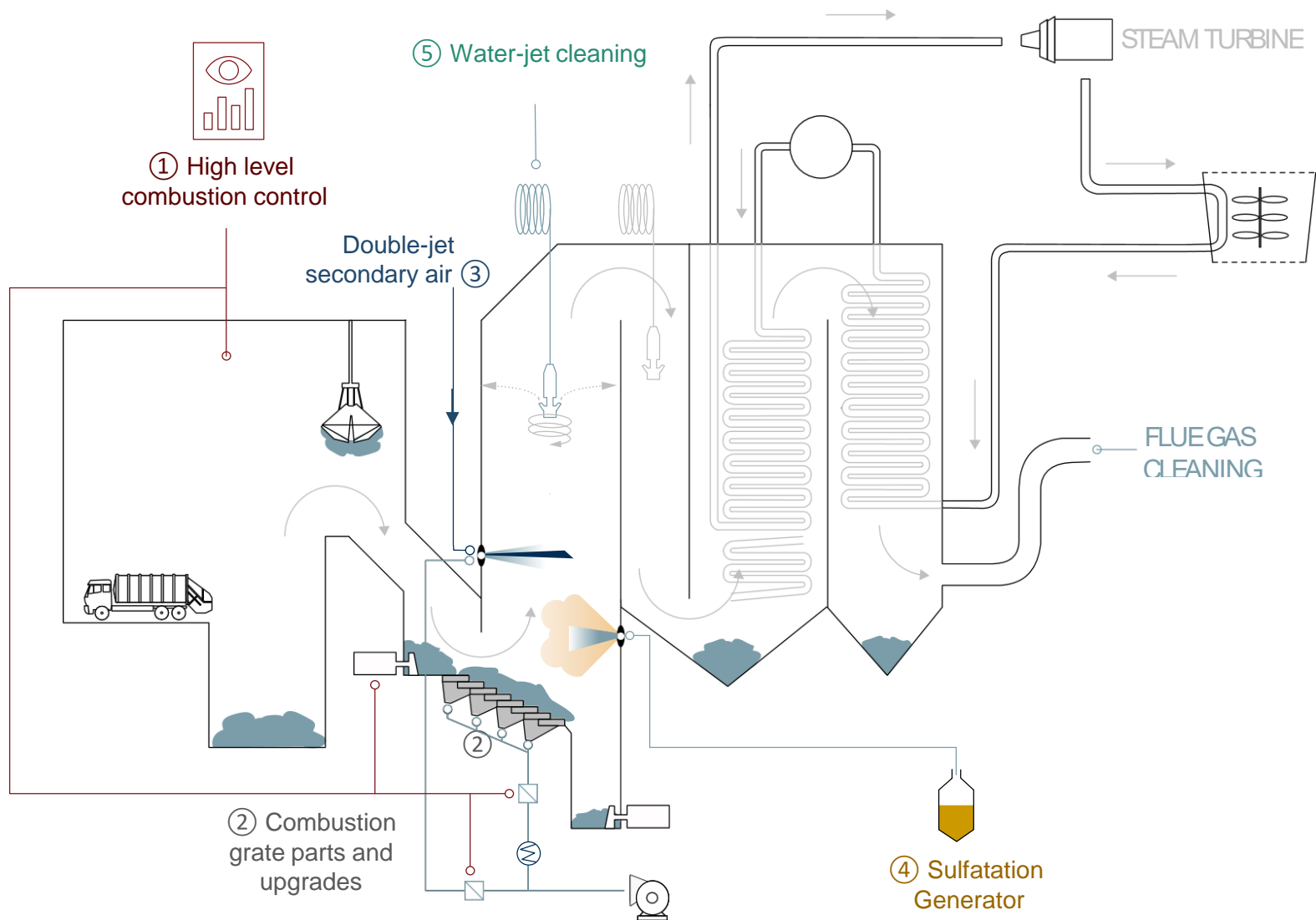


Dr. Jörg Krüger  
Senior Advisor  
(VWT)



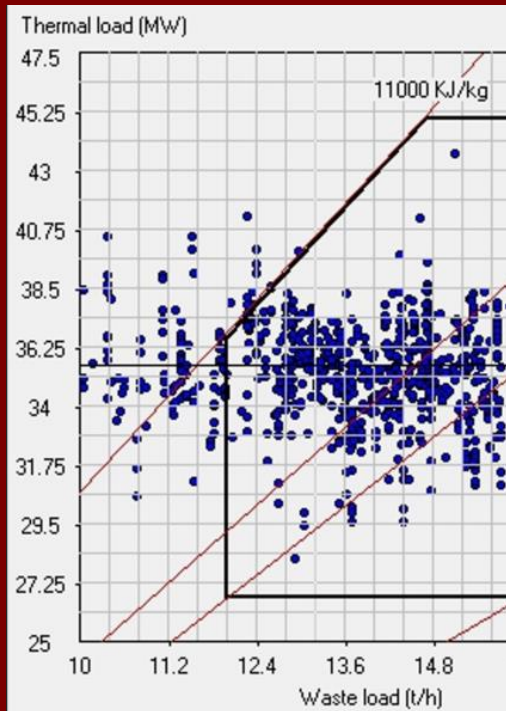
Bertram Holst  
Mechanical and  
grate expert

# Engineered solutions to boost the performance of your waste-to-energy plant

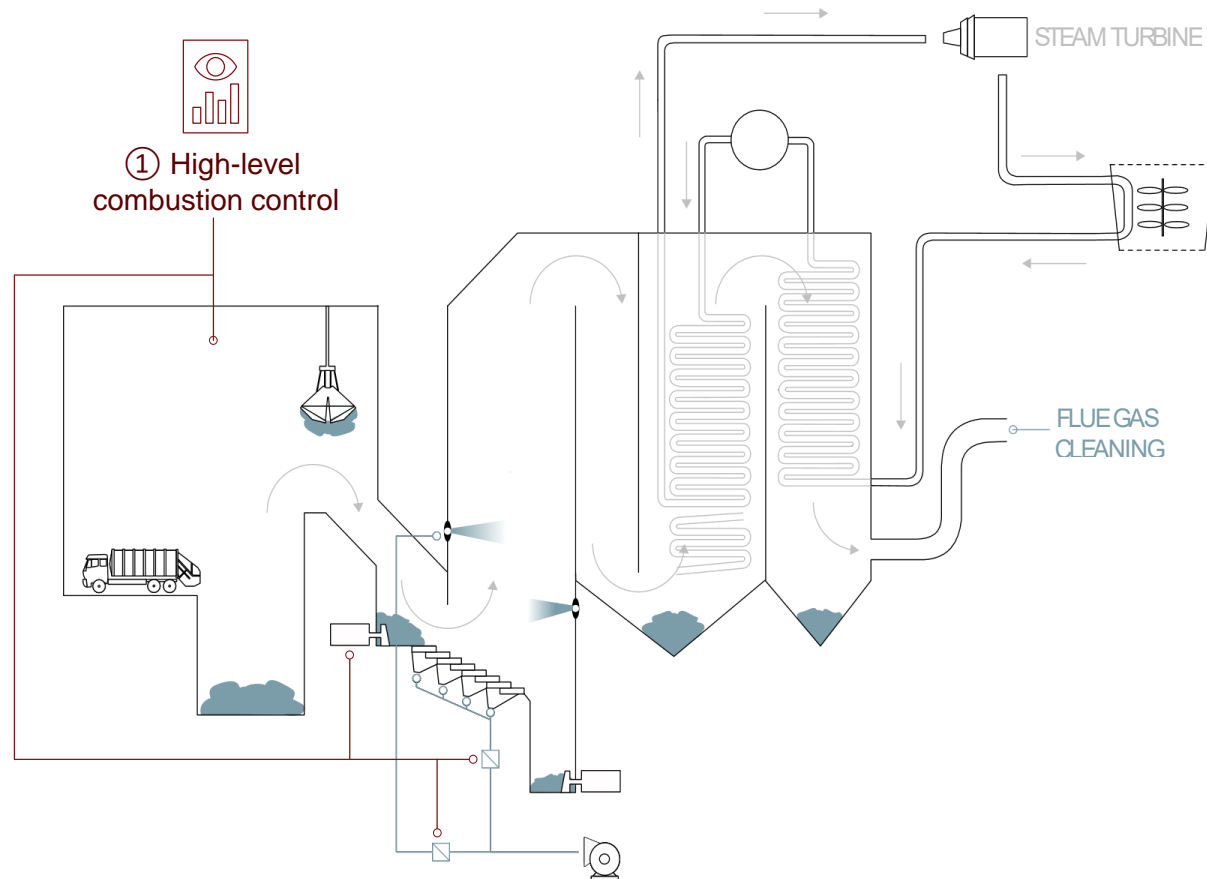




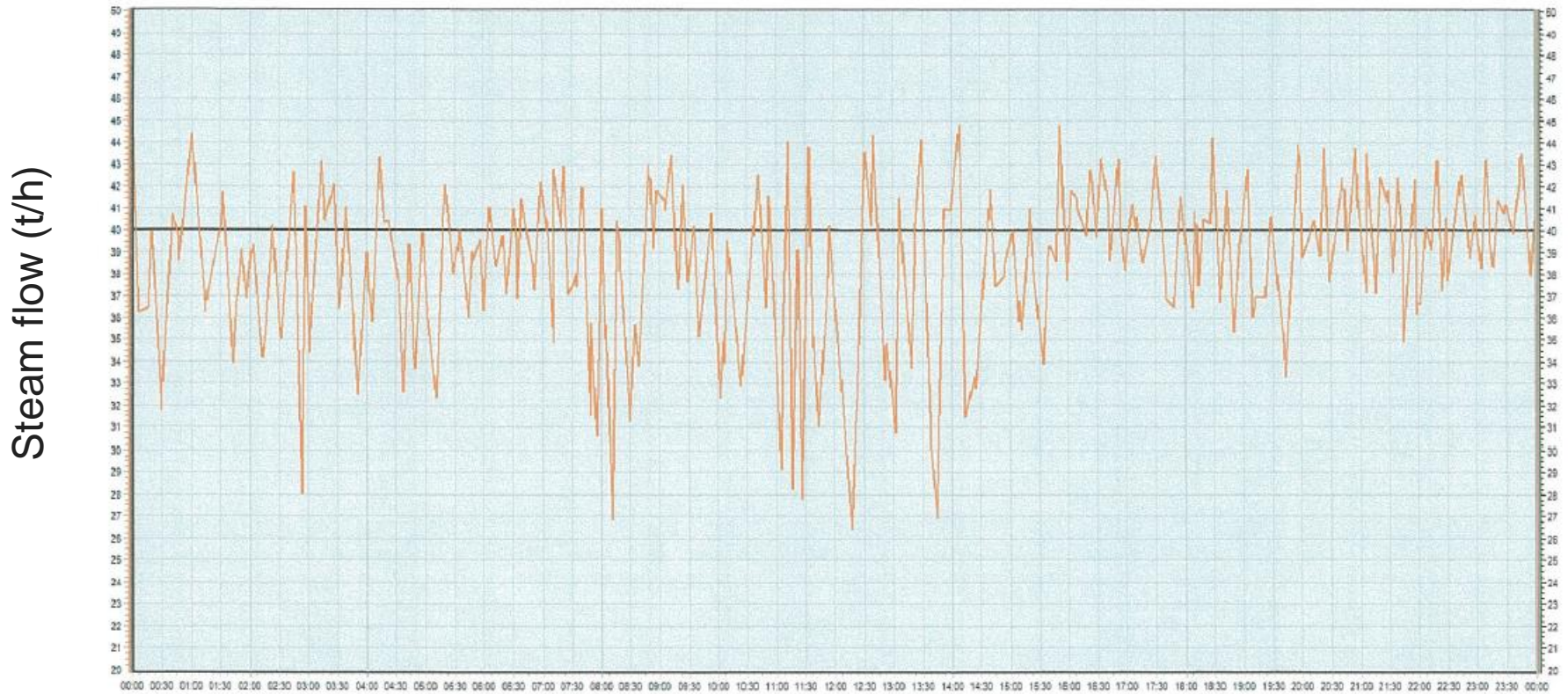
# 1. High level combustion control (FuzEvent)



① High-level  
combustion control



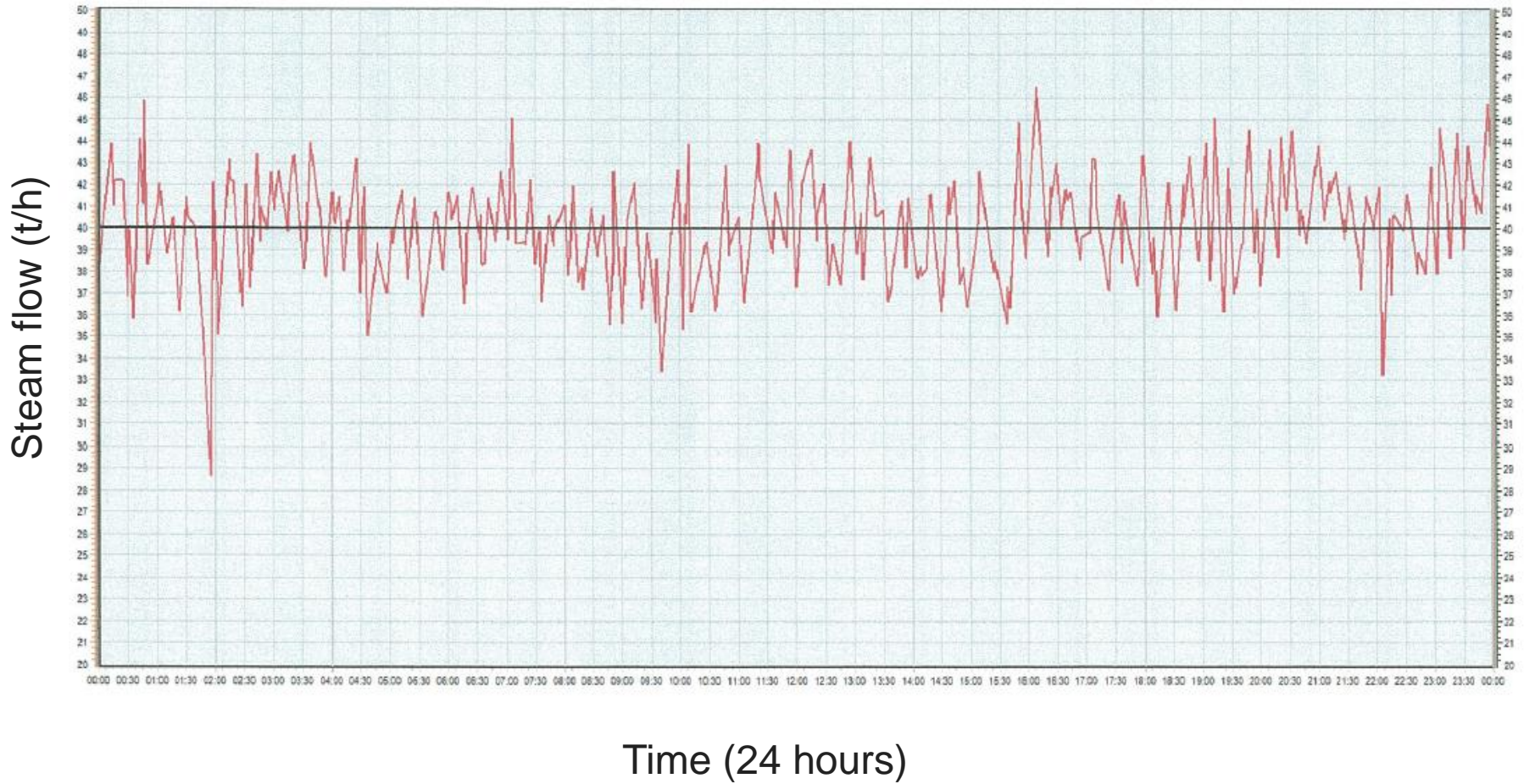
# Example of WTE plant: Classical control (Line B)



Time (24 hours)



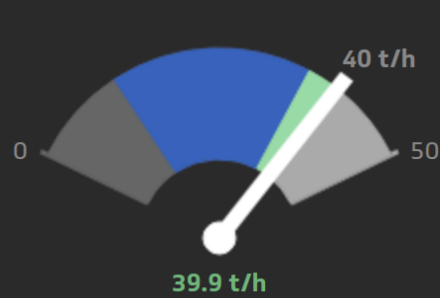
# FuzEvent control (Line A)



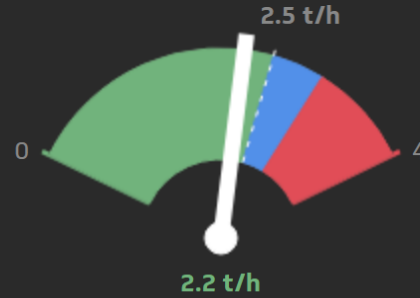
Time (24 hours)

# FuzEvent – online dashboard

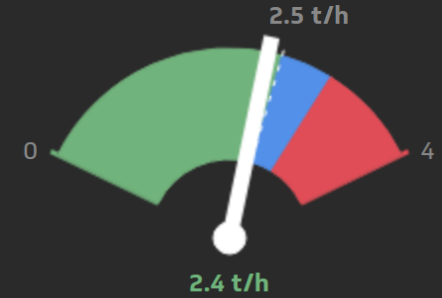
## Combustion performance (24 hours)



39.9 t/h  
Steam flow



2.2 t/h  
Standard deviation



2.4 t/h  
Standard deviation (4h)

Steam av. / setpoint

100.2 %

CO

36 mg/Nm<sup>3</sup>

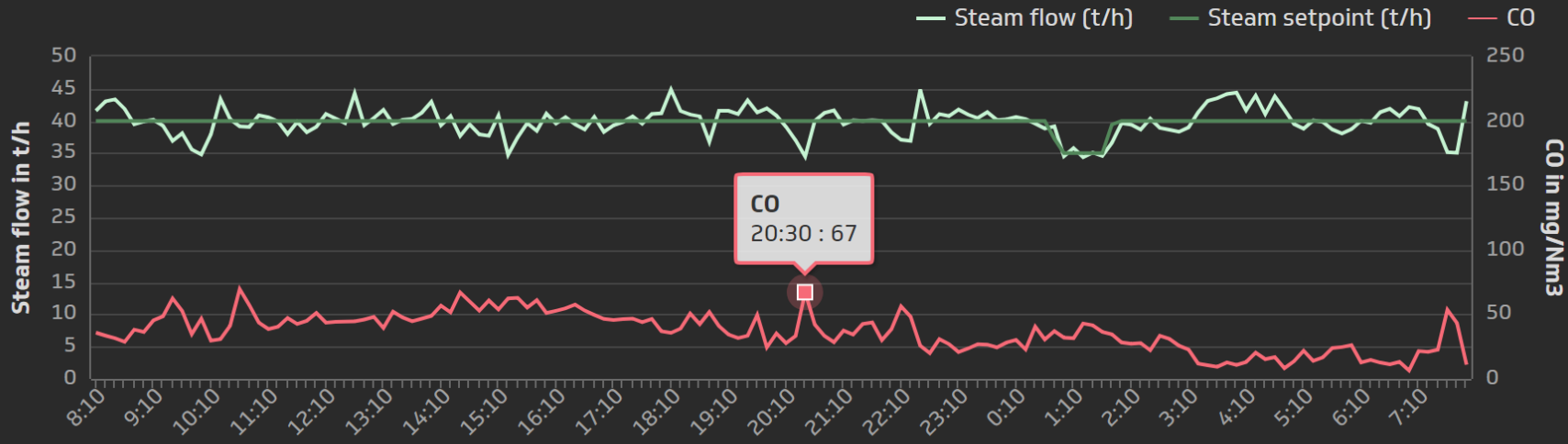
CO exception

284 #

CO > 100 mg/Nm<sup>3</sup>

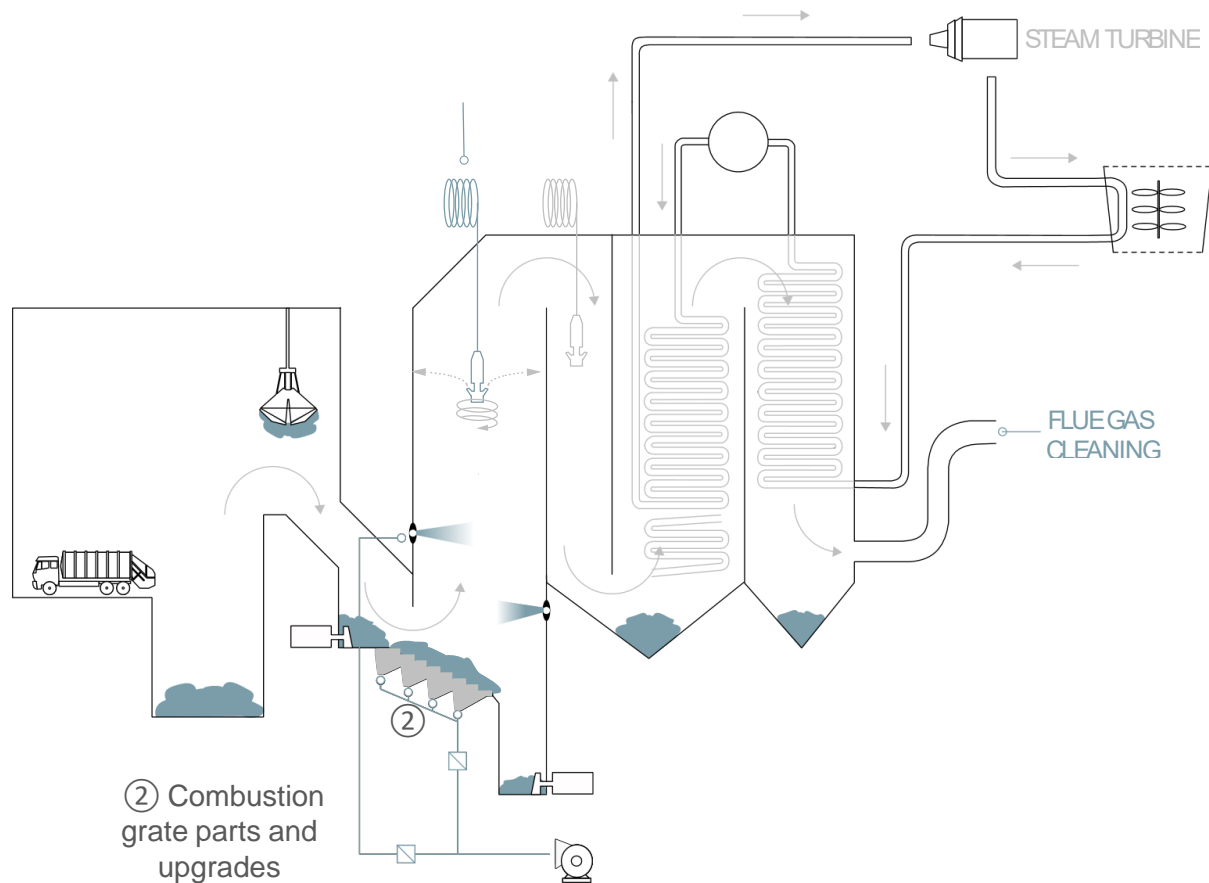
14 minutes

## Trend data (24 h)





## 2. Combustion grate parts and upgrades







# MVA Rostsysteme - Engineering, Service / Teile



DUB3 System in Arezzo, Italien  
(kompatibel mit klassischen Volund-Rosten)



# DUB 3 grate system (for classical Volund type)



Reduce riddlings and maintenance time with DUB3 for Volund type grates



Improved combustion air distribution on the grate



Parts, maintenance and engineered upgrades from a single WTE specialist



Extended operating time at max load



Modernized features to a proven design

## Why WtE plants choose the DUB 3 combustion grate

80 %

Reduction of riddlings

60 %

Reduced maintenance time during outage

3 years

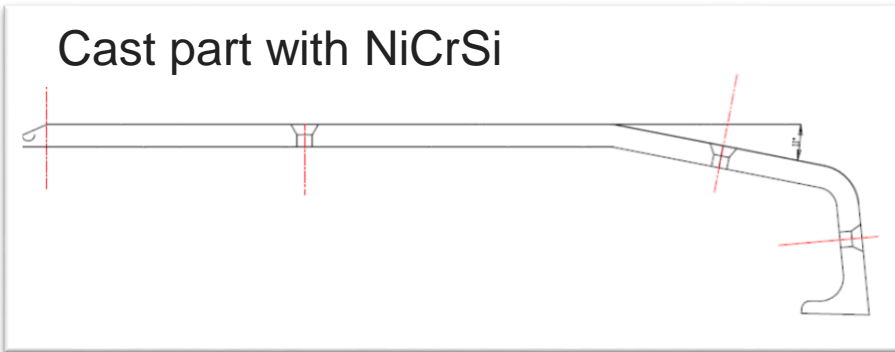
Extend operation without major replacement

40 %

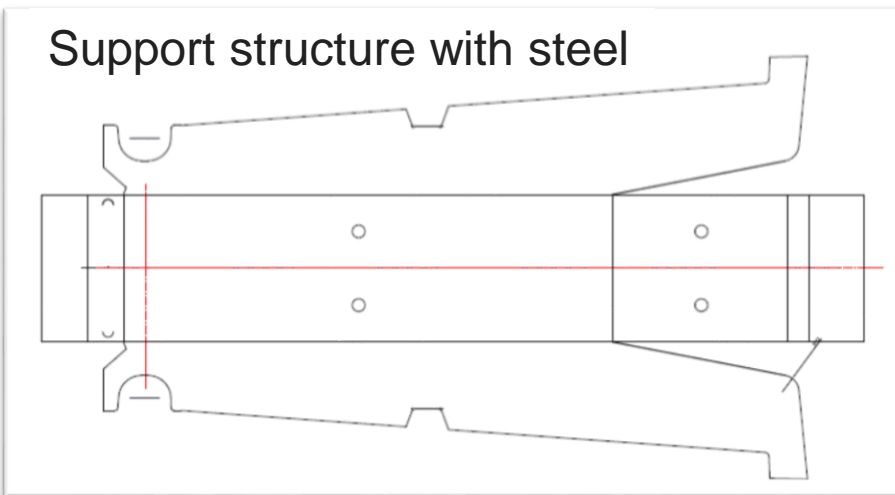
Reduced cost for grate exchange

# Composite grate bars for forward pushing grates

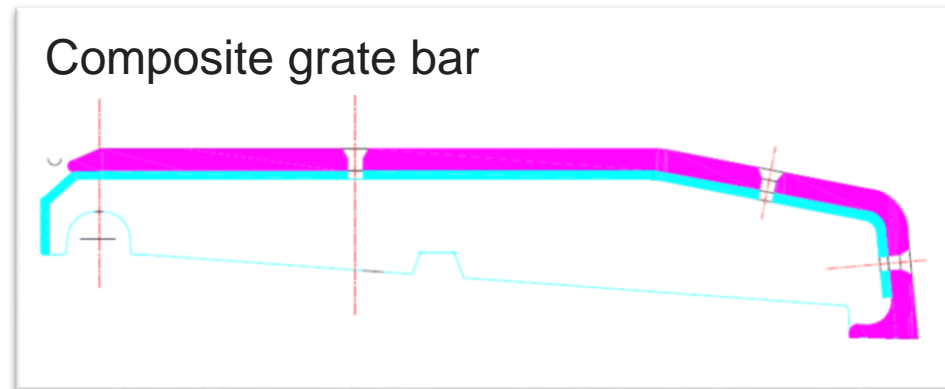
Cast part with NiCrSi



Support structure with steel

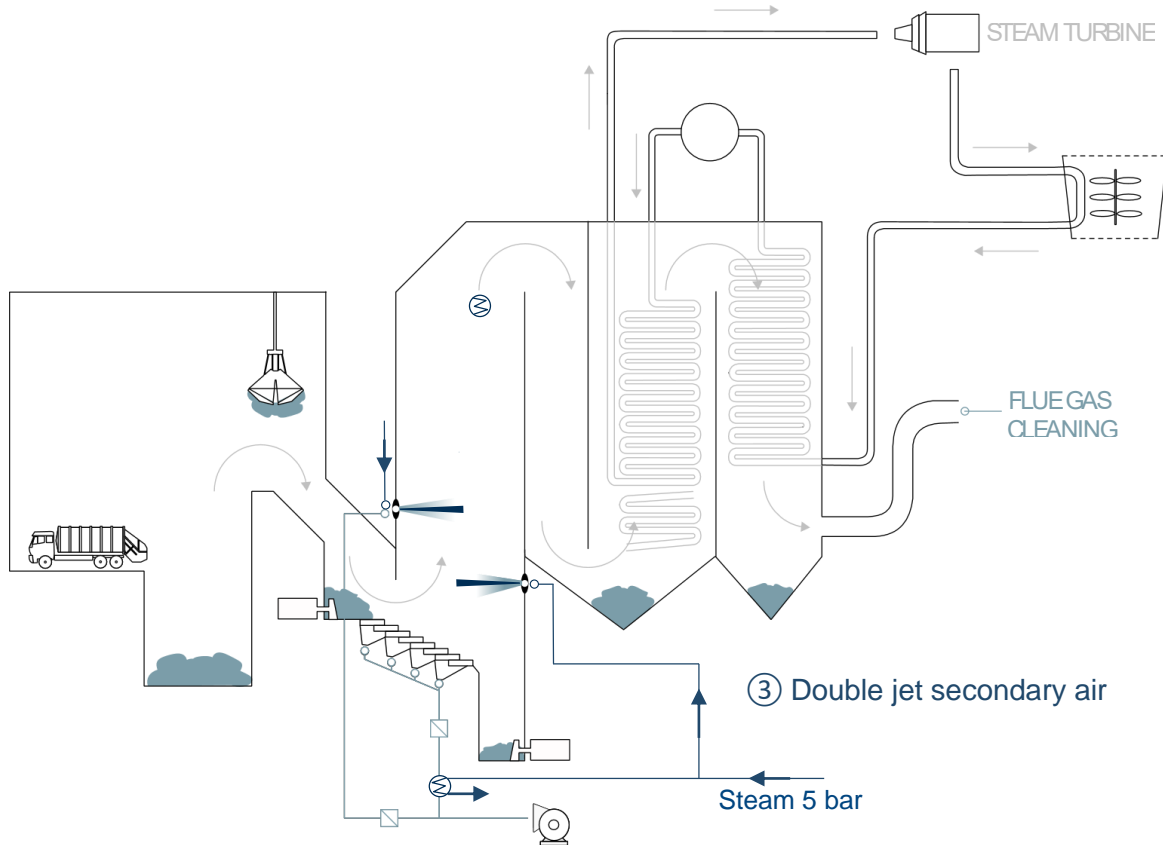


Composite grate bar





### 3. Avoiding CO and slagging with double jet secondary air (BoosterSteam)





# Booster Steam injection (Schwandorf front wall)





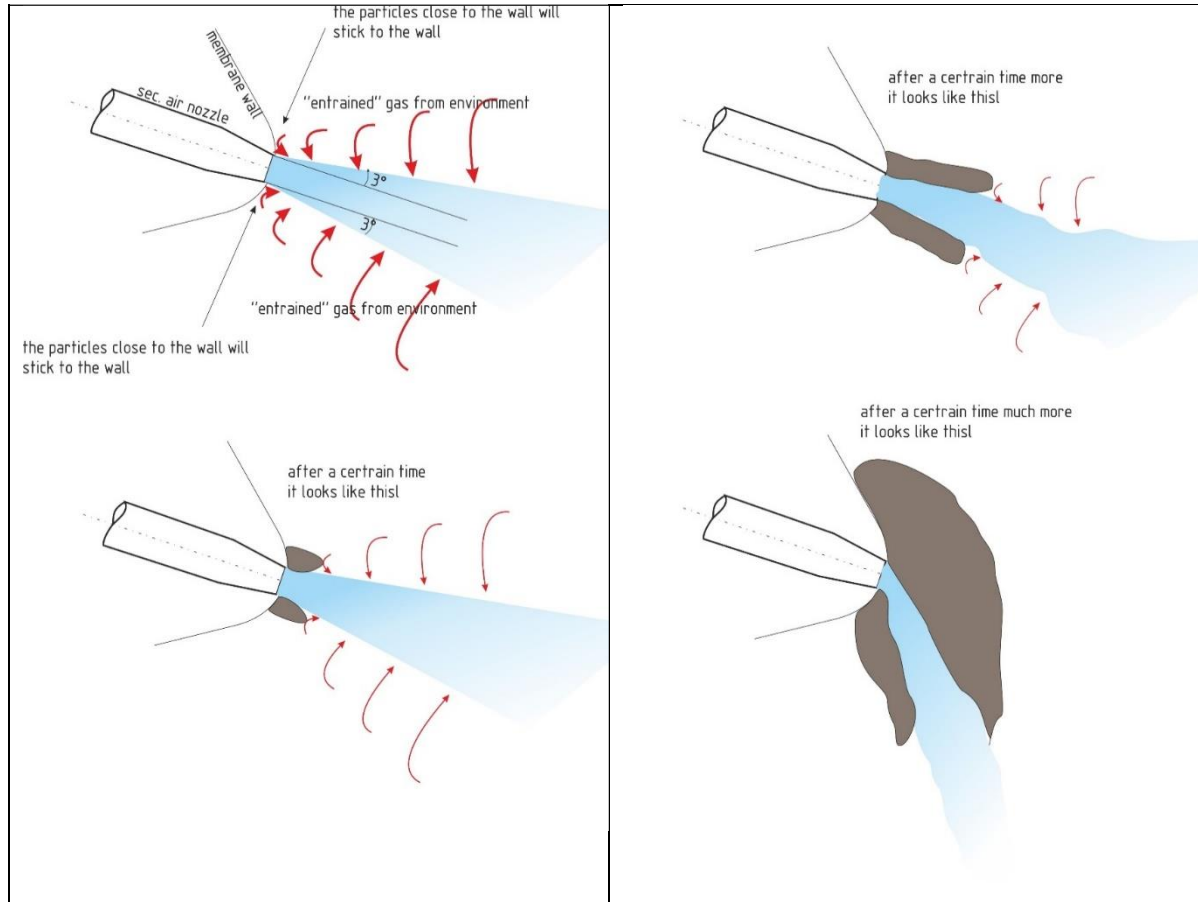
# BoosterSteam – Injection device



# CO reduction with supersonic concentric double jet overfire air nozzles (BoosterSteam)

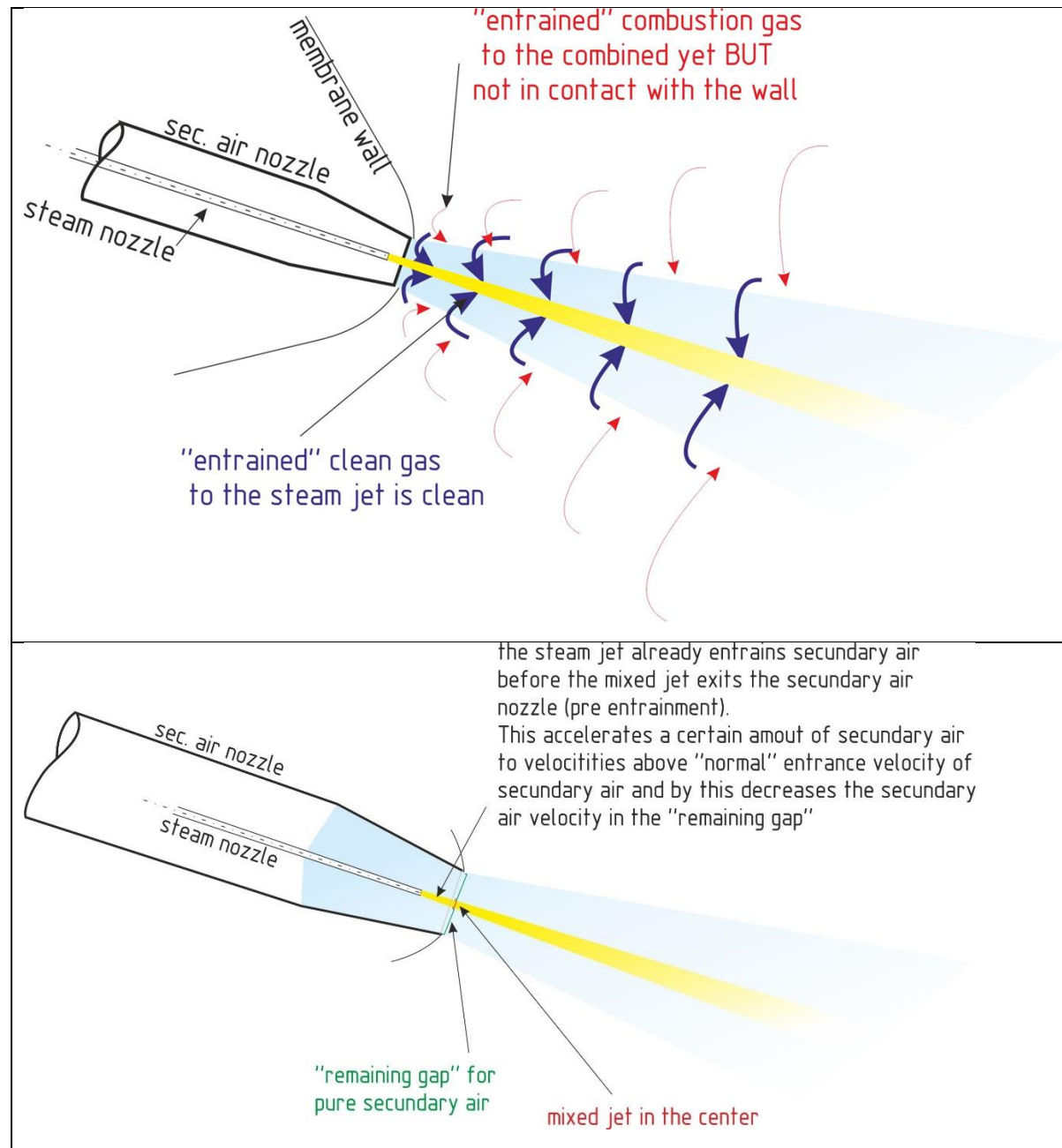


# Origin of slagging at secondary air level



Source: Sascha Krueger

# Avoiding slagging at secondary air level

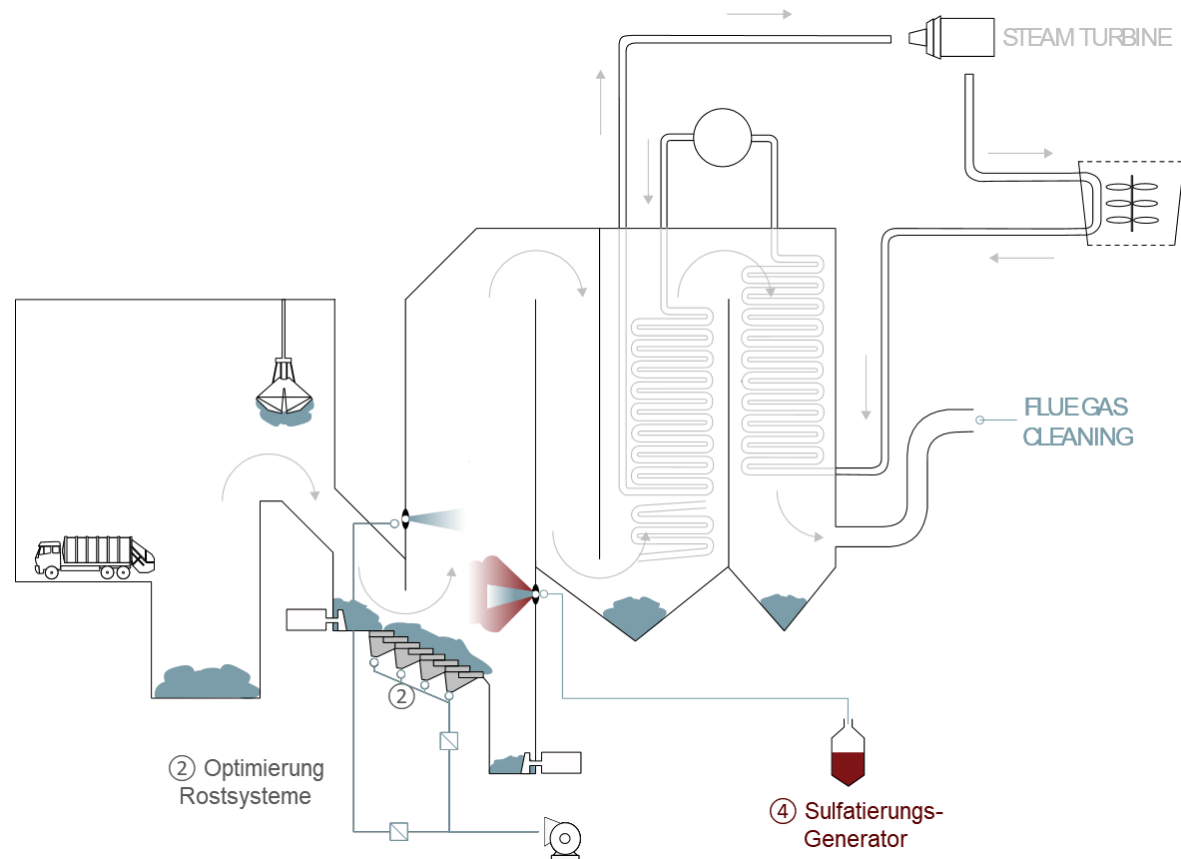
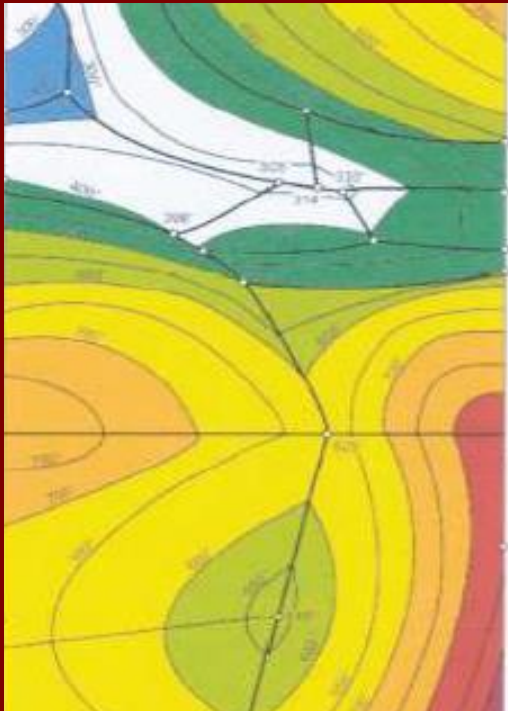


Source: Sascha Krueger



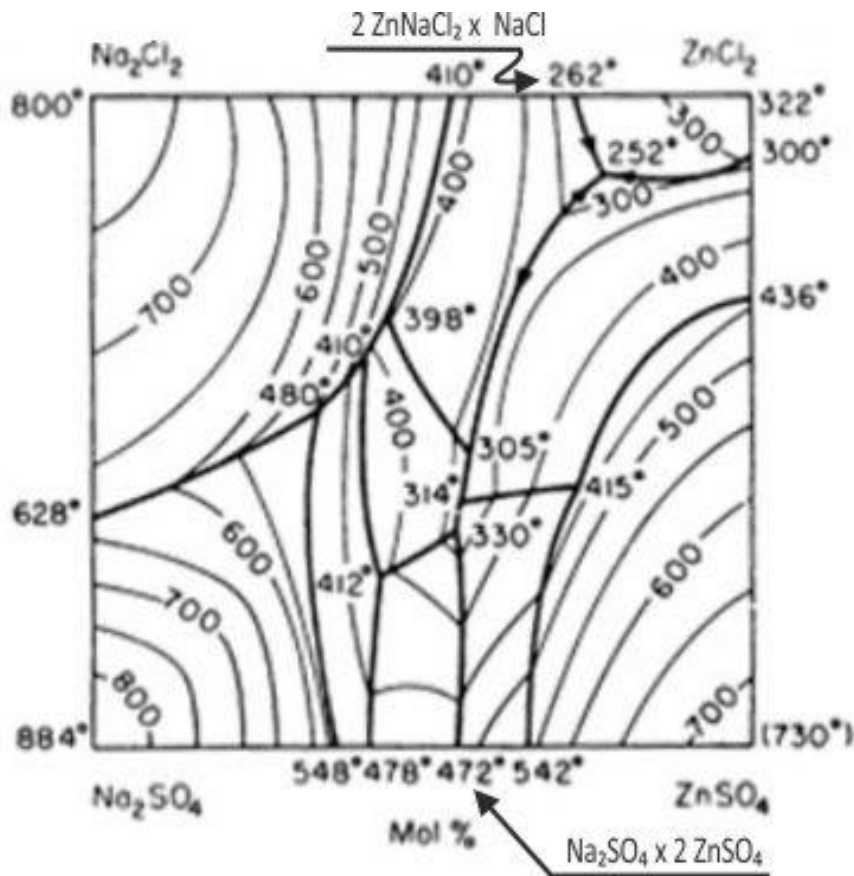


## 4. Preventing fouling and corrosion (Krueger-Sulfatation)





# Avoiding fouling and corrosion



- Temperature lines for phase transition solid-liquid for pure and mixed salts of chlorides and sulphates in systems containing Sodium and Zinc. [1].
- Minimum melting point  
 $2 \text{ ZnNaCl}_2 \times \text{NaCl} = 262 \text{ }^\circ\text{C}$
- Minimal melting point  
 $\text{Na}_2\text{SO}_4 \times 2 \text{ ZnSO}_4 = 472 \text{ }^\circ\text{C}$
- $2 \text{ NaCl} + \text{SO}_3 + \text{H}_2\text{O} \rightarrow \text{Na}_2\text{SO}_4 + 2 \text{ HCl}$

[1] Evseeva, N. N., Bergman, A. G. 1952; further source: Dr. Sascha Kruger

# Equipment Weener test plant

Industrial scale prototype



Distribution kit



Distribution with secondary air

# Weener test plant

- 3-pass boiler with water cooled grate (Baumgarte)
- Commissioning April 2008
- 70 MW thermal with 85 t/h steam at 27 bar/320 °C
- Since 2013: Performance increase to 77 MW with 93,5 t/h steam
- Since 2017: Performance increase to 84 MW with 102 t/h steam
- Round about 50 % of steam for paper factory
- Excess steam to 2 condensation turbines of 9,4 MWel
- Throughput of refuse derived fuel
 

2009-2014	162.500 t/a
2015:	188.585 t/a

Source: Thomas Tappe, WVT Breiding Rostock 2016

# Dosing and distribution skid



Pymouth test plant





# Injection through overfire air

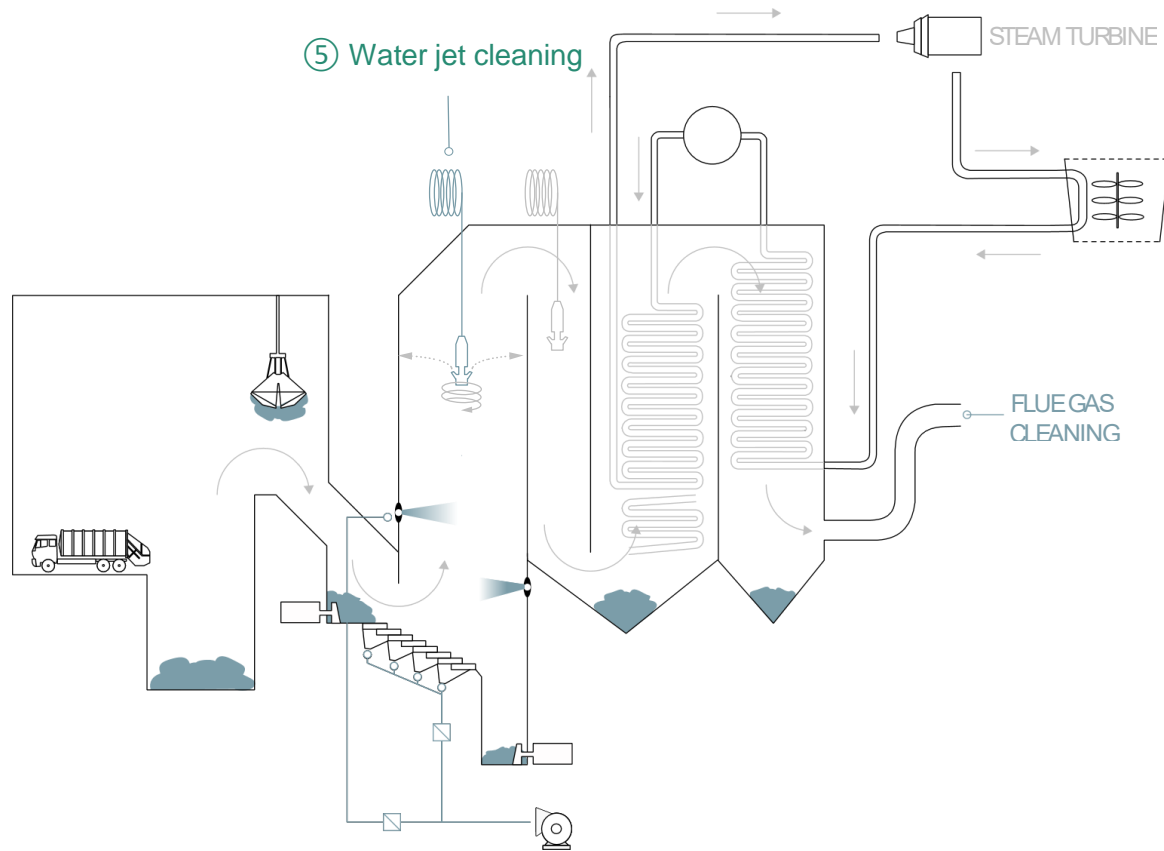


Plymouth test plant





## 5. Water jet boiler cleaning (DD Jet)



# Turning self propelled nozzle head



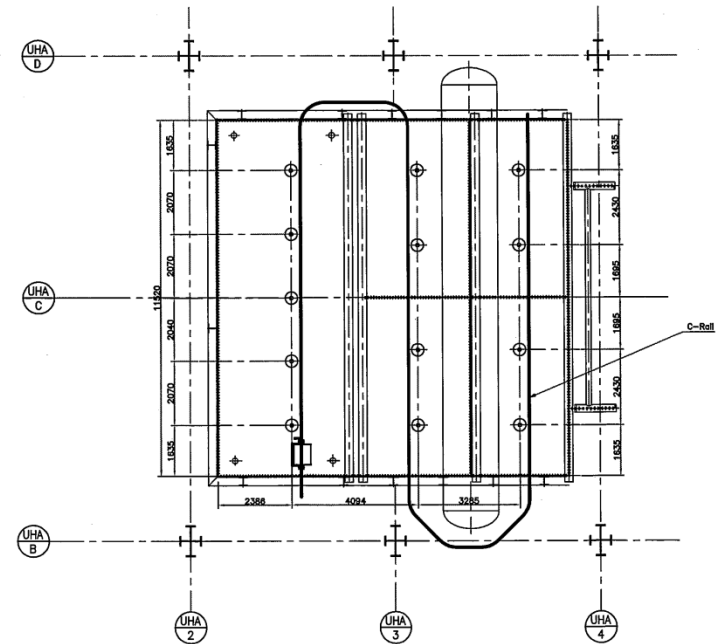
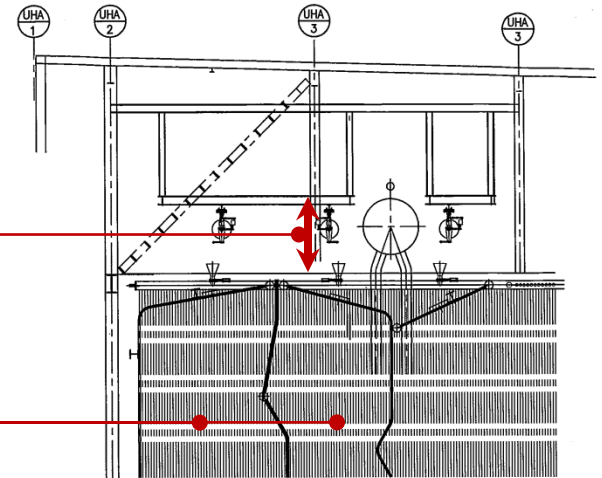
# Full installation



# Inegration into the boilers

Installation height < 2 m

Efficient cleaning up to 6 m

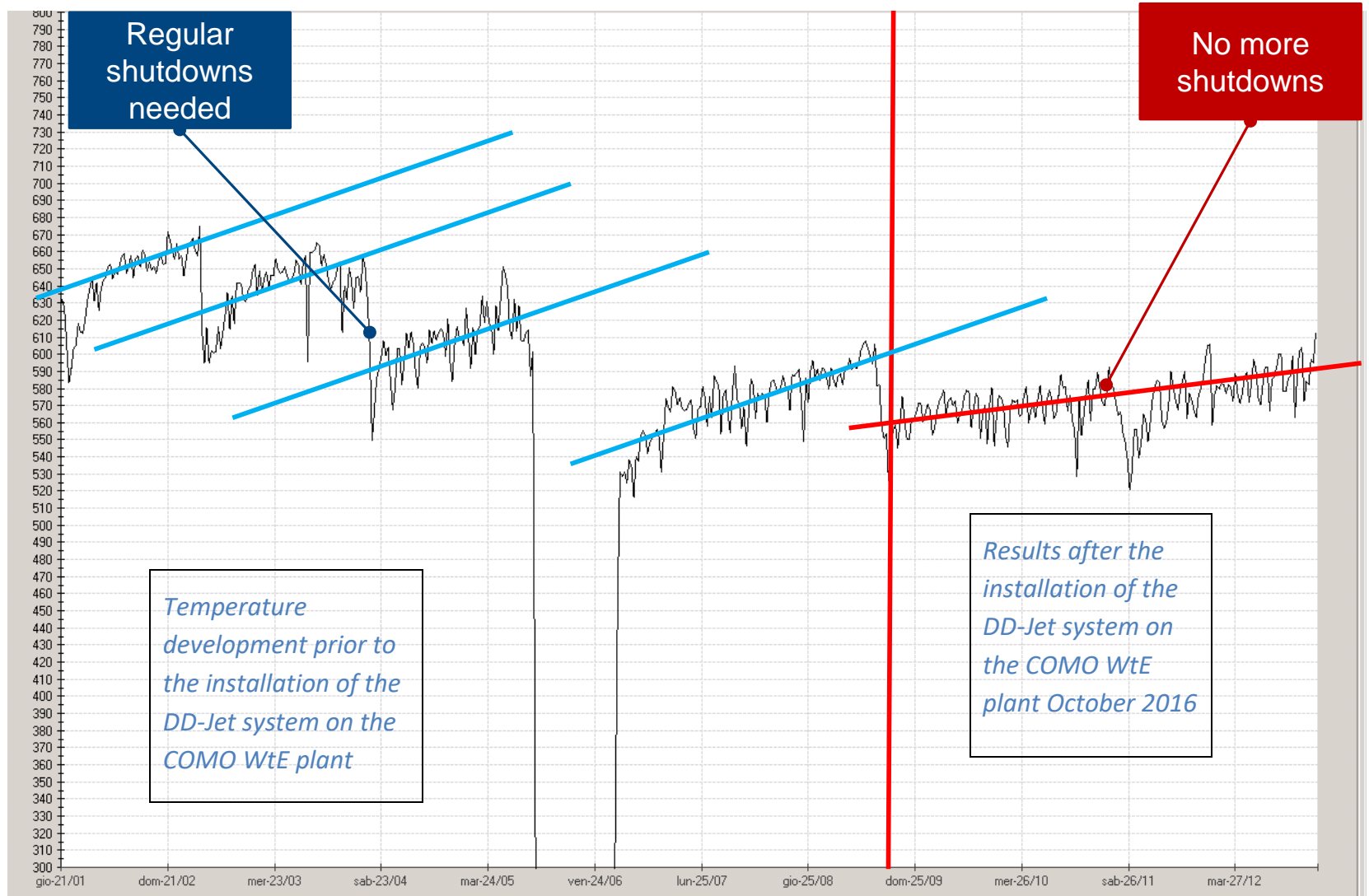


# Recent DD-Jet references

- **Veolia Singapore, fully automated system**
- **HVC Dordrecht, NL, fully automated system**
- **Klinge Weener, D, fully automated system for 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup> pass**
- **GEQ Shinseung, S. Korea, fully automated system**
- **Charleroi, Belgium, fully automated system**
- **Hallingdal, Norway, semi automated system**
- **Veolia STVL Limoges, France, 2 semi automated systems**
- **IVM Eeklo, Belgium, 2 DD-Jet Nozzle heads**
- **IVAGO, Belgium, 1 DD-Jet Nozzle head**
- **Essent Wijster, Holland, 4 DD-Jet Nozzle heads**
- **IBW Virginal, Belgium, full system (Fabricom project)**
- **Veolia Italy, Gioro Tauro, Fluid bed, semi automated system**
- **Vaasa, Finland, HZI, semi automated system Vantaa**
- **Finland, HZI, 2 fully automated systems**

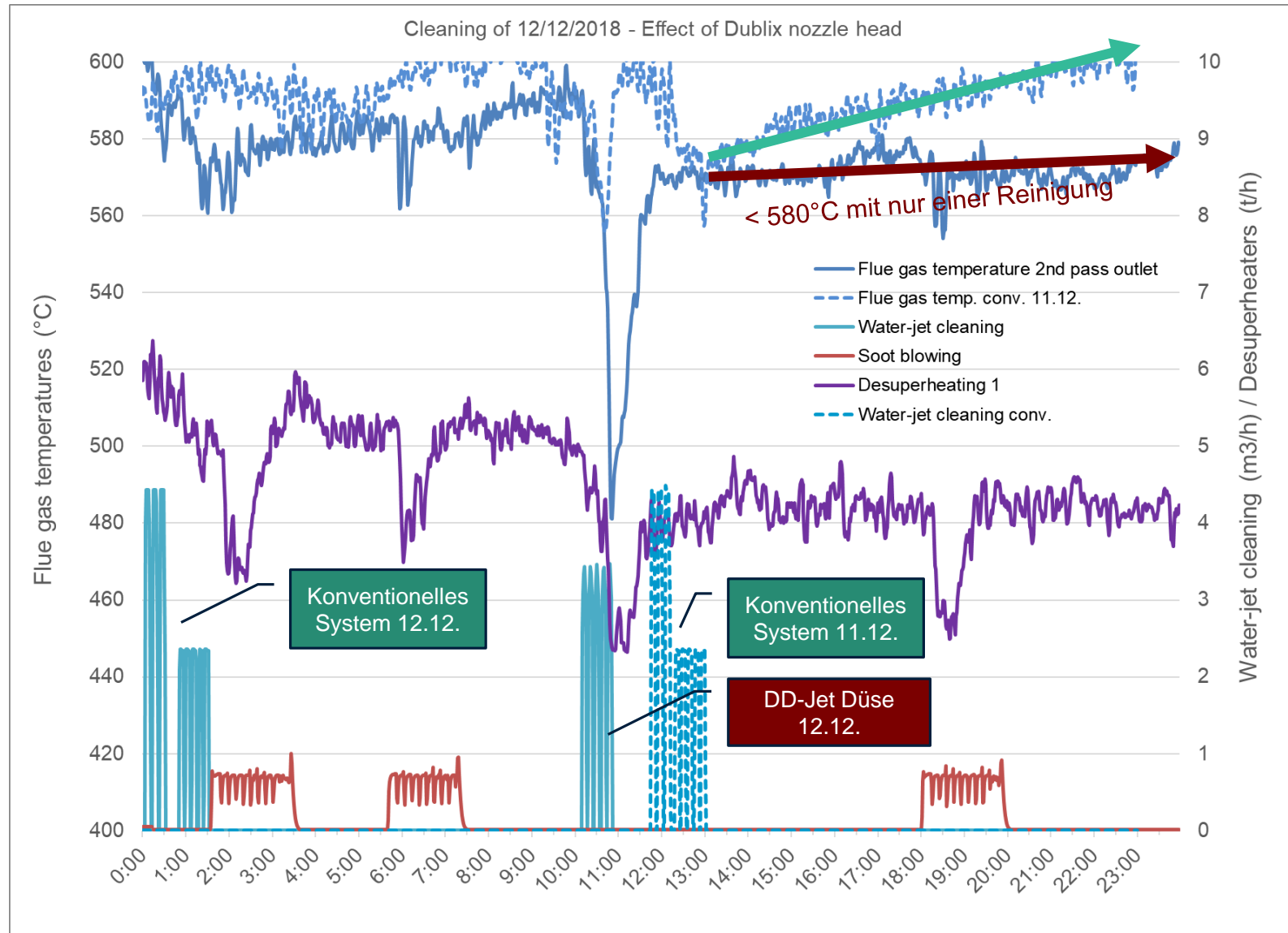


# DD-Jet case Como

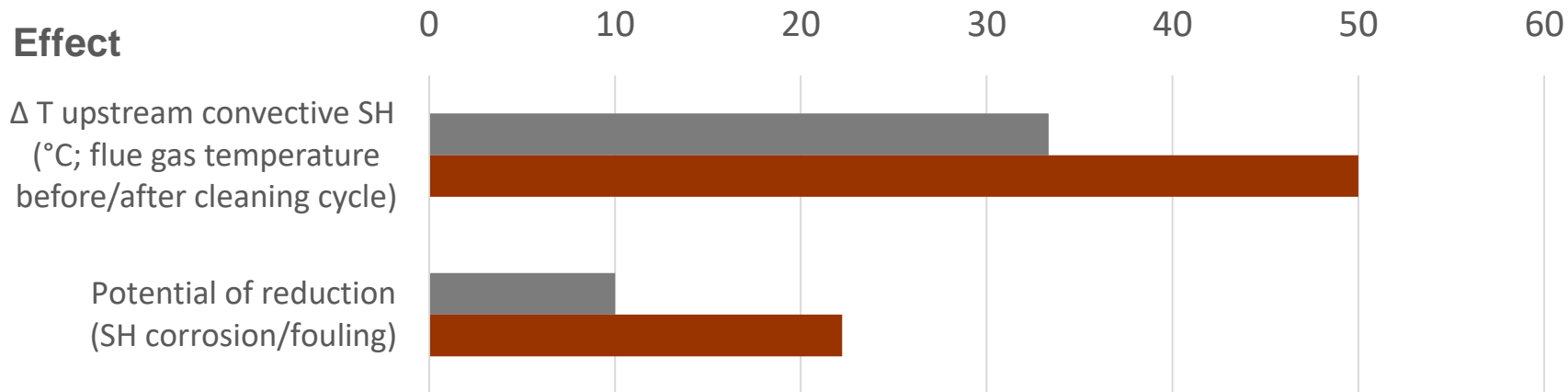
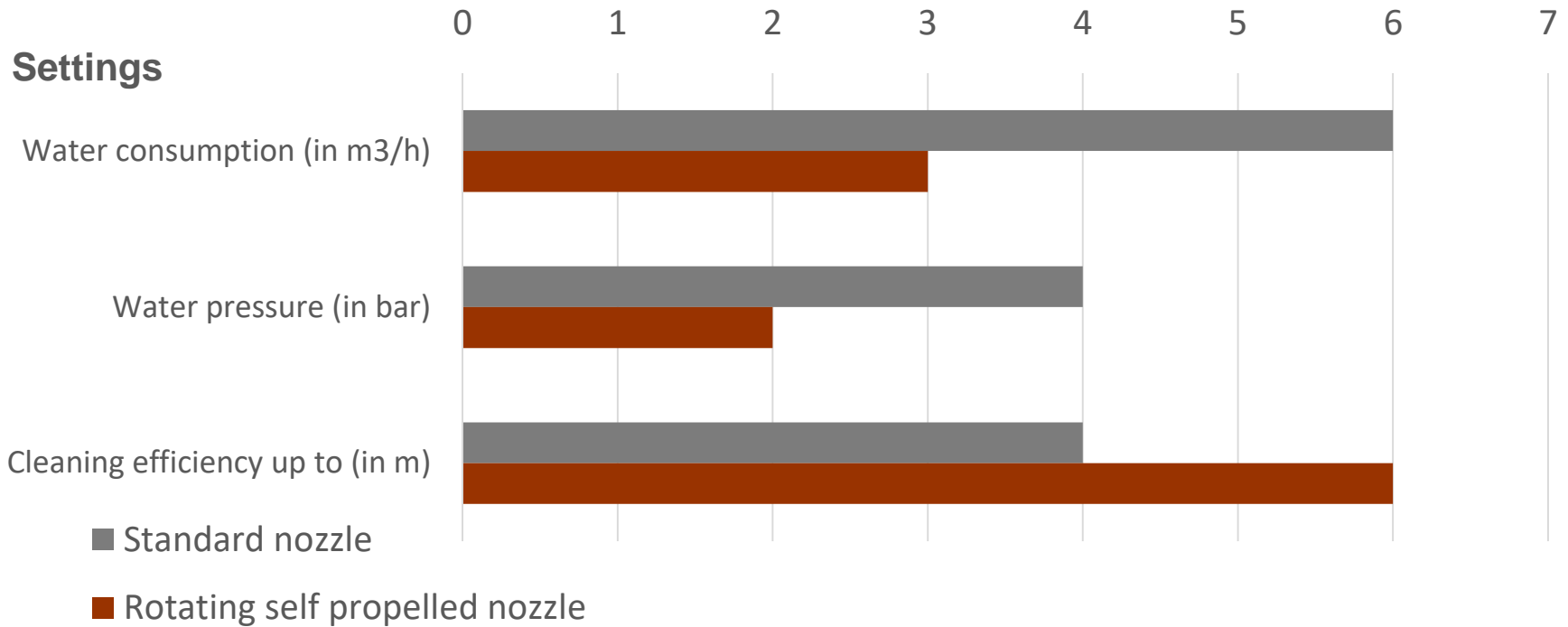


Time scale =  
3 months

# Comparison to day before (conventional nozzle head)

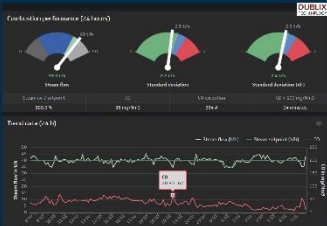


# Effect of self propelled turning DD-Jet nozzle



# Engineered solutions to boost the performance of your Waste-to-Energy plant!

## High level combustion control FuzEvent



- Standardized and modular
- No “black-box”
- Existing control stays in place
- > 20% increase of combustion stability
- > 20 references

## Combustion grate improvements DUB3



- DUB3 system (for Volund)
- Engineering, services / parts
- > 35% reduced outage time
- > 25 references

## CO reduction with steam injection BoosterSteam



- Supersonic steam for penetration
- Reduced secondary air
- > 35% reduced CO emissions
- > 5 years in Schwandorf/D

## Preventing fouling and corrosion SulfGen



- Sulfur injected with overfire air
- Sulfatation of Chlorides in fly ash/deposits
- > 35% reduced fouling and corrosion
- > 5 years in Weener/D

## Water jet boiler cleaning DD-Jet



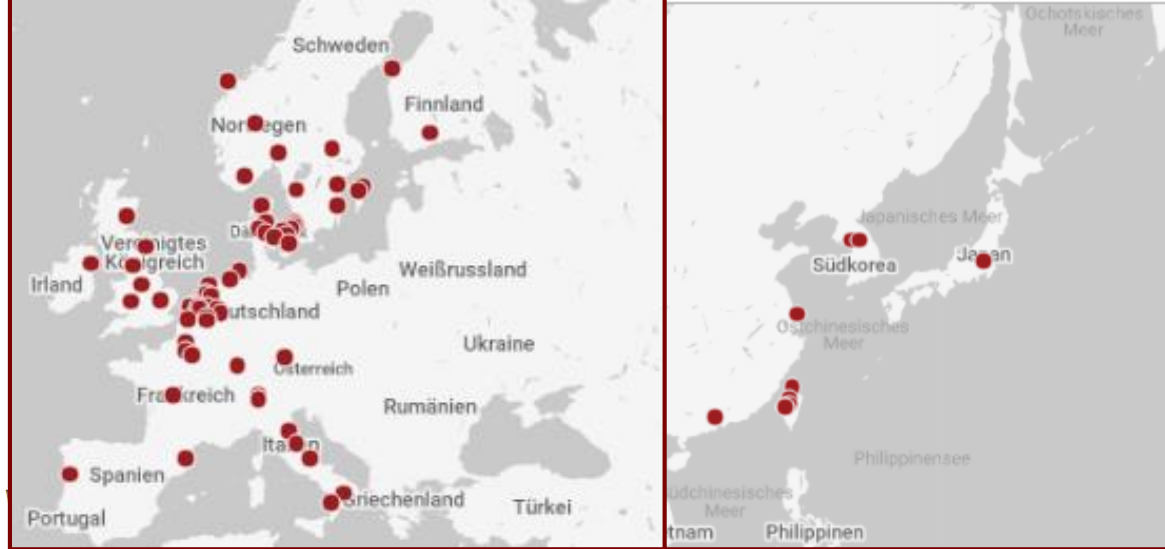
- Self propelled turning nozzle
- Efficient up to 6m from nozzle
- > 80°C reduced flue gas temp.
- > 25 references



# References

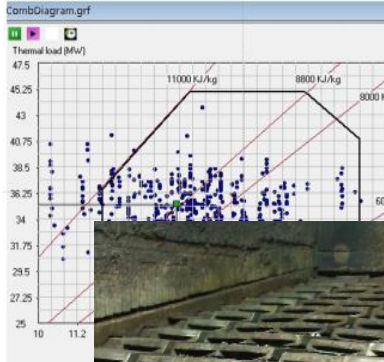
See:

[www.dublrx.com/library/references](http://www.dublrx.com/library/references)



Year	Project	Technologies	Country
2018	Optimization of flue gas cleaning	Combustion Engineering Services	Japan
2018	DD-Jet system for AffaldPlus Slagelse	Boiler Cleaning	Denmark
2018	DD-Jet For HVC Dordrecht, Netherlands	Boiler Cleaning	Netherlands
2018	DD-Jet Automatic System for Veolia ES Singapore Ind. Pte Ltd	Boiler Cleaning	Singapore
2018	Borregaard EKG, WtE plant optimization	Combustion Engineering Services • Combustion Feasibility Study • High-Level Control	Norway
2018	Tafjord Kraftvarme AS, lifetime evaluation	Boiler Cleaning • Combustion Engineering Services • Combustion Feasibility Study • Combustion Grates • High-Level Control	Norway
2018	Plant optimization a2a Milano-Silla 2	Combustion Engineering Services	Italy
2018	BoosterSteam feasibility study SWM Munich-North	Combustion Feasibility Study	Germany
2018	IVOO, Oostende 2*4,5 ton waste/h	Combustion Feasibility Study • Commissioning & Supervision • High-Level Control • Service Contract	Belgium
2018	Bionerga, Houthalen 2*8.5 ton waste/hour	Combustion Engineering Services • Combustion Feasibility Study • Commissioning & Supervision • High-Level Control • Service Contract	Belgium
2018	DD-Jet boiler cleaning at SRF plant in Weener SRF (Klinge Paperwerke)	Boiler Cleaning	Germany

It is about **developing** smart engineered solutions ...



Combustion control



Combustion grate improvements



Steam injection



Preventing fouling and corrosion



Boiler cleaning

But also about good cooperation!

