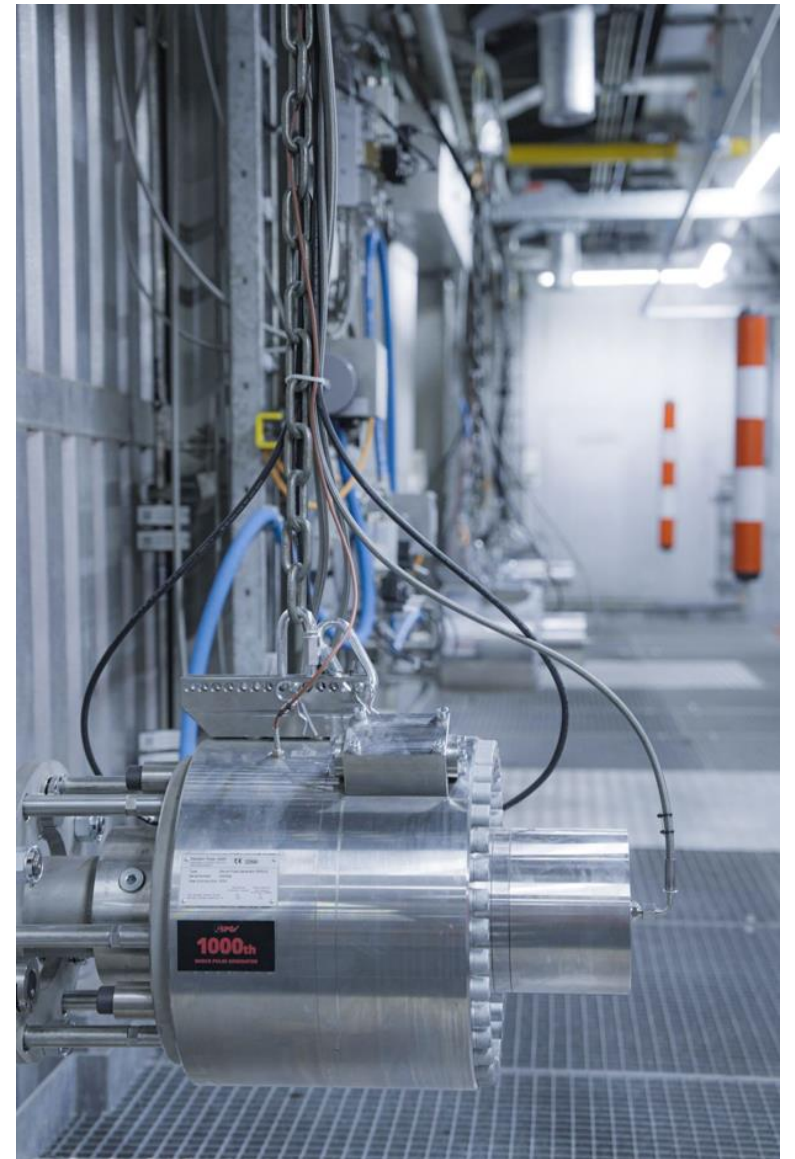


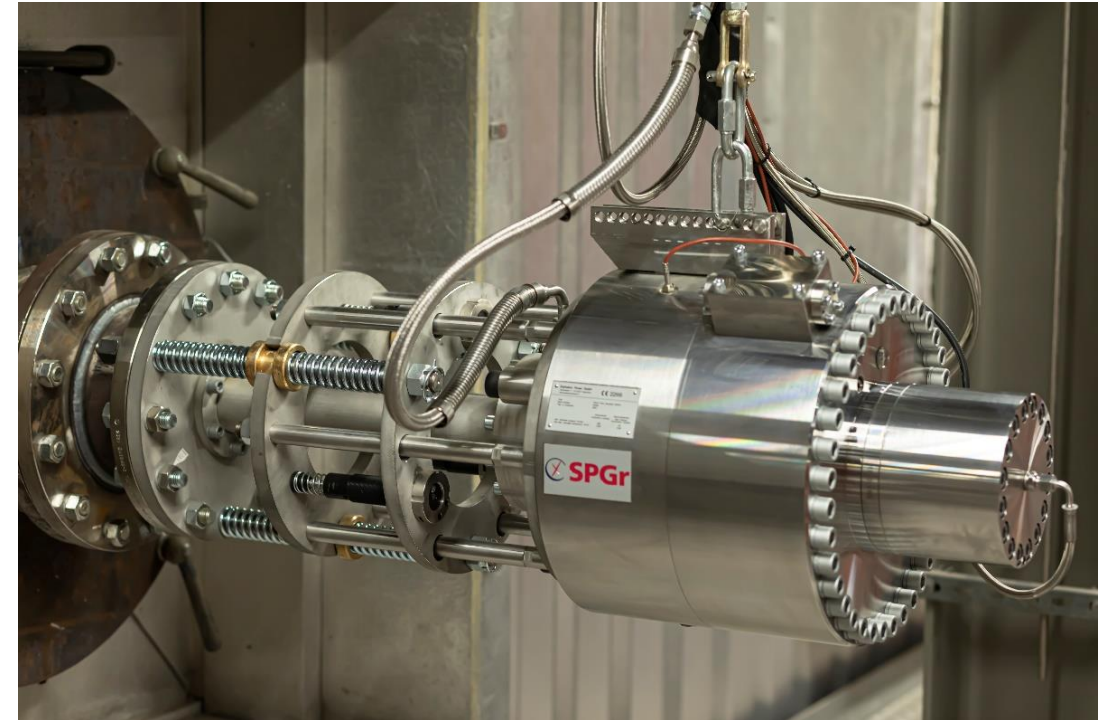
Valmet: Shock Pulse Generator Update

CIBO May 2024



Agenda

- Background
- Applications
- Cleaning and system setup
- CO₂ reduction
- Milano case study 1
- Silbitz case study 2
- Biomass case study 3
- Future installs
- Key takeaways



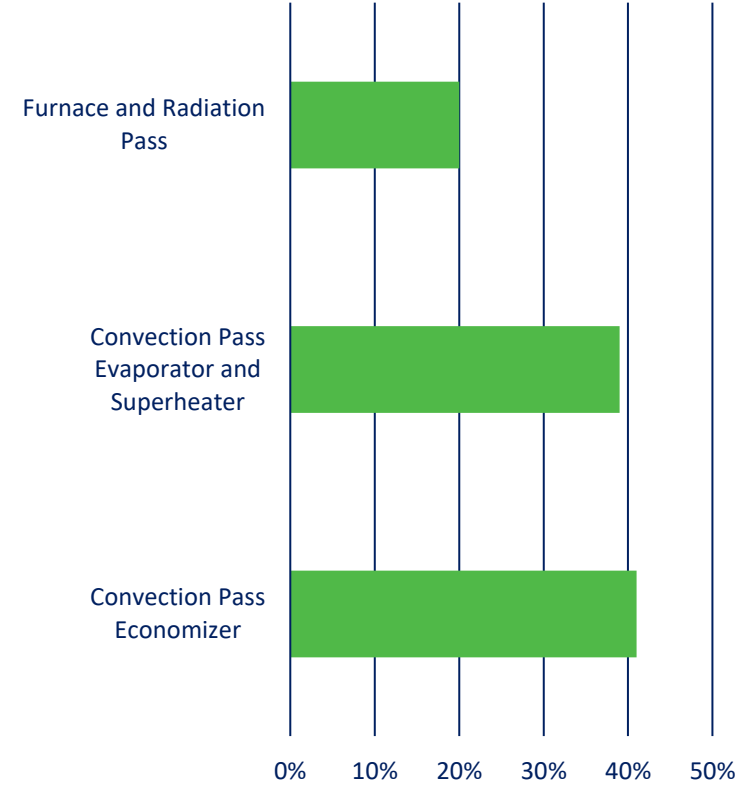
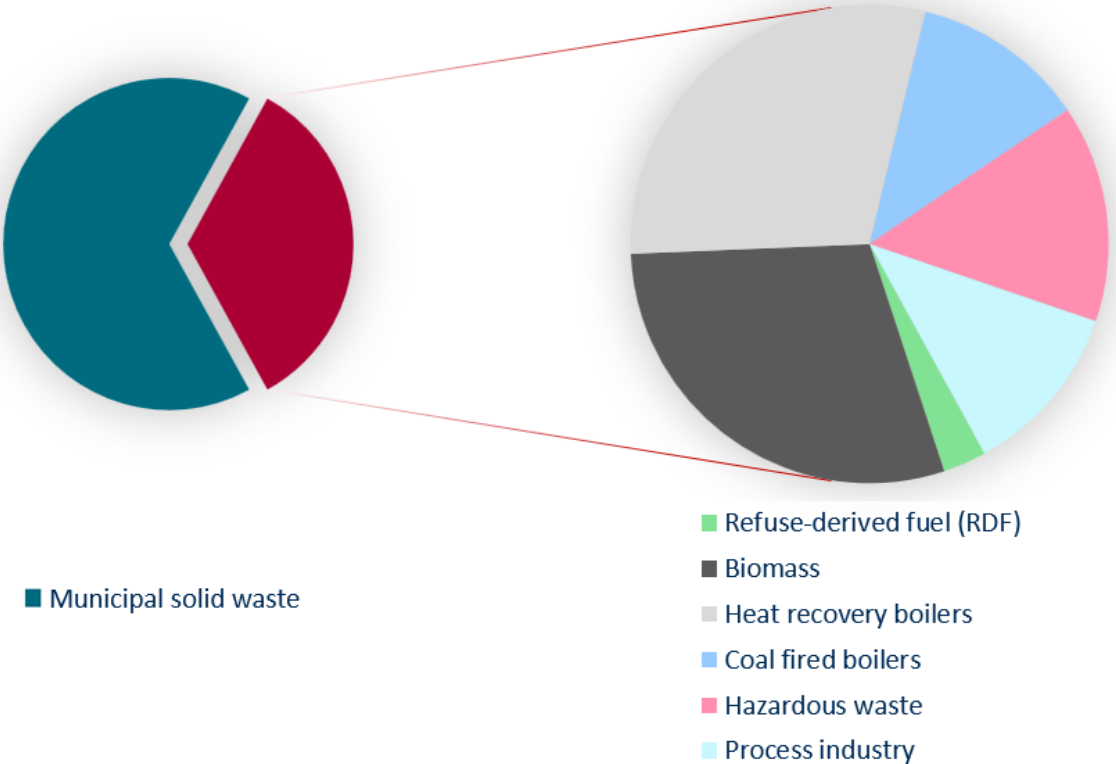
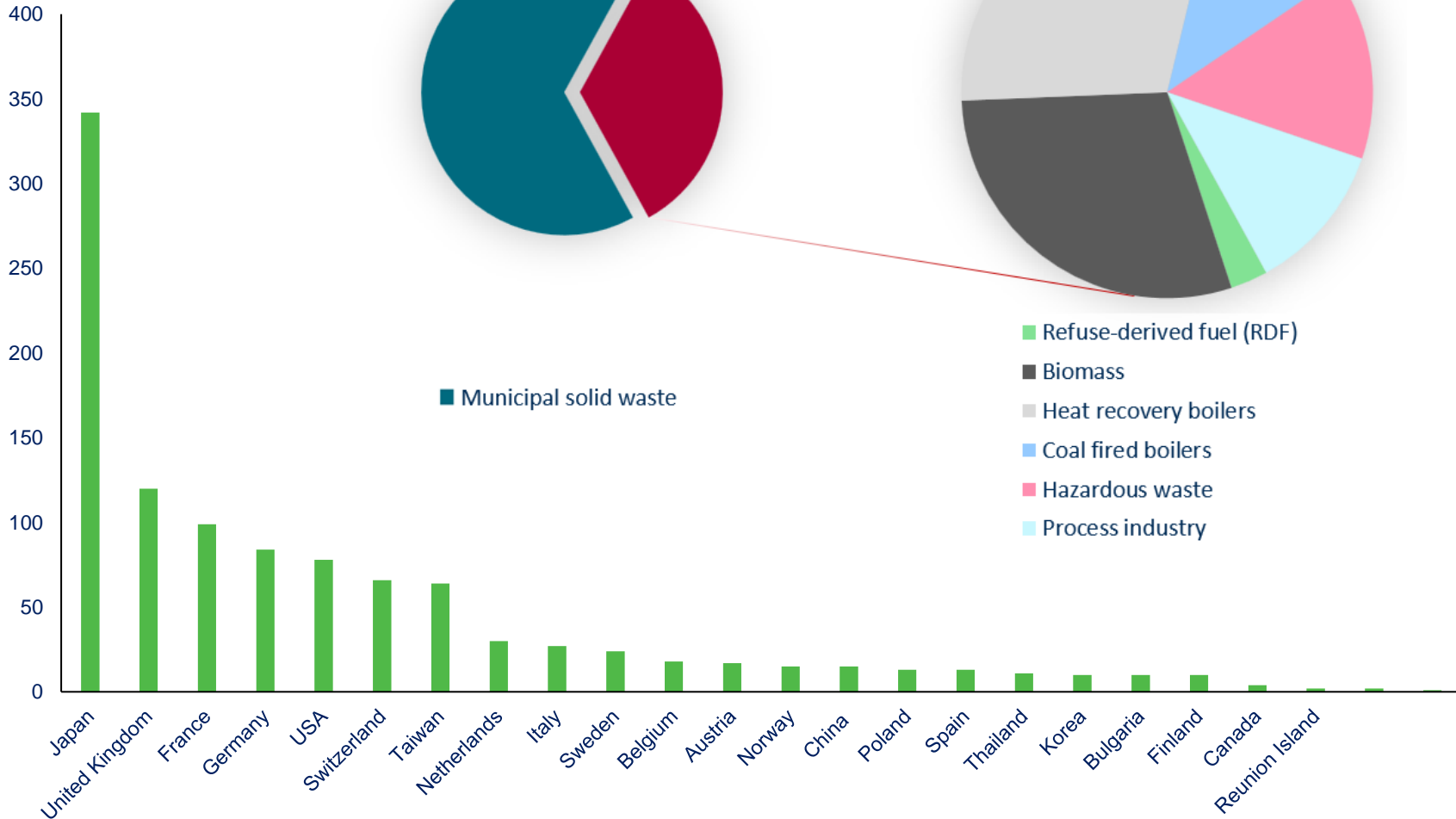
Technology Origin

- 3rd generation is comprehensive step forward utilizing Shock Pulse Generators as mechanism for cleaning
- Technology developed and patented in 2009 by Explosion Power GmbH
- Broad application for utility and industrial boiler designs
- Ability to clean from upper furnace through air preheaters
- Over 1200 units installed at over 150 facilities worldwide
- Valmet has a distribution agreement with Explosion Power for North America

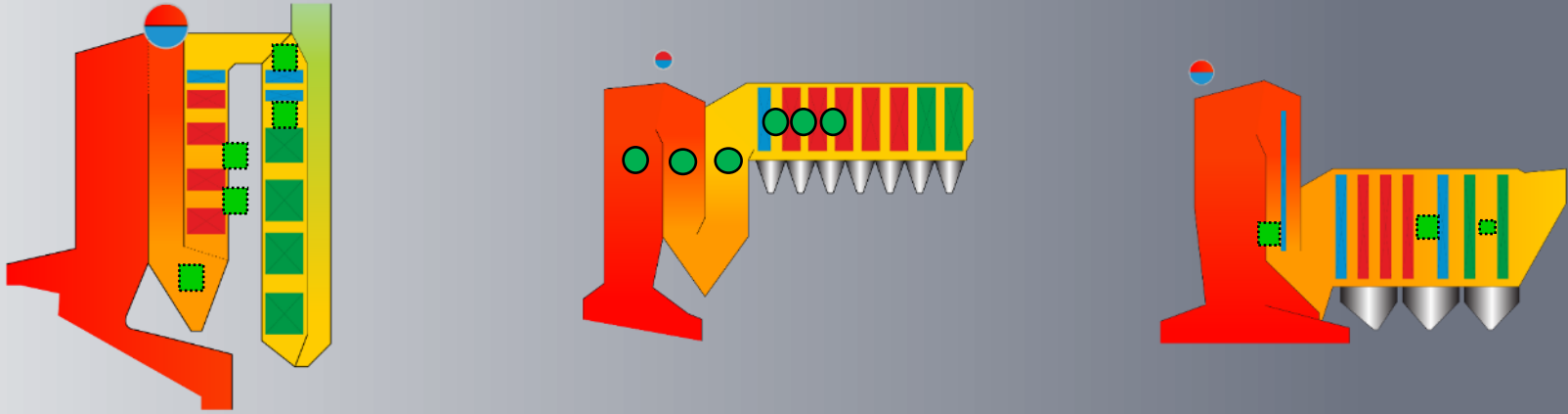


Application Range

Percent of delivered SPGs



Application Range



22 KPPH

Steaming Rate

2209 KPPH

8.2 ft

Boiler Width

78.7 ft

392 °F

Temperature

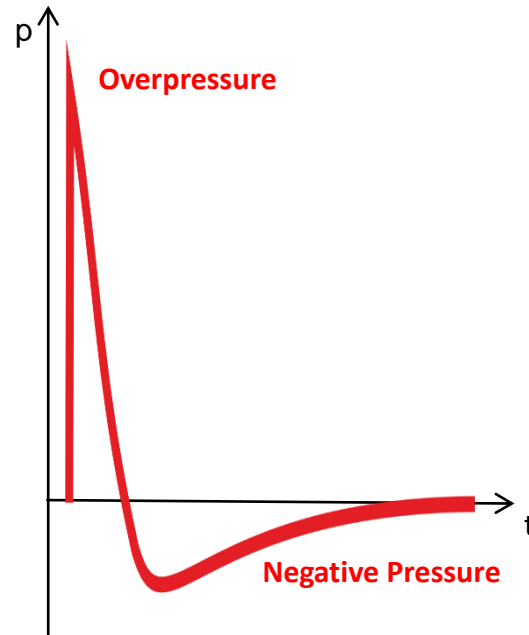
2732 °F

Main Cleaning Mechanism of the Shock Pulse



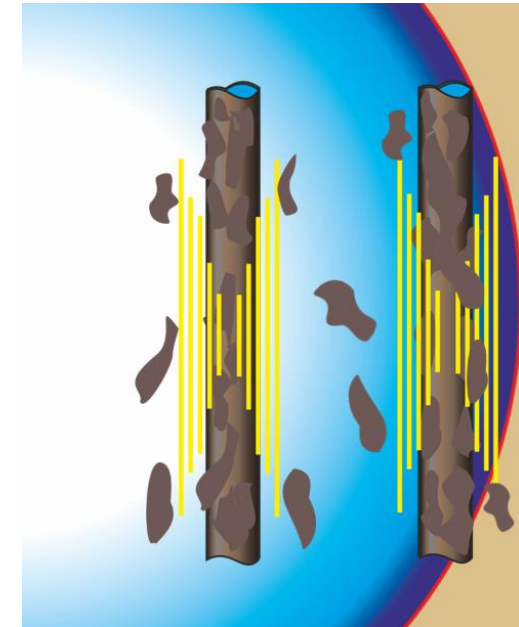
Impact-sound vibration

- Induction of an impacted-sound vibration within the fouling
- Generation of tension and compressive stress
- Initiation of cracks inside the fouling; Support of the fouling removal.



Pulling and suction effect

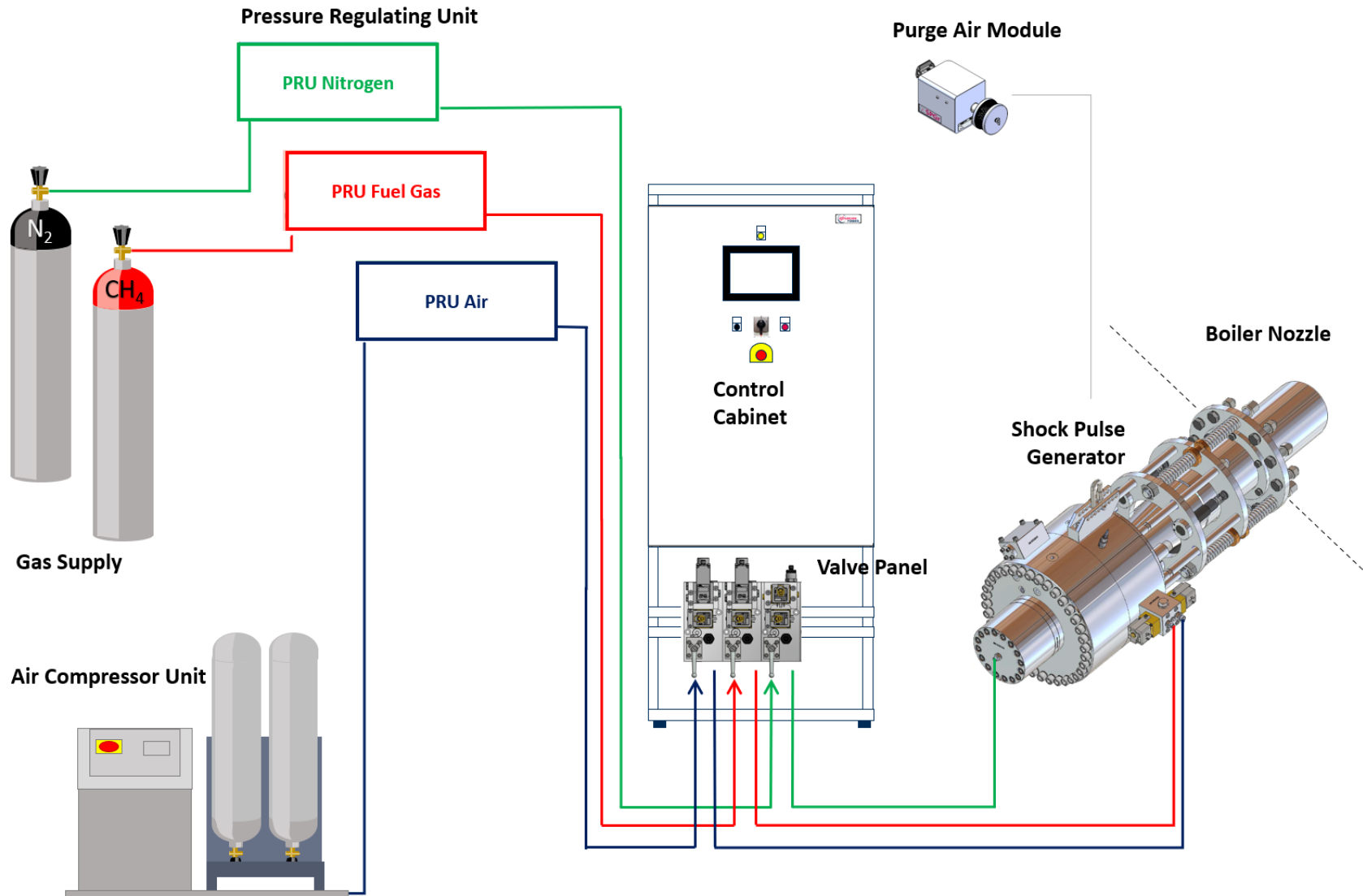
- According to the Friedlander wave form the shock peak is followed by a zone with negative pressure
- This pulling and suction effect promotes the removal of the fouling



Short-term vibration

- A short-term vibration of the tube-bundle is initiated by the shock wave
- This supports removal and cleaning effect

System Setup SPGr



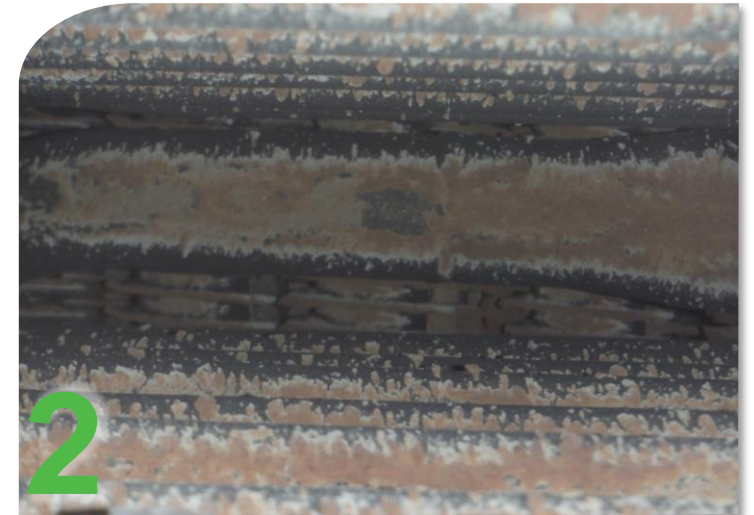
SPG Advantages

- Most efficient boiler cleaning nevertheless gentle towards boiler tubes (no abrasion)
- Lower flue gas temperatures
- Higher boiler efficiency
- Higher plant availability due to extended period of operation
- Less cleaning required during boiler shutdowns
- Fast and easy installation

Regular Sootblower operation



5 months after only SPGs



Environmental Benefits

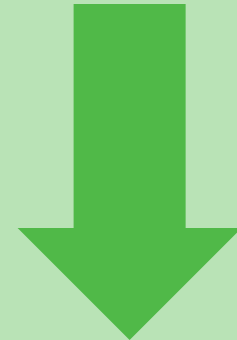
Eliminating Sootblower Steam in a Recovery Boiler

- **Background**

- 74 total sootblowers
- 70,000 lb/hr of sootblower steam= 932,000 MMBTU/year
- SPG natural gas use= 500 MMBTU/year, air compressor = 80.2 MMBTU/year

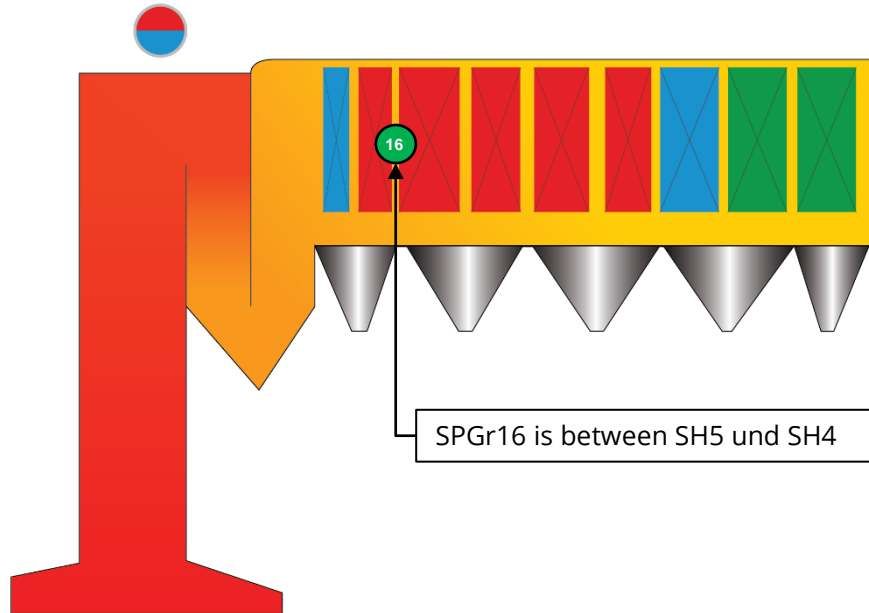
- **If all sootblowers are replaced...**

- 6.8% reduction in energy cost/salable Ton paper board (932,000 MMBTU/year)
- 12% reduction in fossil CO₂/salable Ton paper board (53,000 T CO₂/year)
- 7.5% reduction in RB flue gas volume to Precipitator
- 0.5% reduction in mill water usage (75 MGal/year)



Waste to energy (WtE) plant - Milano

Case 1 Background



16 Shock Pulse Generator SPGr16 at side wall

Boiler data

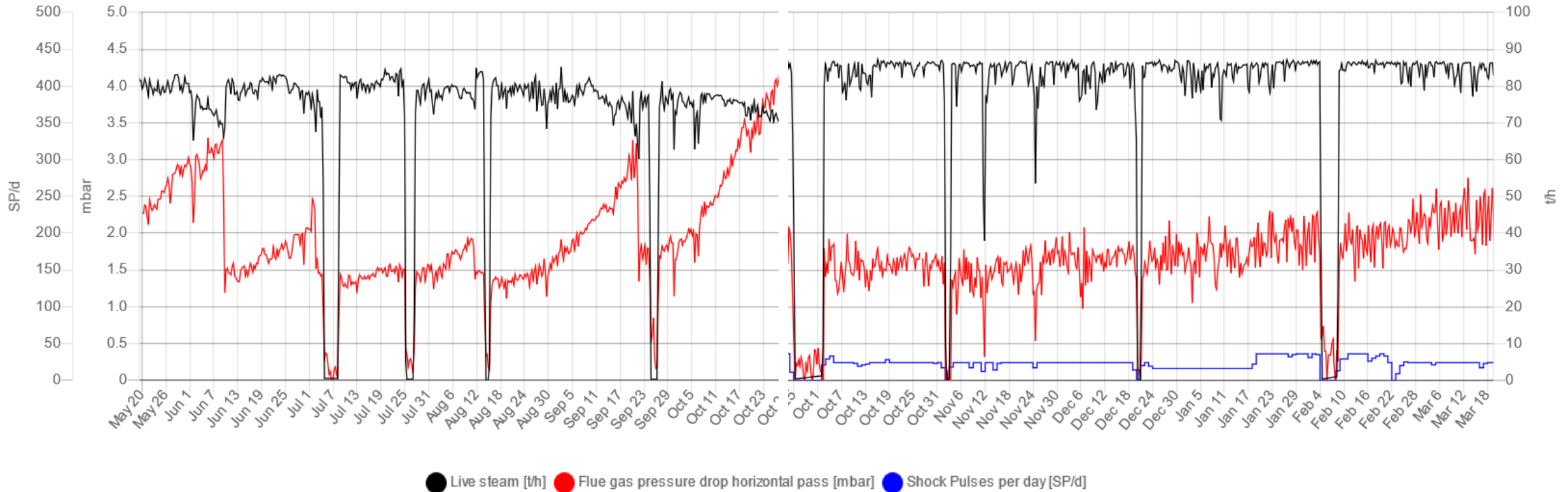
- 3 identical boilers
- Steam production: 190 KPPH per boiler
- Radiation pass width= 28.2 m
- Horizontal pass width= 20.3 m
- Shock Pulses: ca. 36 per day, in Mixed Mode operation

WtE Plant – Milano Case 1

6 months period

No SPG 2021

SPG in Operation 2023



WtE Plan A2A- Milano

Case 1 Results Summary

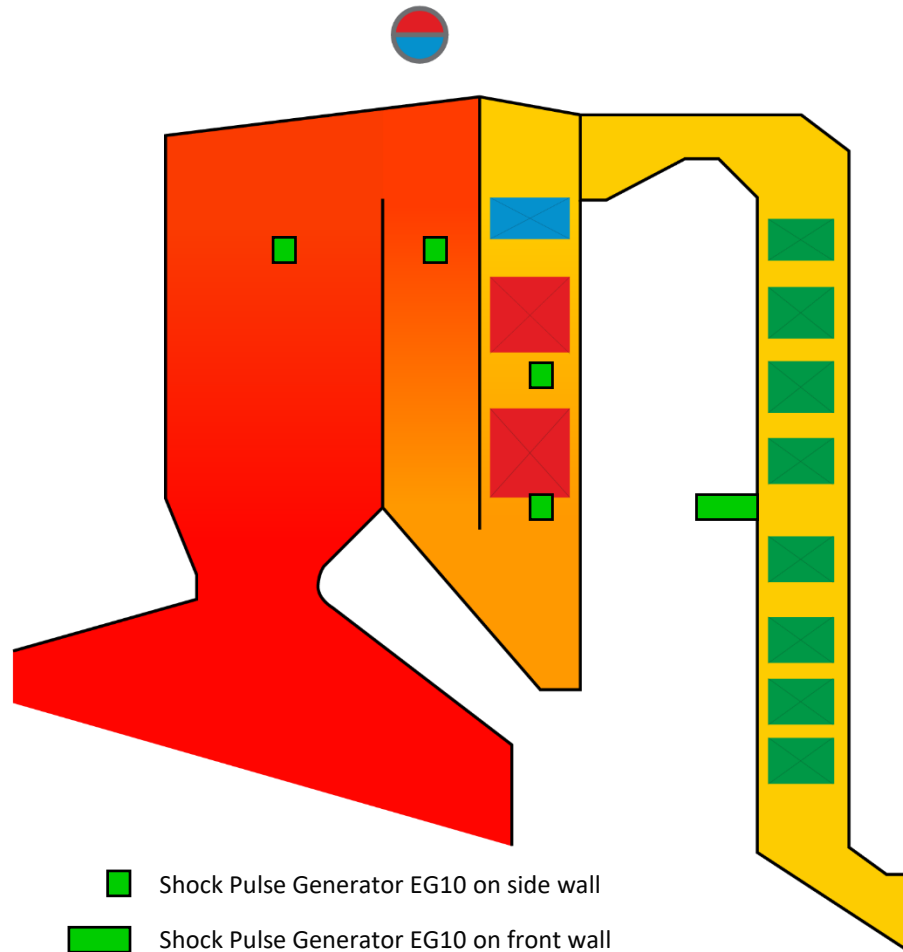
- ↑ 8.6% Increase in steam
- ↓ 17.9% Decrease in flue gas max dp
- ↓ 20-30% Reduced rapping
- ↓ Decreased manual cleanings per year from up to 8 to 1
- ↑ More stable operation



	2021	2023
Live steam	77.9 t/h	84.6
	171.7 Klb/hr	186.5 Klb/hr
Flue gas dp	2.0 mbar	1.8 mbar
	0.8 inwc	0.7 inwc
Flue gas dp (max)	3.0 mbar	3.2 mbar
	1.2 inwc	1.3 inwc

Biomass Boiler Plambeck Holding GmbH - Silbitz (DE)

Case 2 Background



- 62 KPPH steam capacity, 667 psig, 800°F
- Boiler width: 13 ft
- Very good cleaning in furnace. Buildup that would fall and damage the grates was reduced.
- Flue gas temperature was reduced
- Eliminated the need for manual cleaning
- The sootblower operation was reduced

Silbitz Furnace

Case 2 Results



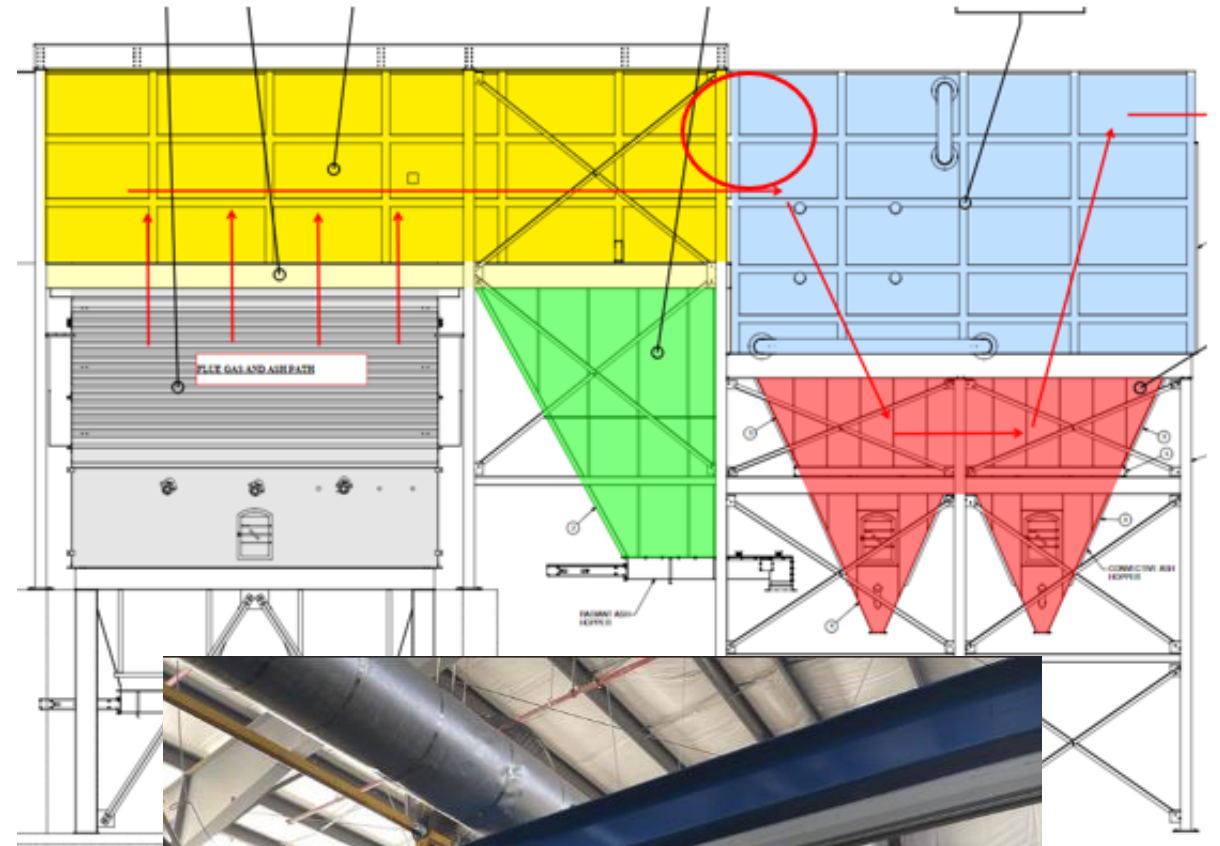
Furnace pass slagging after 10 weeks of operation



Furnace pass slagging after 12 weeks of operation with a Shock Pulse Generator (SPG)

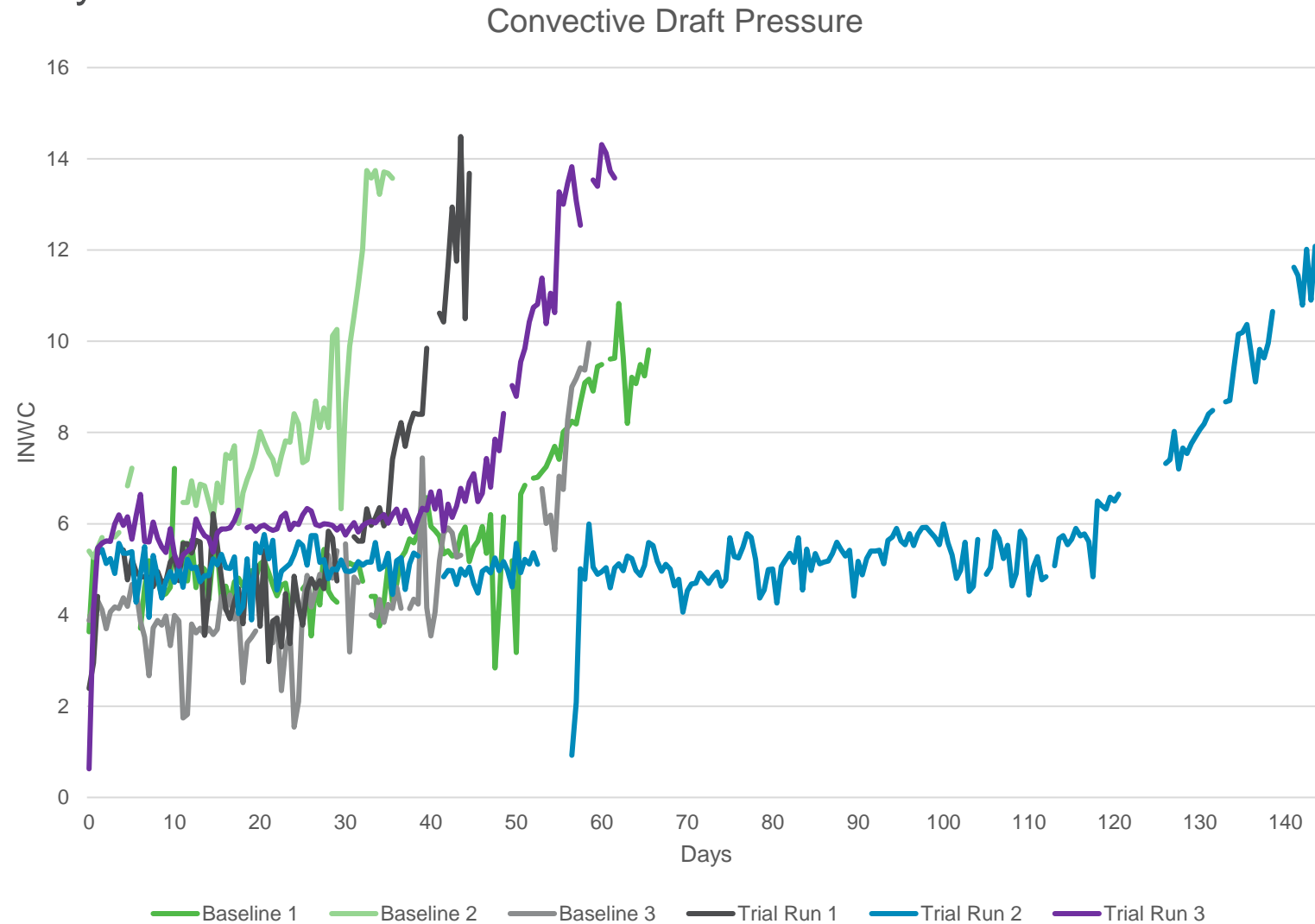
Biomass Boiler Case Study 3

- 6-month trial of EG10XL
- Unit would be used to clean a 110MMBTU Biomass Thermal Oil Heater
- Area of worst fouling occurs at crossover from radiant to convective section (marked with circle).
- Performance of boiler would be judged by increase in draft in convective section



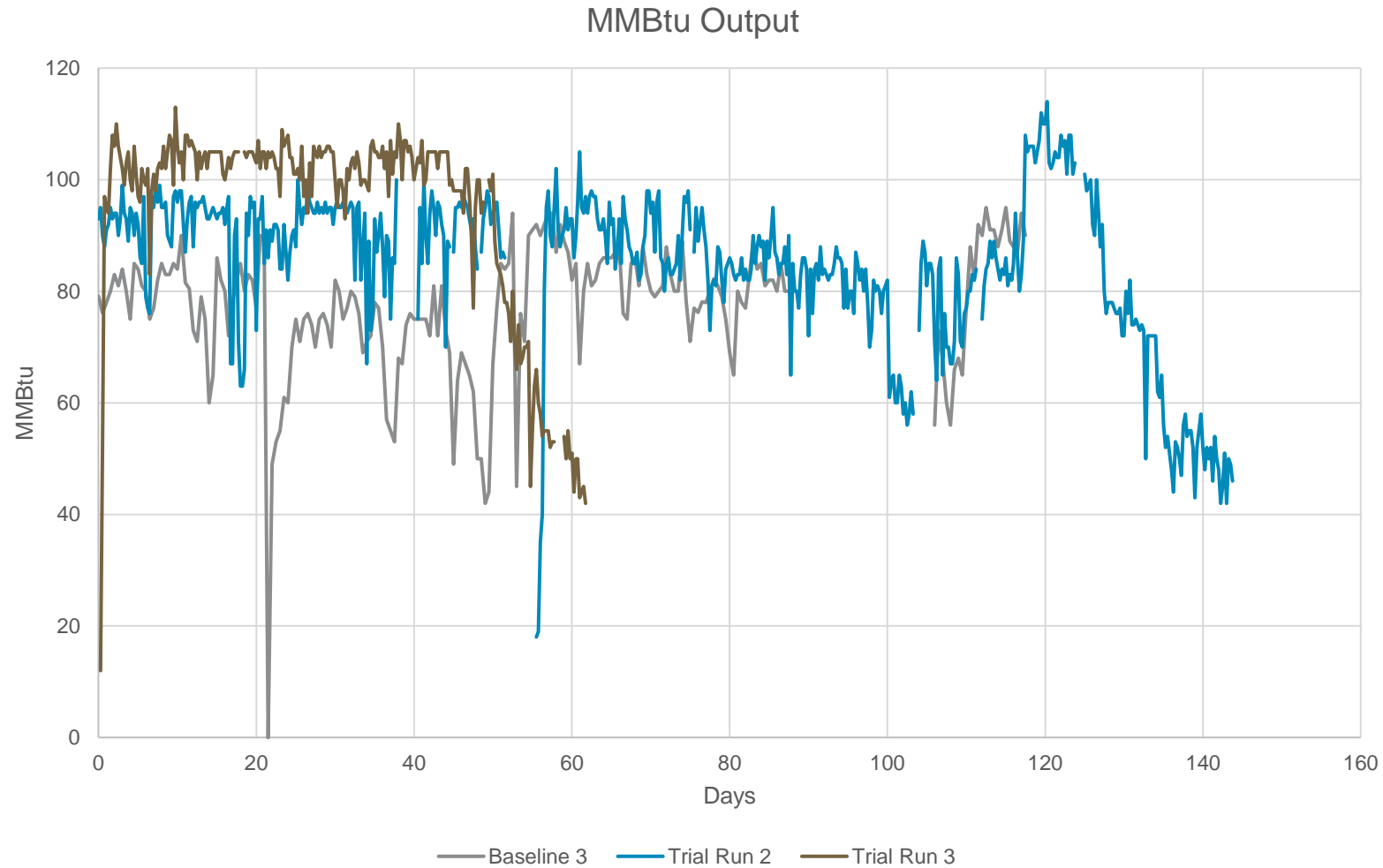
Draft Pressure Results

Biomass Case Study 3



MMBtu Output Results

Biomass Case Study 3



Results Summary

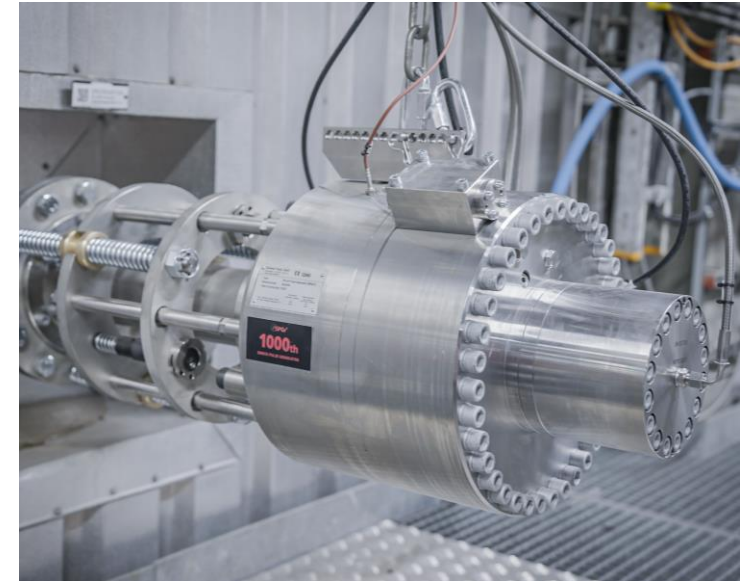
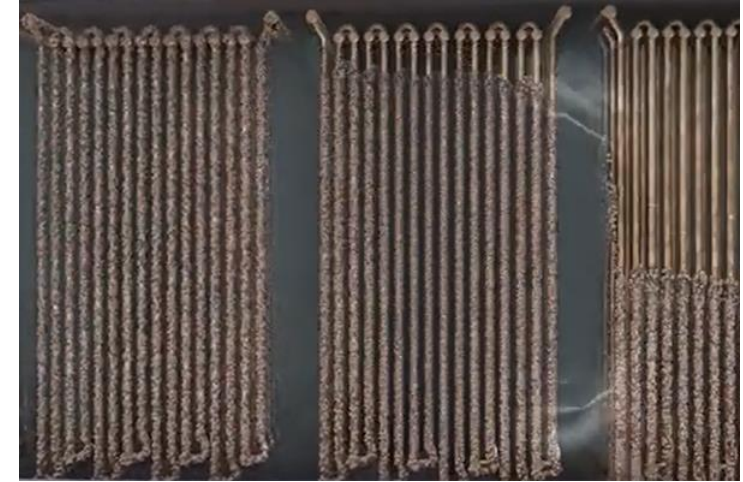
Biomass Case Study 3

- Trial 2: Unit ran for 142 days, average of 85 MMBtu average
- Trial 3: Unit ran for 62 days at 95 MMBtu average which is a 72% increase in runtime at a higher output
- Unit is still operating today



Key Takeaways

- Improved cleaning efficiency compared to other cleaning technologies;
Higher boiler efficiency due to lower exhaust temperature
- Higher plant availability
- Less unplanned shutdowns for cleaning
- No thermal abrasion of boiler pipes
- Reduce sootblowers and steam consumption
- Improved CO₂ plant performance and lower environmental impact
- Opportunity in many different types of applications



Thank You!

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