



HeatMatrix[®]

URNS WASTE HEAT INTO PROFIT

New generation heat exchanger improves industrial energy efficiency

“Turn waste Heat into Profit”

By Robert Sakko

14 November 2013

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- 1 HeatMatrix introduction**
- 2 Waste heat potential
- 3 HeatMatrix technology
- 4 For corrosive and fouling service
- 5 Applications

Introduction HeatMatrix Group

- Founded in 2008, employing 10 people with 10 – 30 yrs industrial experience
- HeatMatrix develops and markets innovative plastic high efficiency heat exchangers
- HeatMatrix's mission is to increase industrial energy efficiency through waste heat recovery
- ISO 9001:2008 certified

Customers



Bonar
partners in performance



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Energy Management

Efficient
Technology

Optimize
usage of
assets

Stop
leakage (a.o.
insulation, steam
traps)

Direct
integration of
waste heat

Waste heat
to heat grids,
to electricity,
heat pumps,
drying

HeatMatrix



Stacks: Energy savings at centralized location



HeatMatrix: Turns waste heat into profit

Opportunity



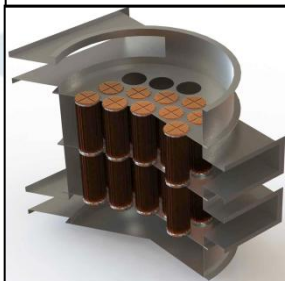
- ~ 90% of hot flue gas was previously cold (combustion) air.
- Simple direct heat integration improves energy efficiency by up to 4% and requires only 1 heat exchanger

Problem



- However, gaseous waste heat streams are difficult to recover with existing technology due to corrosion, fouling, weight

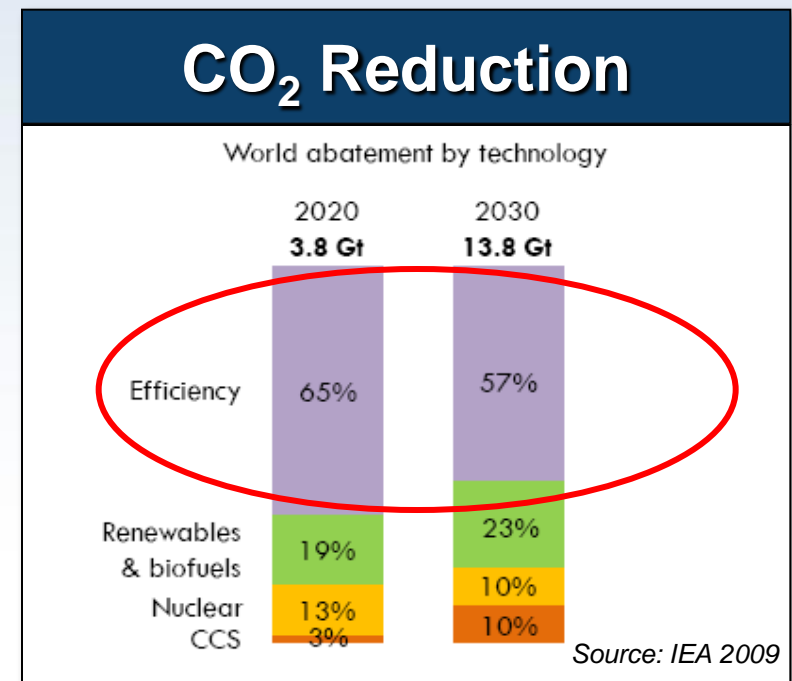
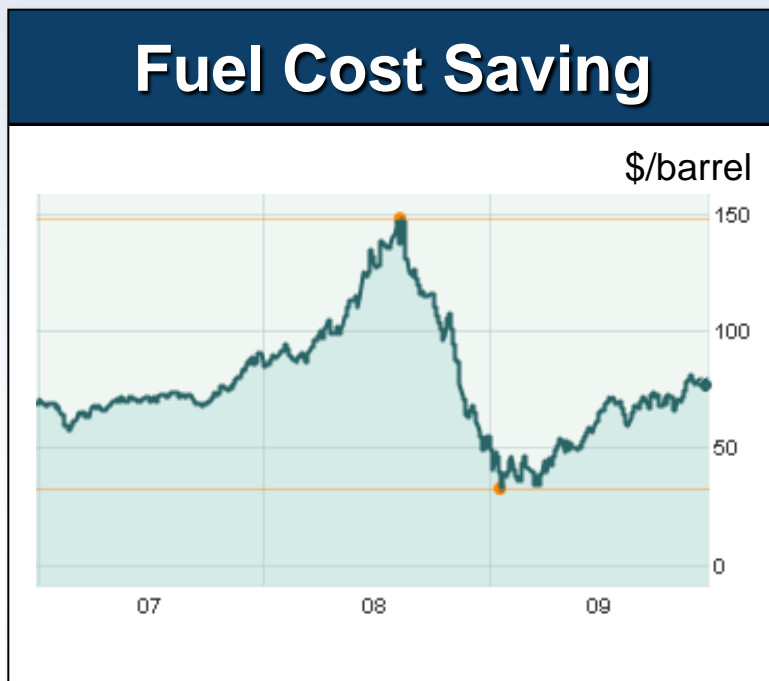
Solution



- HeatMatrix offers a low weight corrosion resistant plastic heat exchanger with an excellent pay-back for these applications

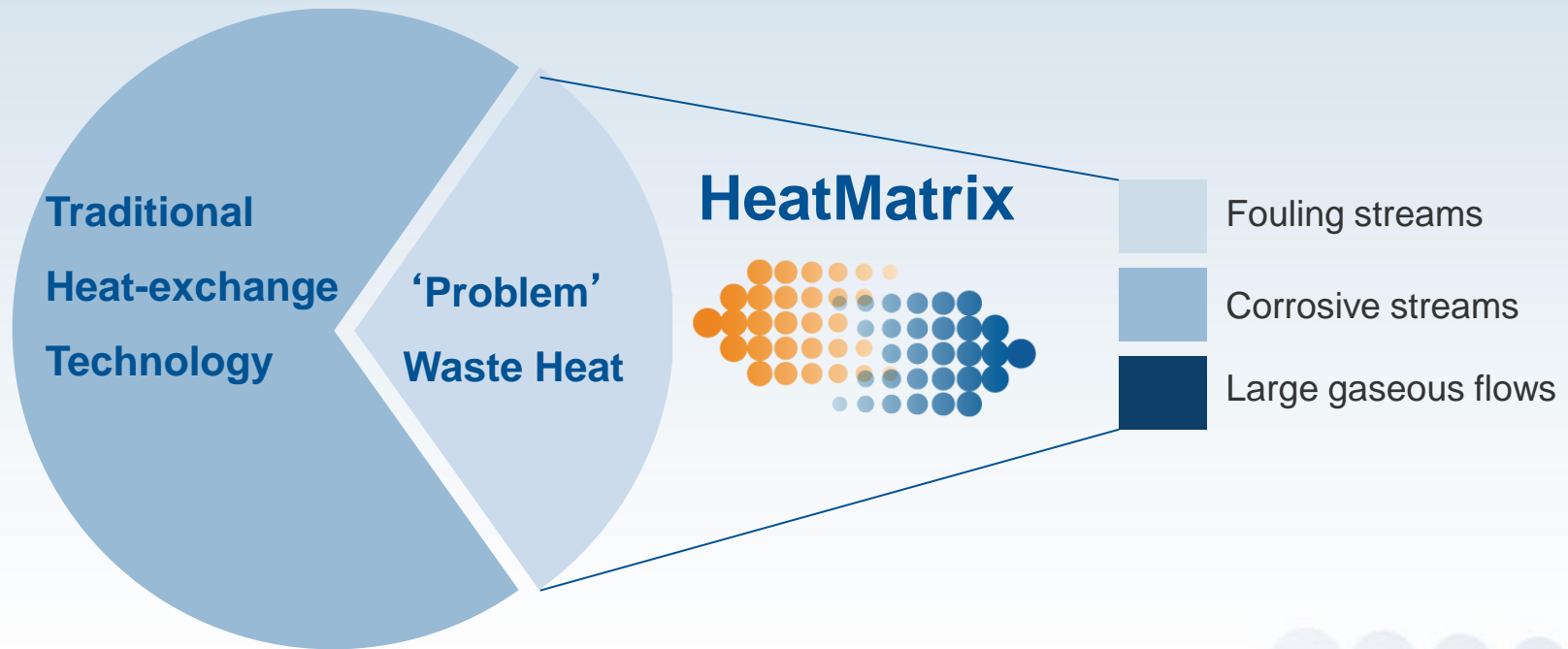
Energy Efficiency Double Whammy

Energy Efficiency Reduce Fuel Expenditures and Realize CO₂ Savings



Higher Fuel and CO₂ Prices Increase the Value of Waste Heat

HeatMatrix Recovery Beyond the Conventional



- ✓ Compact
- ✓ Low weight
- ✓ Corrosion resistant
- ✓ Counter current
- ✓ Easy to install

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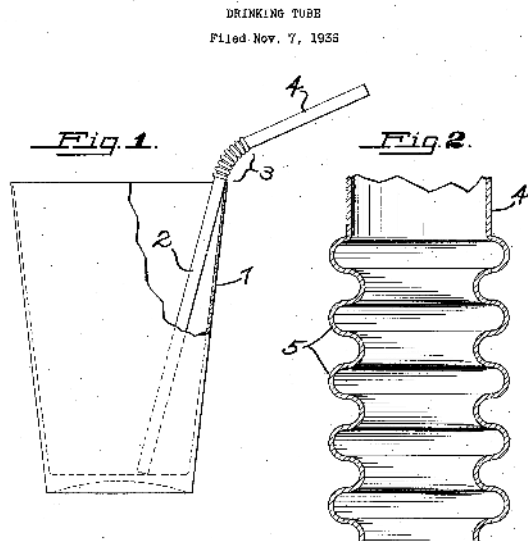
4 For corrosive and fouling service

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Lasting Innovations are Simple

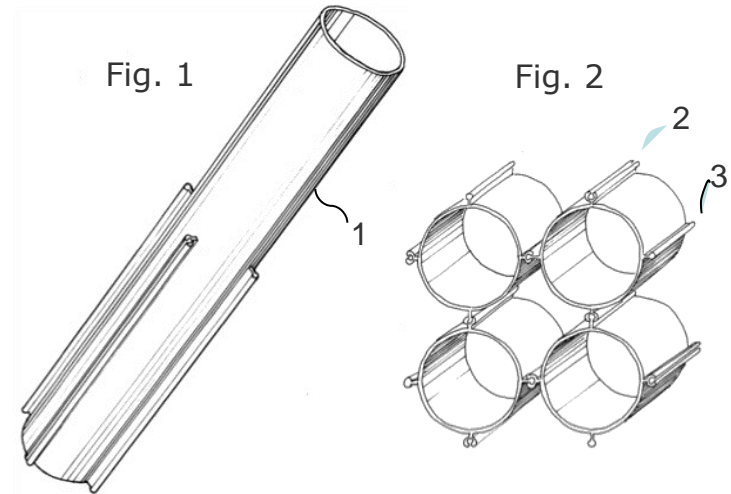
Drinking Straw (Friedman)

Invention (Patent 1936)

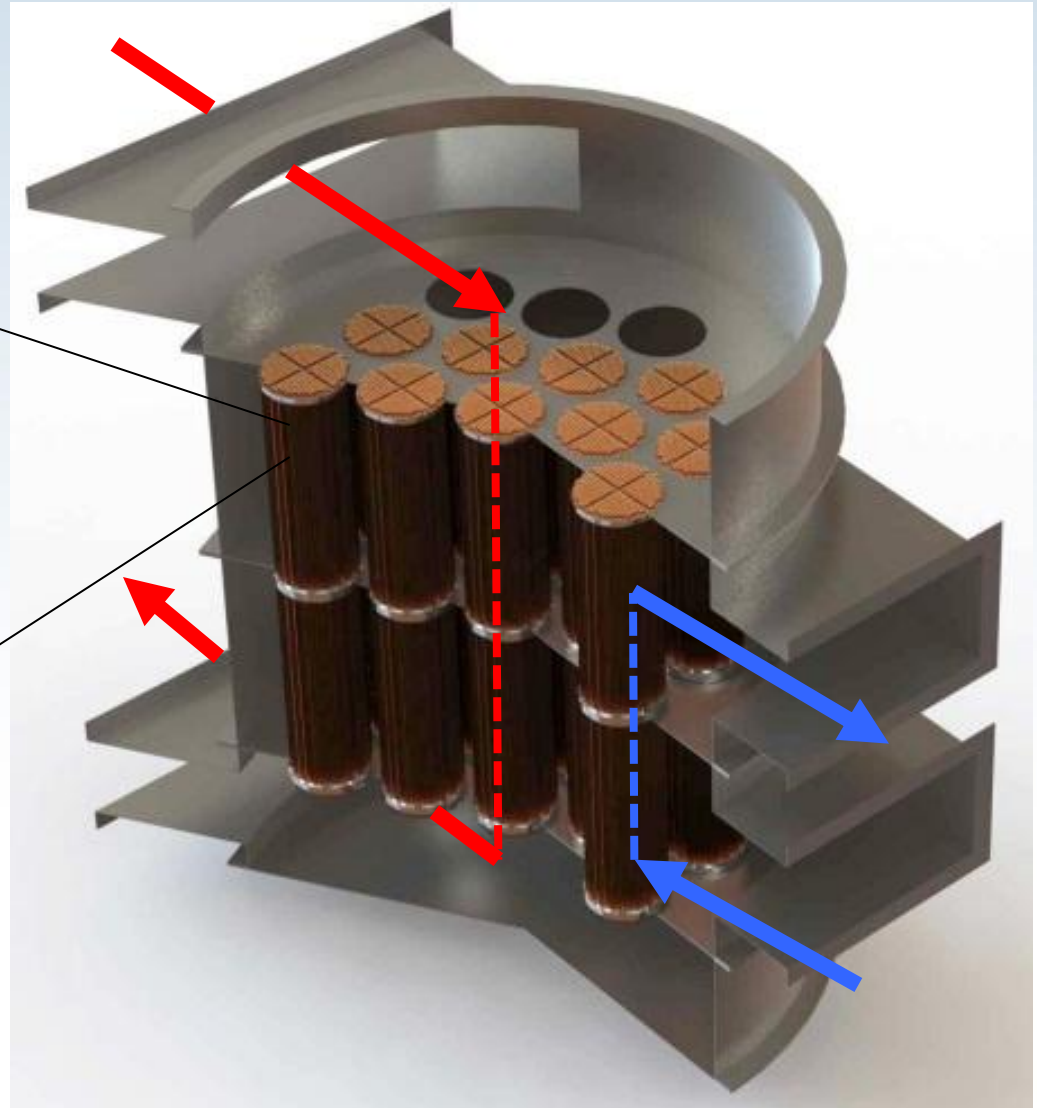
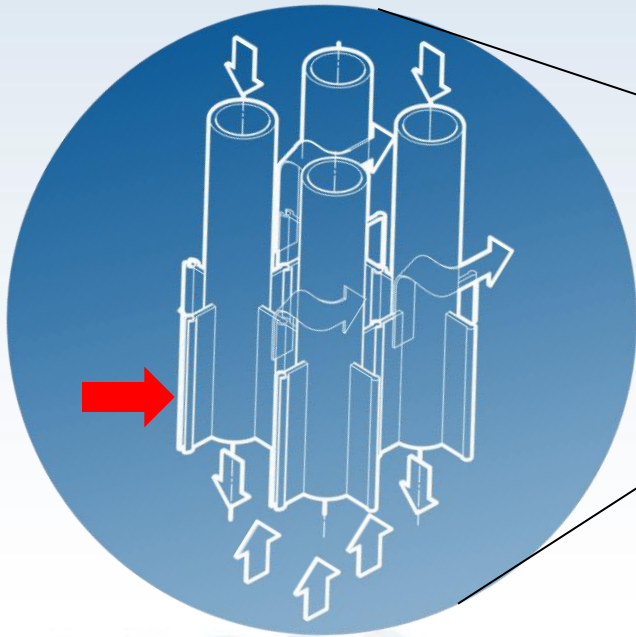


HeatMatrix Technology

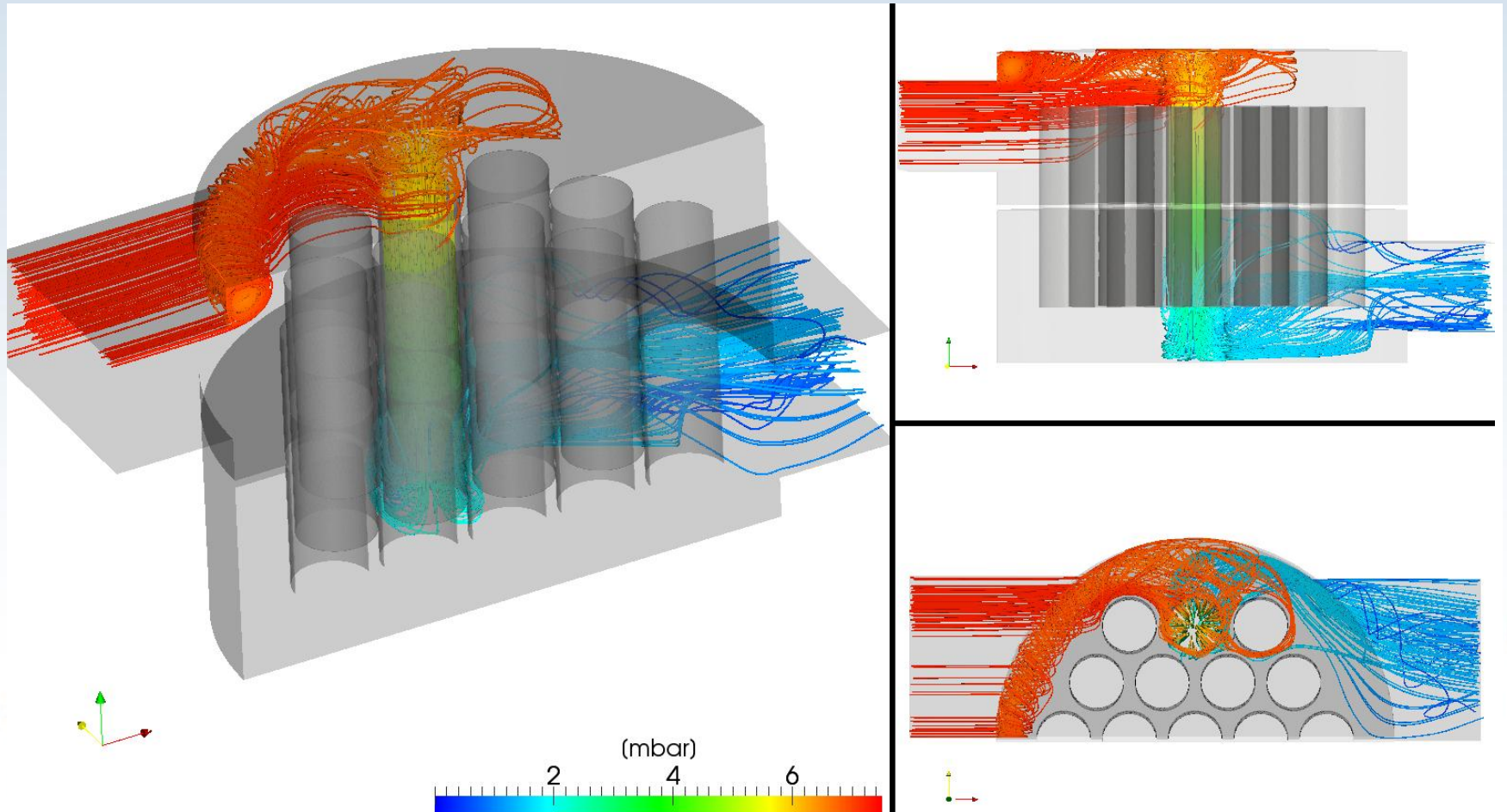
Invention (Patent 2007)



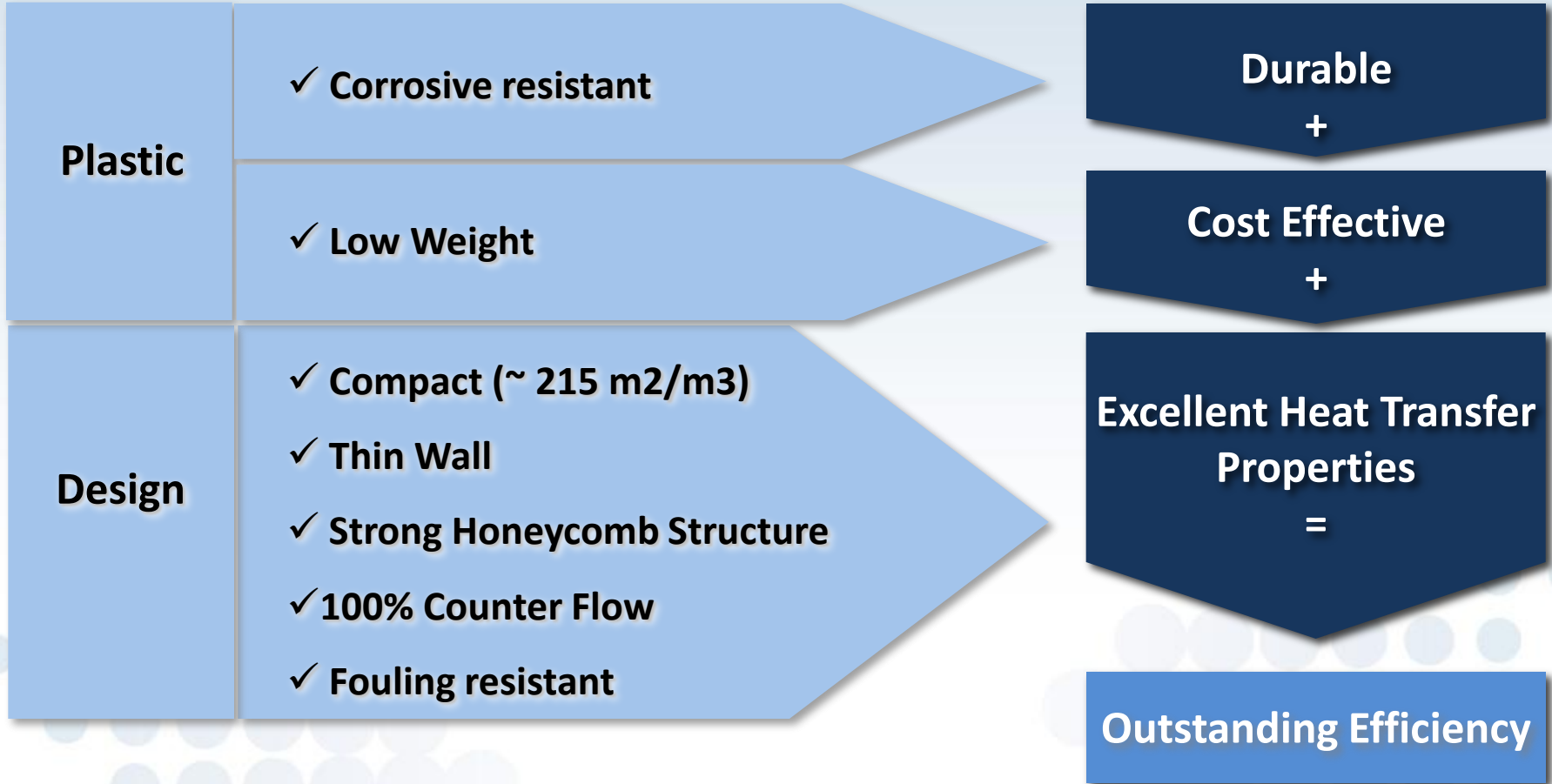
HeatMatrix® LUVO gas/gas exchanger



Gas flow through heat exchanger



HeatMatrix Heat exchanger Advantages



HeatMatrix® LUVO XL gas/gas exchanger

Typicals:

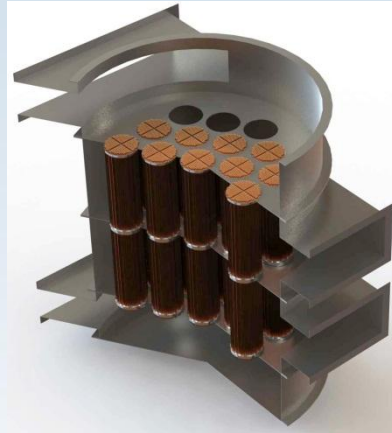
- Modular design
- Scalable to any size
- Innox , coated, lined casing
- Nozzles in any direction
- Easy to clean

Operating Range

- F: 5,000 – 500,000+ kg/hr
- Tdesign: 200 ° C
- Pdesign: 150 mbar
- ΔP : ~6 mbar

Advantages:

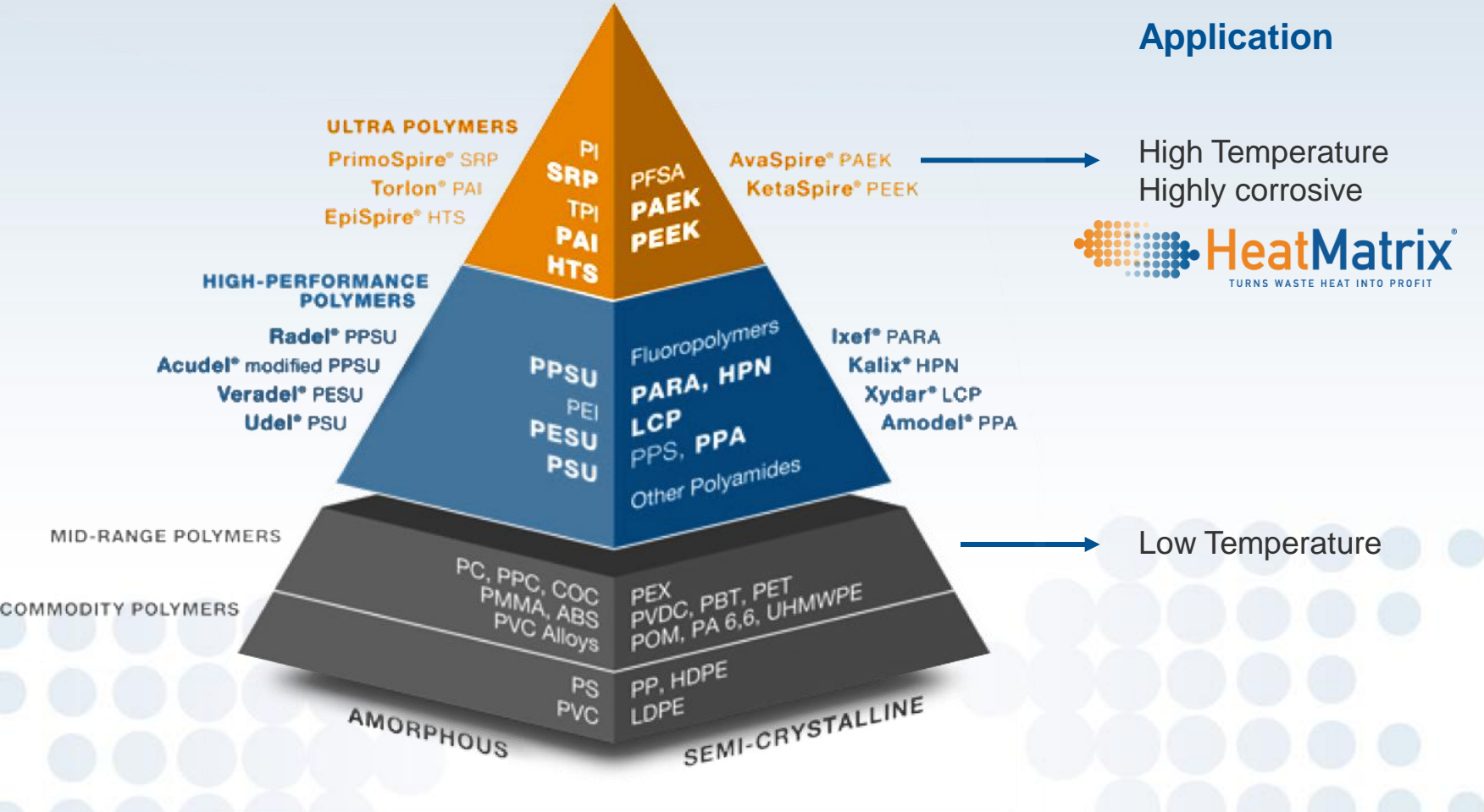
- Compact
- Low Weight
- Counter Current
- Corrosion resistant
- Easy maintenance
- Easy to install



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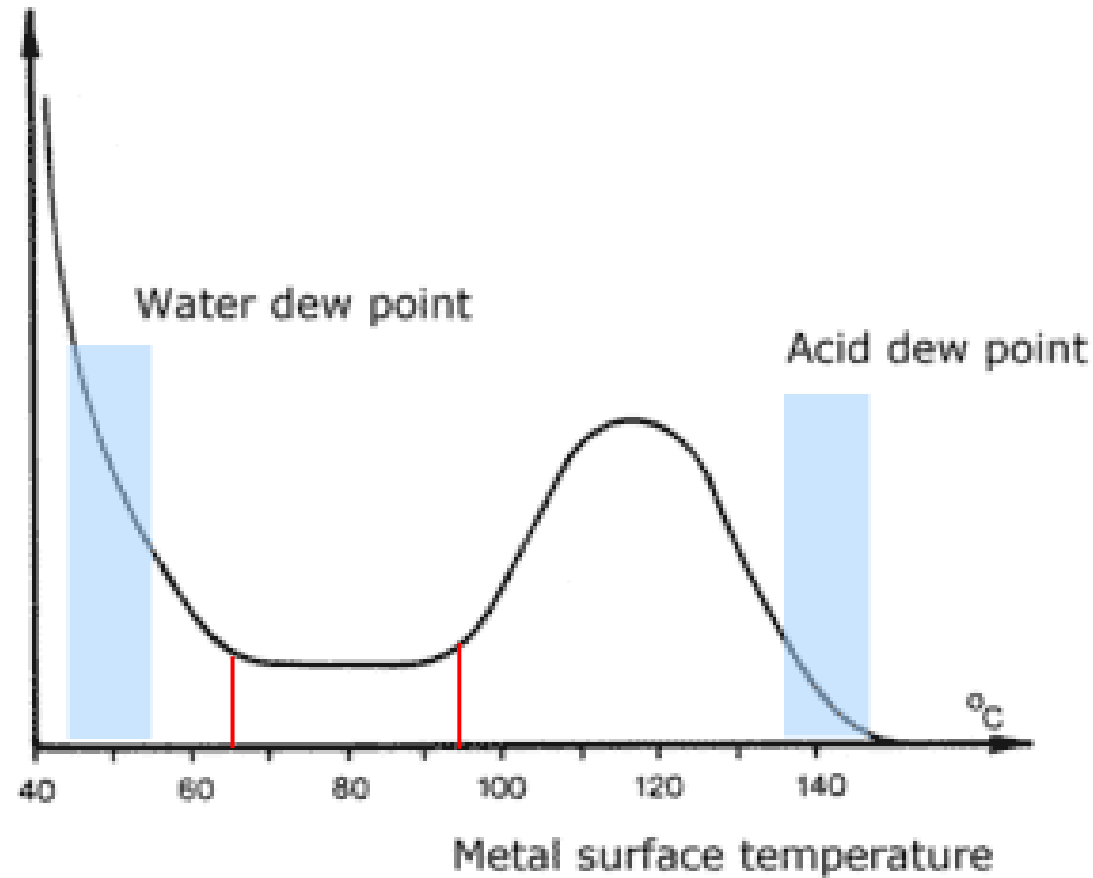
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Plastic Pyramid



Acid dew point

Rate of corrosion



Acid dew point corrosion of metal in biogas

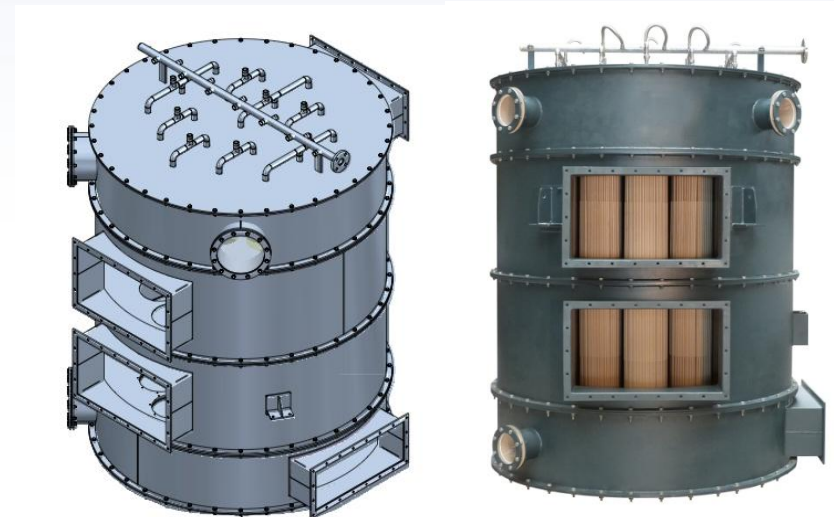


Fig. 13: Sulphuric deposits by undercutting the acid dew point [13]

HeatMatrix in corrosive flue gas at Vion



In-situ cleaning system: cleaning during operation



Cleaning system



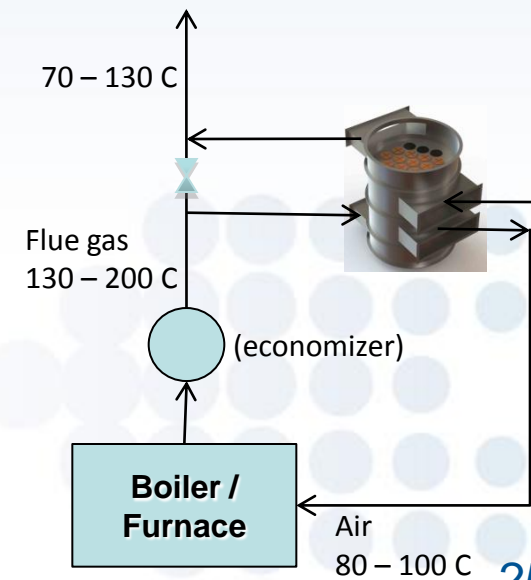
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Typical application I

Air preheating with flue gas from combustion processes:

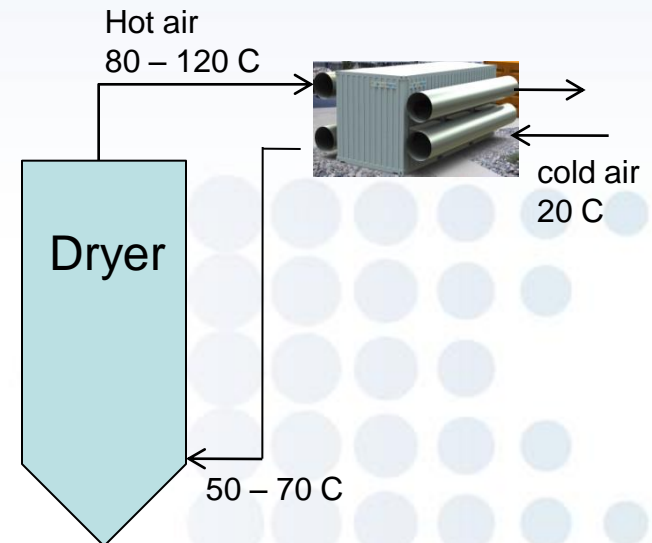
- Standard natural gas boilers
- (Petro) Chemical / Refinery boilers
- Furnaces / Fired heaters
- Biogas / biomass / coal fired boilers
- Incinerators / RTO's



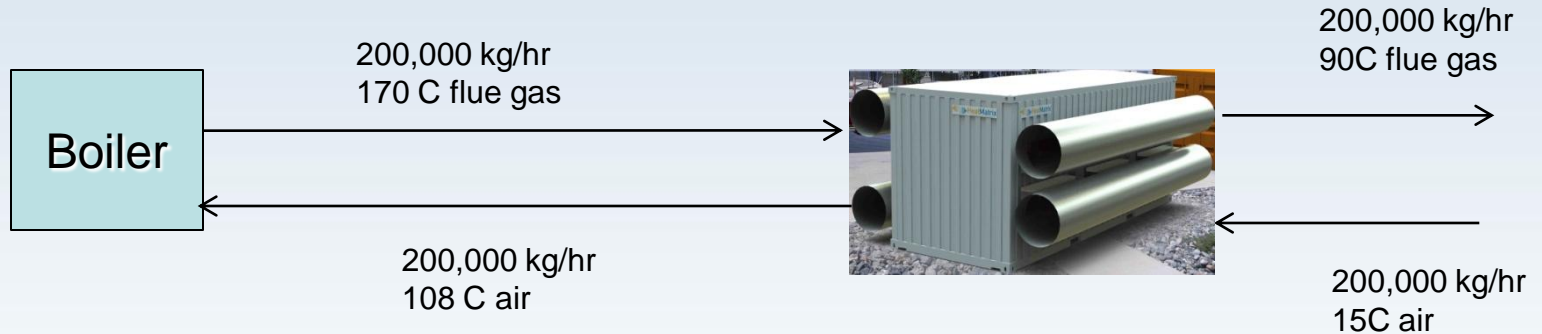
Typical application II

Air preheating in Dryers:

- Food / non-food industry
- Spray dryers
- ovens



Typical refinery boiler case



HeatMatrix LUVO	
• Energy Saving	• 4.91 MW
• Annual fuel costs saving**	• 1,278,000 €/yr
• Price LUVO XL CR	• 850,000 €
• Installation costs (estimate)	• 850,000 €
• Return on Investment	• 1.3 year
• NPV (10yr, 6%)	• 7,700,000 €
• IRR (10 yr)	• 75 %

** Based on 8000 hr/yr and € 0.30 /Nm³

CO₂ reduction = 8,600.000 kg/year

Reducing stack temperatures:

- Recovers over 50% of the lost heat
- Has an average pay-back time of 1,5 year
- Is the most profitable investment in sustainability





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Director Technology

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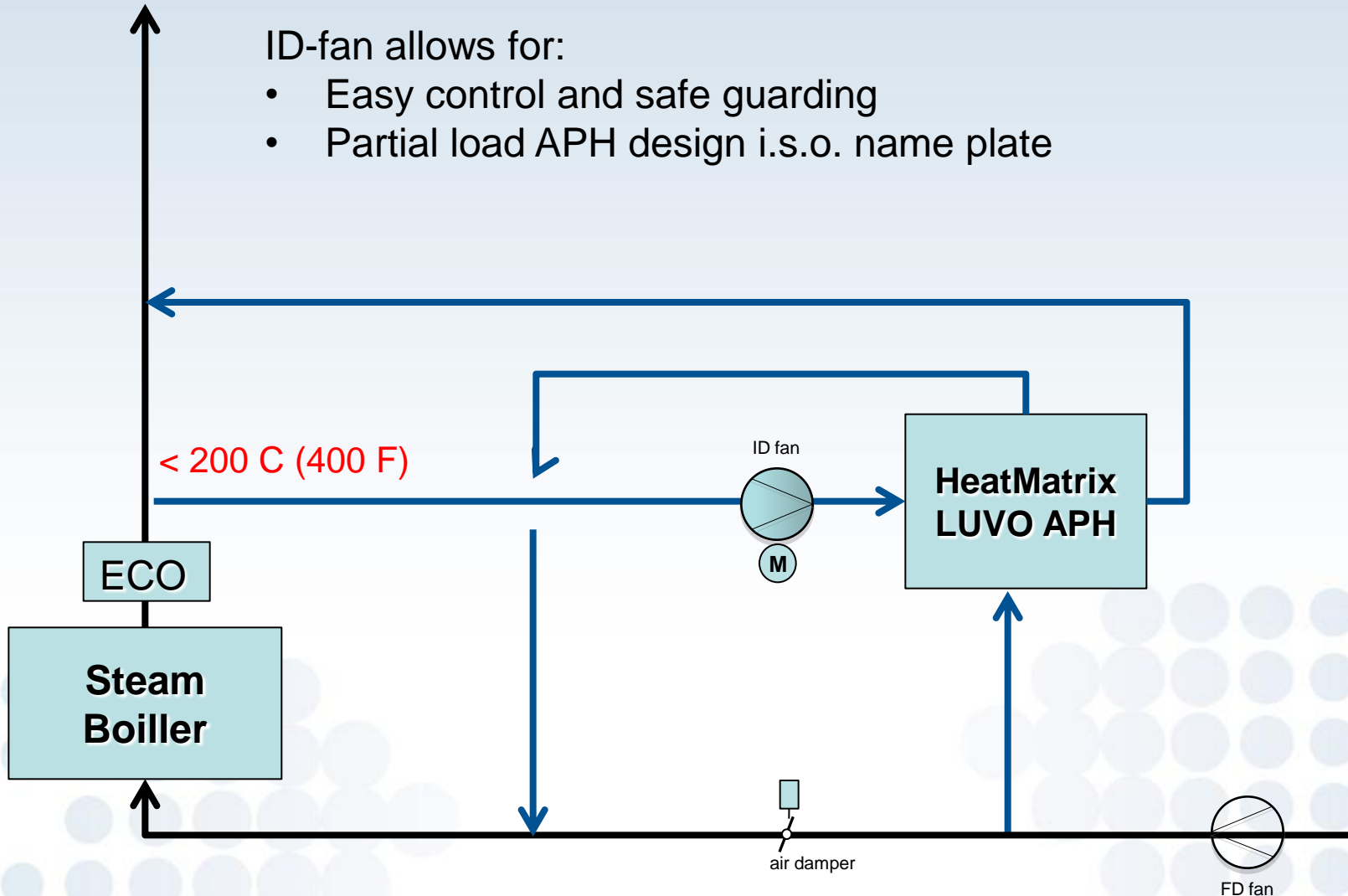
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Typical design 1

ID-fan allows for:

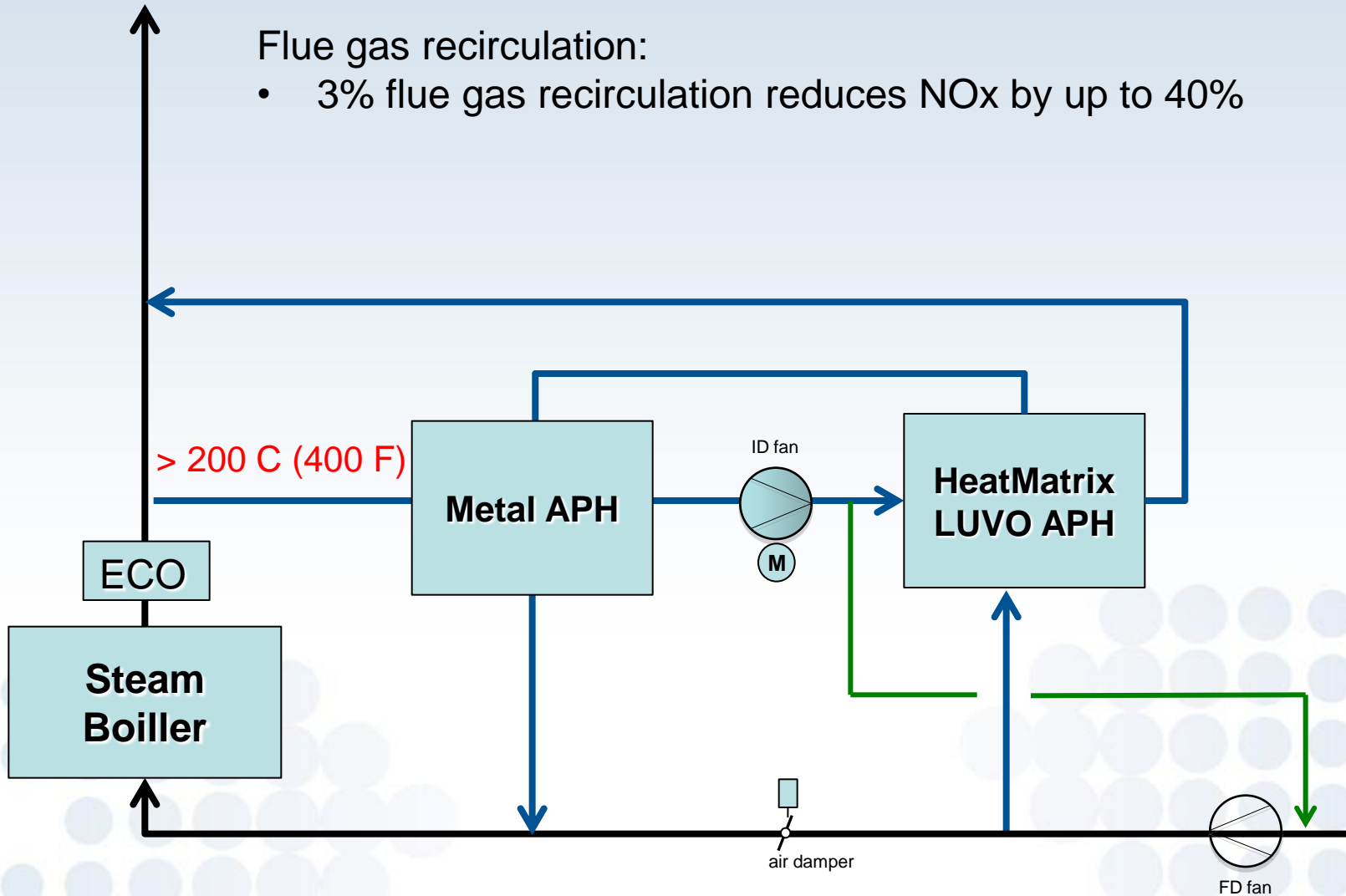
- Easy control and safe guarding
- Partial load APH design i.s.o. name plate



Typical design 3

Flue gas recirculation:

- 3% flue gas recirculation reduces NO_x by up to 40%



Typical design 4

Stack:

- German design standard for stacks recommends alloy 904 for corrosive service

DIN V 4133:2007-07 — Vornorm —

Tabelle 5 — Nichtrostende Stähle für Schornsteine von Verbrennungsanlagen

Brennstoffe ^a	Erdgas	Heizöl EL ^b , Holz (natur)	Heizöl S ^c , Kohle (max. 1% S)
mit einem Gehalt im Abgas von	SO ₂ < 35 mg/m ³	SO ₂ < 500 mg/m ³	SO ₂ < 1 700 mg/m ³
	sowie HCL < 30 mg/m ³ und HF < 5 mg/m ³		
maßgebende Wandtemperaturen im planmäßigen Betriebszustand in °C	Verwendbare Stähle (Werkstoffnummern)		
0 bis 100	1.4571 1.4435 1.4539		1.4539 1.4539
über 100 bis 150	1.4541 1.4571 1.4435 1.4539	1.4571 1.4435 1.4539	1.4539
über 150 bis 300	1.4541 1.4571 1.4435 1.4539	1.4571 1.4435 1.4539	1.4571 1.4435 1.4539

