



Development and experience in Biomass Gasification of Metso

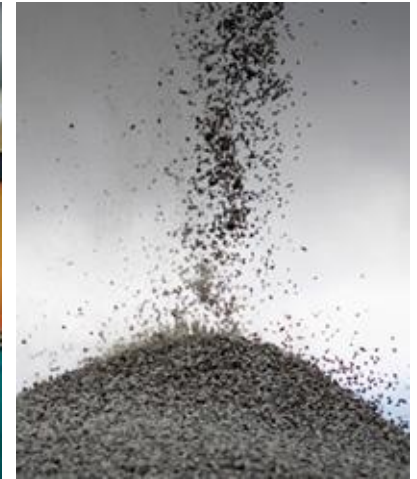
BiogasMax Conference

7-9 September 2009 Gothenburg Sweden

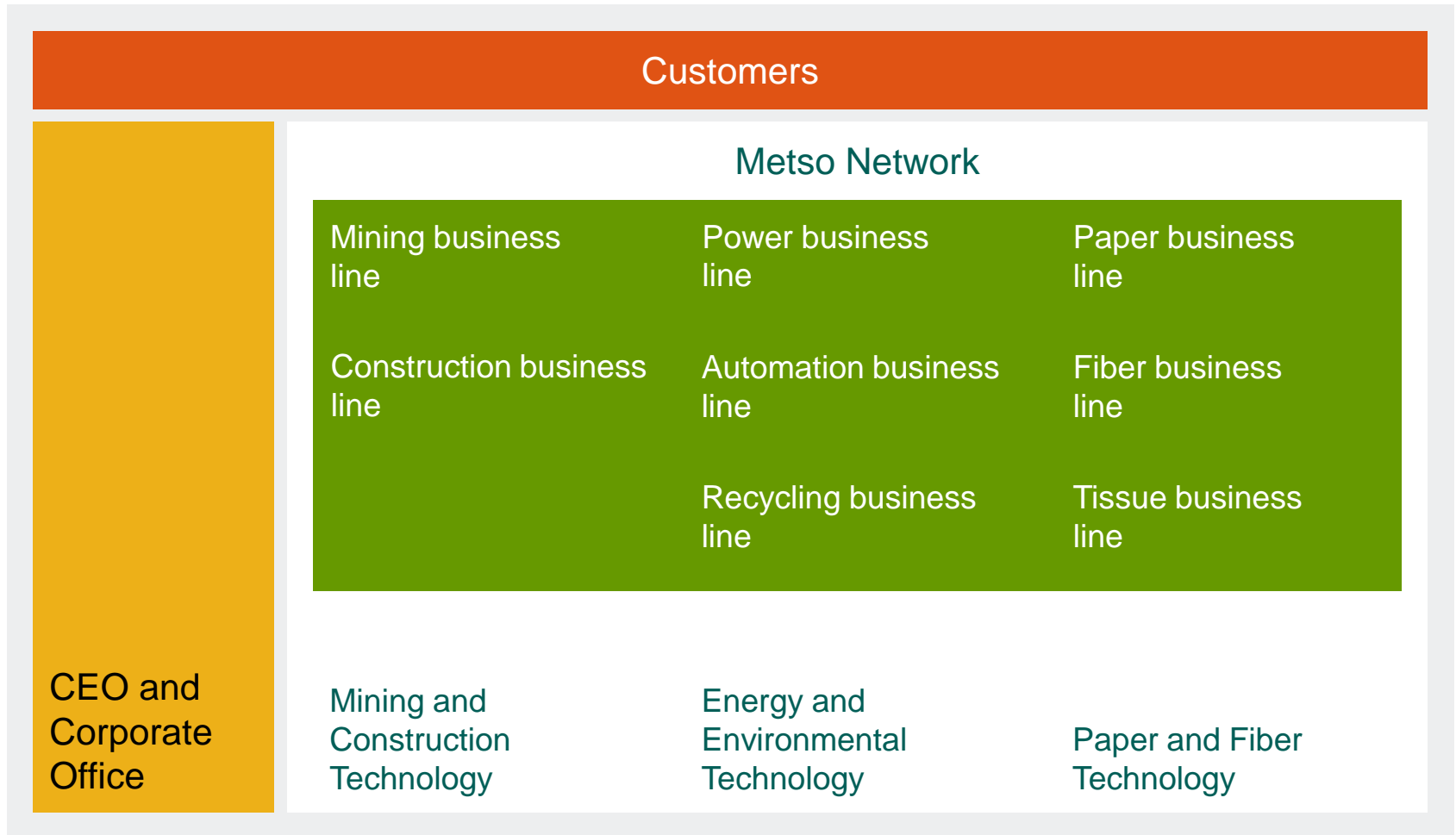
Claes Breitholtz

Metso: a global supplier of sustainable technology and services

- Our customers operate in the following industries:
 - Mining
 - Construction
 - Power generation, oil & gas
 - Recycling
 - Pulp and paper
- More than 28,000 employees in over 50 countries
- Net sales in 2007 over EUR 6 billion
- Shares listed on NASDAQ OMX Helsinki Ltd






Global network organized by customer industry-specific business lines



Energy and Environmental Technology

Our offering

Business line	Main products	Trade names	Customers
 <p>Power</p>	<ul style="list-style-type: none"> • Power boilers • Air pollution control systems • Services 	<ul style="list-style-type: none"> • Hybex • Cymix 	<ul style="list-style-type: none"> • Power generation industry • Process industry • Pulp and paper
 <p>Automation</p>	<ul style="list-style-type: none"> • Process automation solutions • Specialty analyzers • Life cycle services • Automated, control, ESD and manual valves • Intelligent condition monitoring 	<ul style="list-style-type: none"> • metsoDNA • Kajaani • Neles • Jamesbury • Sensodec • PaperIQ • MAPAG 	<ul style="list-style-type: none"> • Oil and gas • Pulp & paper • Power producers • Industrial gas • Alternative fuels • Chemical industry
 <p>Recycling</p>	<ul style="list-style-type: none"> • Shredders, scrap shears, balers • Complete systems and service solutions 	<ul style="list-style-type: none"> • Lindemann • Texas Shredder 	<ul style="list-style-type: none"> • Metal scrap recycling • Automotive industry • Foundries

Power business line products

- **Boilers**
 - Fluidized bed boilers for combustion of biomass, recycled fuel and coal
 - Oil and gas boilers
 - Recovery boilers for chemical recovery
- **Evaporators**
 - Evaporators for black liquor concentration
- **Environmental systems**
 - Air pollution control systems for the pulp and paper, and power generation industries
- **Service**
 - Rebuilds and upgrades
 - Maintenance
 - Spare parts
 - Accessory products
 - Partner Services
- **New products and technologies**
 - LignoBoost for lignin removal
 - AshLeach for reducing the harmful chemicals in fly ash
 - Biomass gasification to replace oil and natural gas



Biomass gasification to replace oil and natural gas

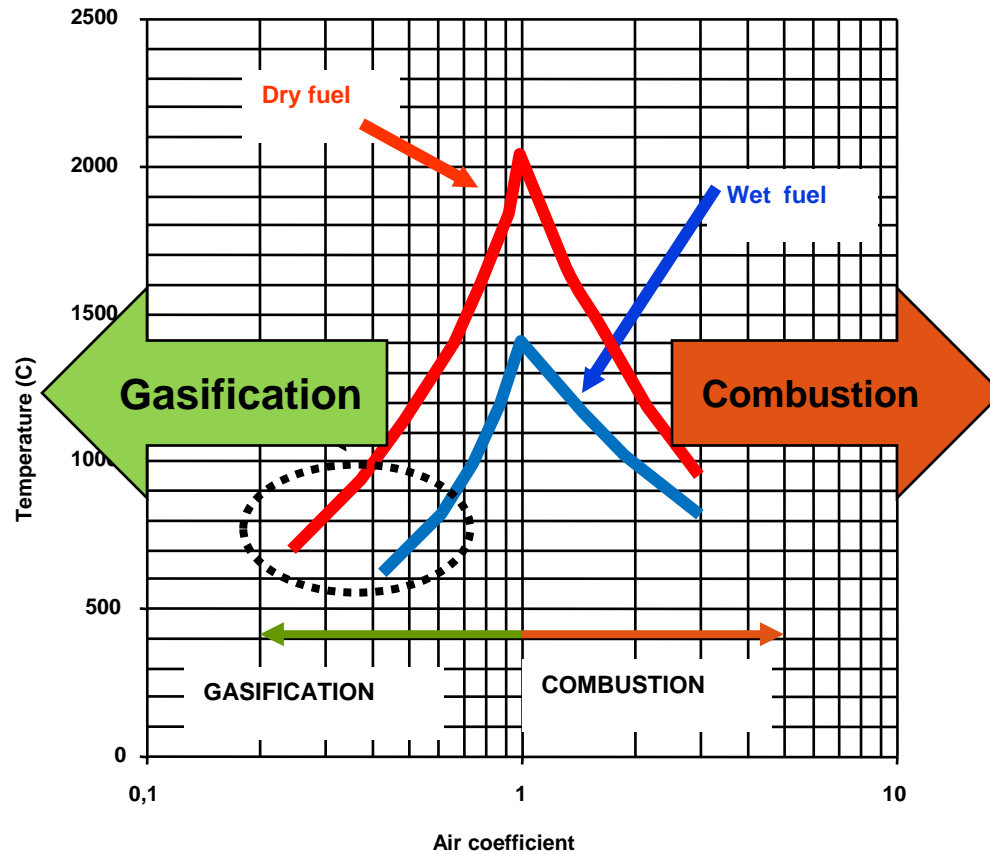
Metso's experience, today's offer and
development of future technologies

Gasification of solid fuels

Adiabatic reaction temperatures and reaction products

CO₂
CO
H₂
H₂O
N₂
CH₄
C_xH_y
Tars

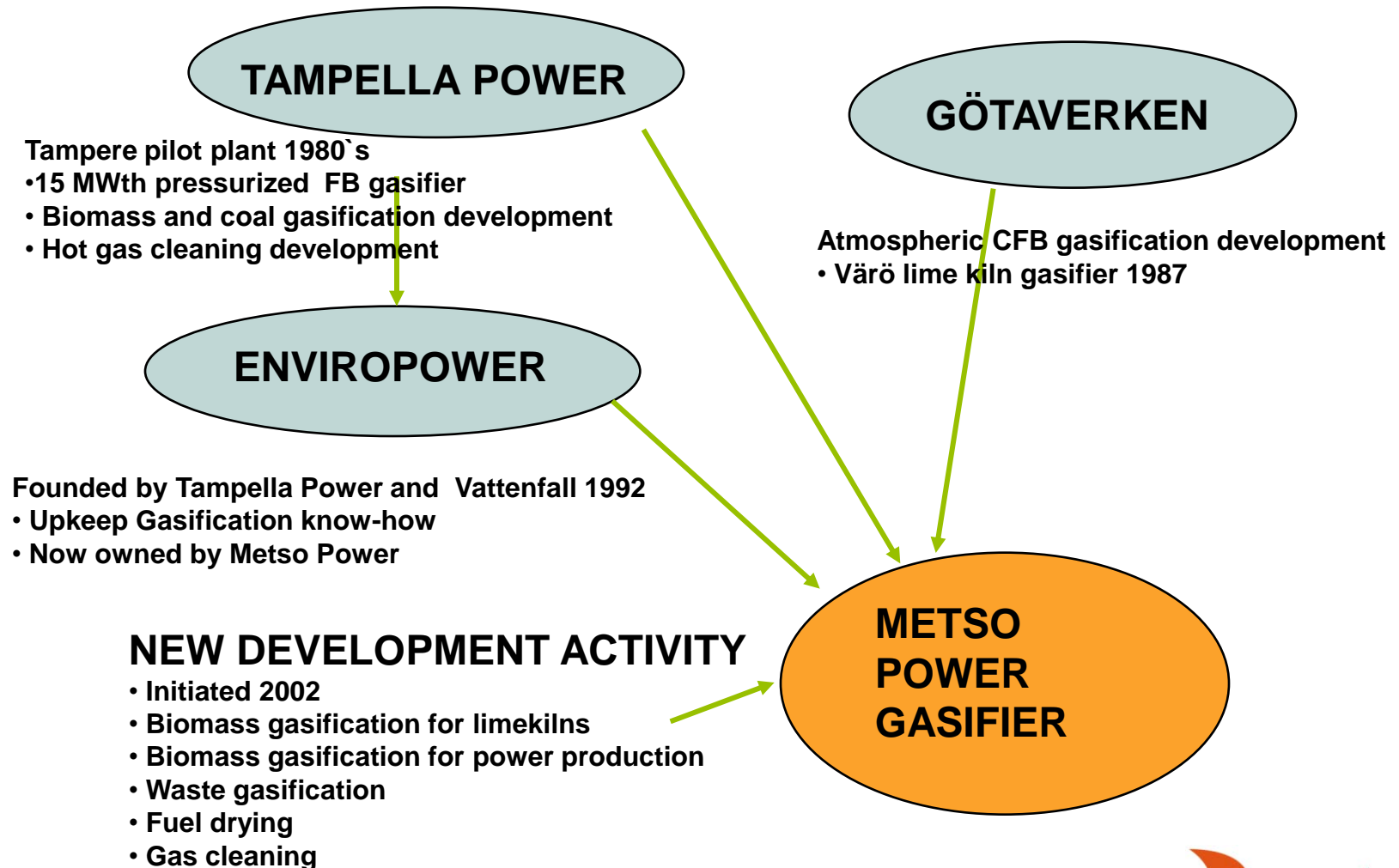
Emissions
H₂S
NO_x
HCN



CO₂
H₂O
N₂
O₂

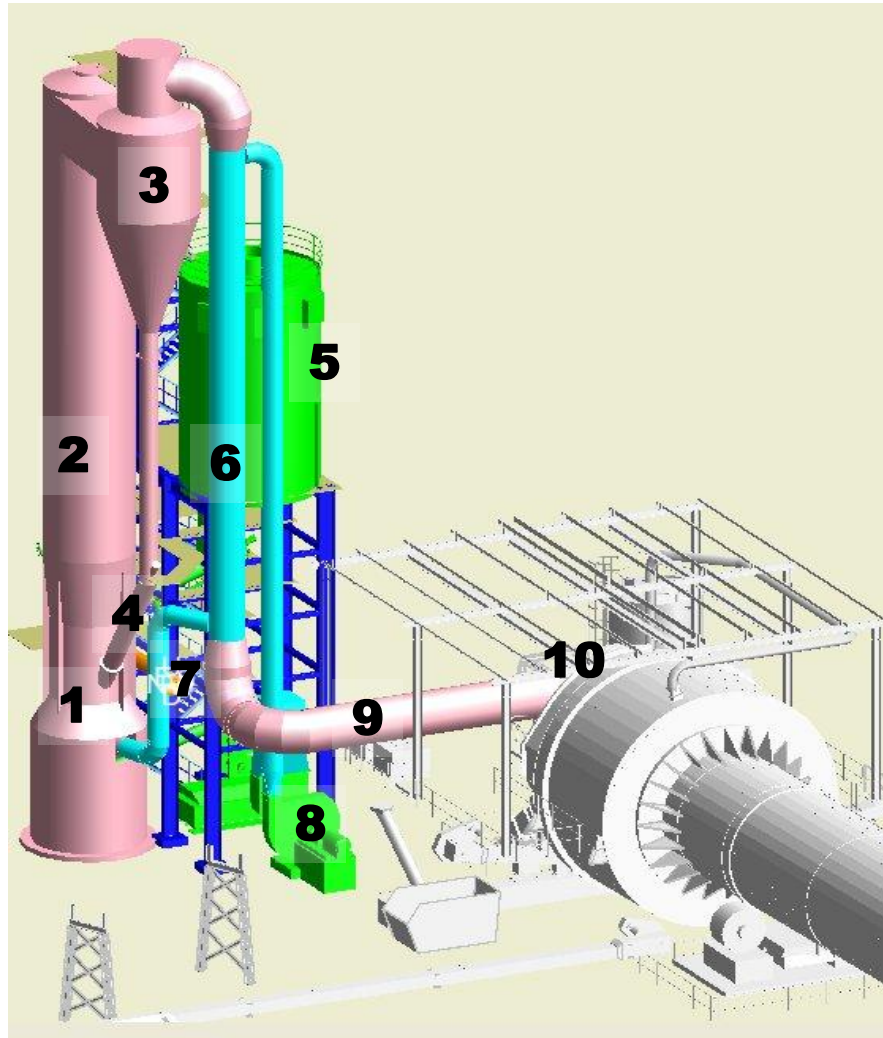
Emissions
SO₂
NO_x
CO

History of Gasification in Metso Power



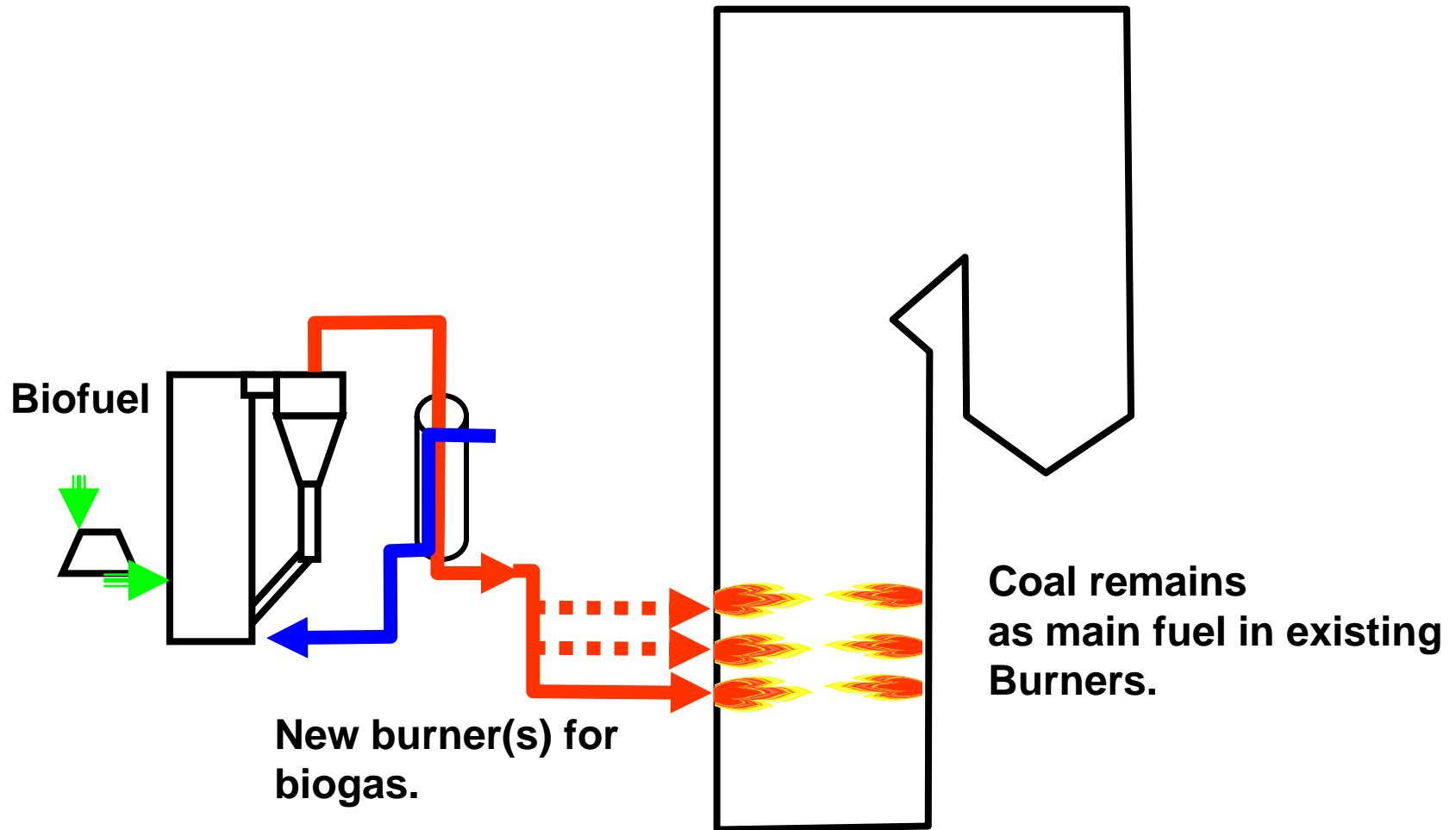
Biomass Gasification

Typical lay-out

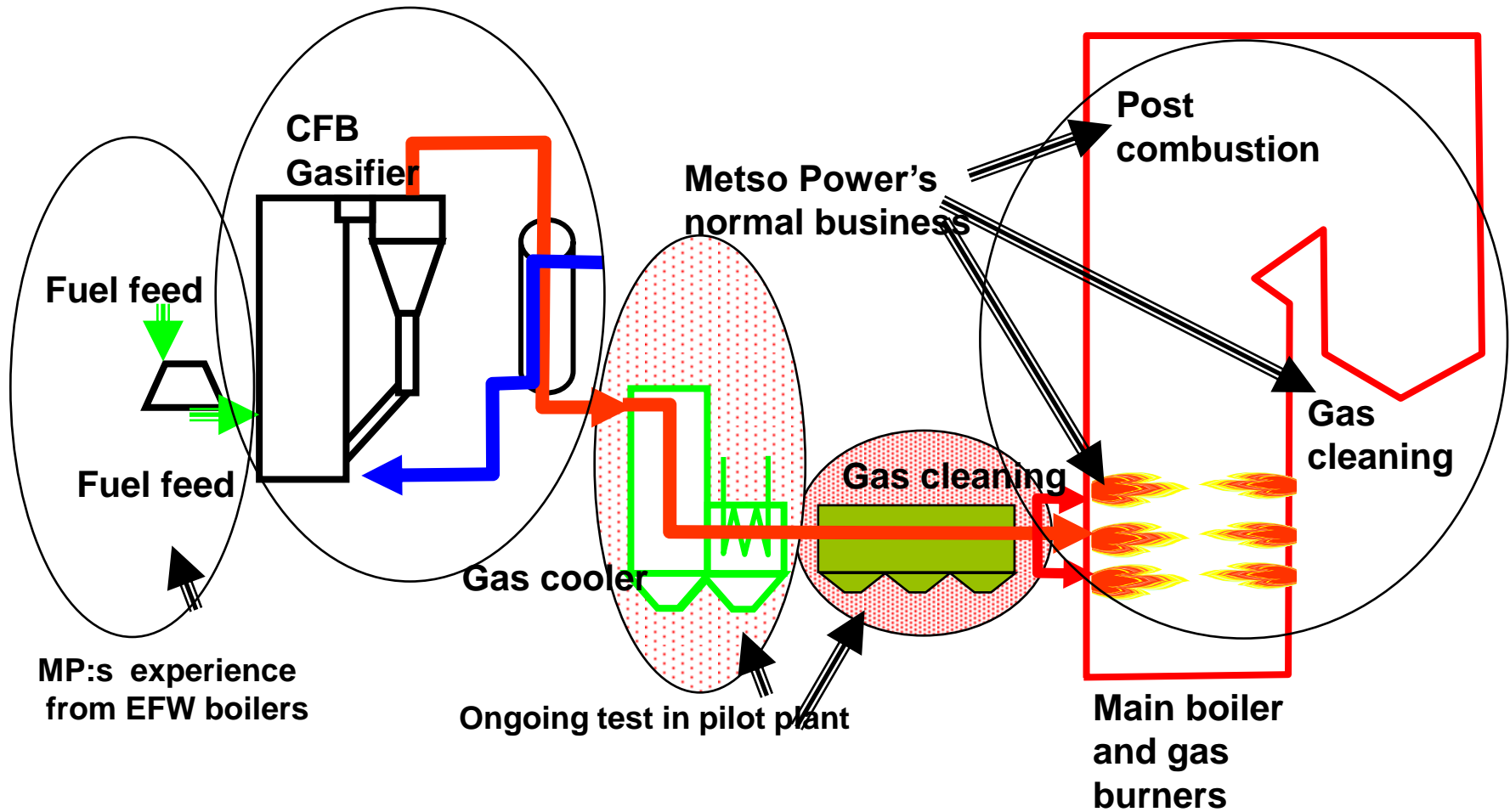


- 1 Grid
- 2 Gasifier Reactor
- 3 Cyclone
- 4 Return leg
- 5 Fuel silo
- 6 Air preheating
- 7 Start-up burner
- 8 Fan
- 9 Gas line
- 10 Lime kiln burner

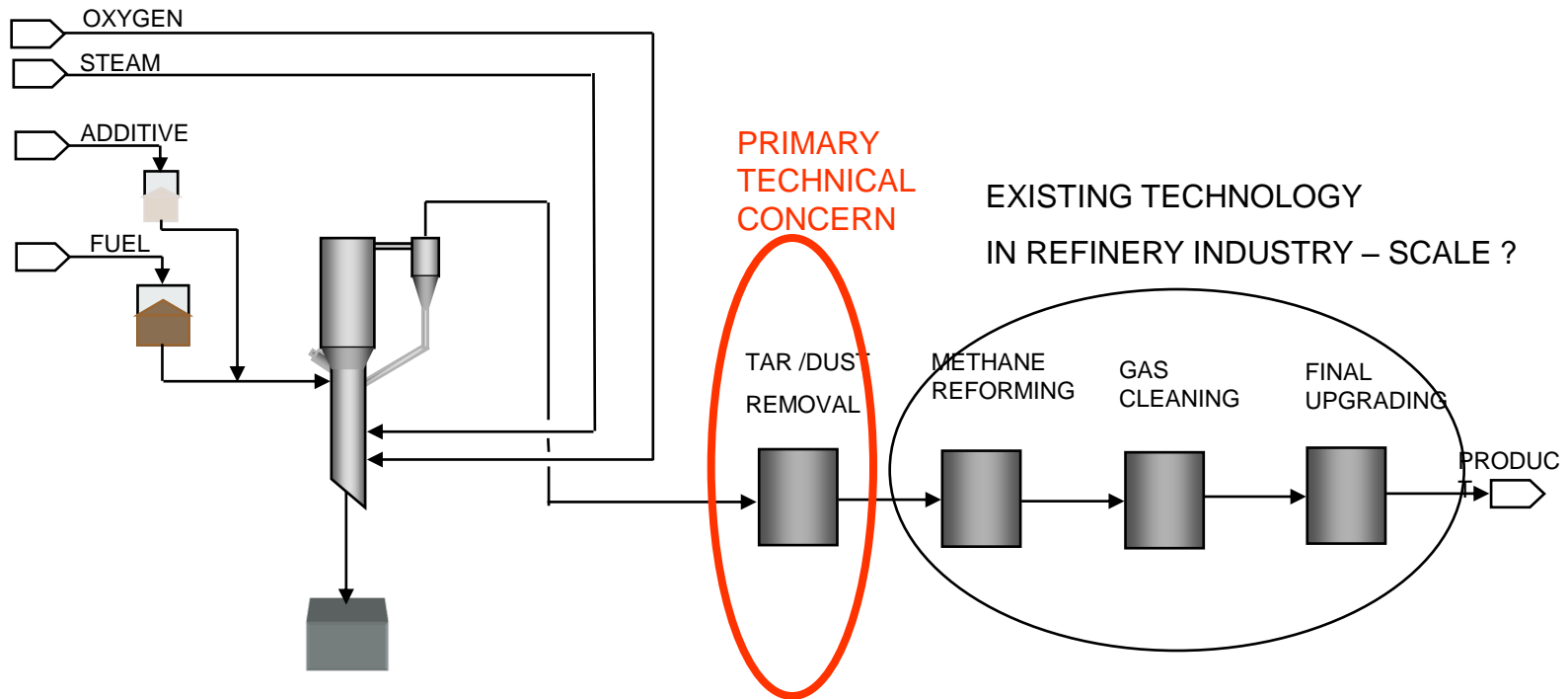
Cofiring biofuel in PC boilers through gasification



Use of waste in high efficiency boilers through gasification



Gas from biomass gasification as raw material for a Biorefinery



Chalmers University gasifier concept: Pilot gasifier docked to existing CFB-boiler

