The heat plant – Future biorefinery
Panndagarna 2015
Västerås, 14-15 April
Valmet Technologies Comprehensive Offering for Energy Customers

- Biomass to Energy, Waste to Energy and Multifuel solutions
  - Fuel handling systems
  - Boiler islands, modularized power plants and heating plants
  - Air pollution control systems

- Products and Technologies
  - Circulating fluidized bed boilers (CYMIC) and Bubbling fluidized bed boilers (HYBEX)
  - Biomass and waste gasification
  - Oil and gas boilers, waste heat recovery boilers

- Rebuilds and conversions
  - BFB conversions, capacity increases and lower emission levels

- Services

Facts

- Solutions for demanding fuels: biomass, waste and multifuel
- Multifuel capabilities
- Wide capacity range
- From-Fuel-to-Stack solutions
- Large installed base

Results

- High fuel flexibility gives economic advantage and security
- Replacement of fossil fuels
- Reducing CO₂ emissions economically
- Minimum emissions

Joakim Autio, Panndagarna
14-15 April, 2015
Valmet acquires Process Automation Systems business from Metso

- Valmet and Metso have signed an agreement on the sale of Metso’s Process Automation Systems business to Valmet on January 15, 2015
  - The enterprise value of the acquisition is EUR 340 million
  - The acquisition is estimated to be completed by April 1, 2015

- Acquisition has an excellent strategic fit
  - Combination of Valmet and Process Automation Systems creates unique customer offering
    - Paper, pulp and power plant technology offering, services, process know-how and automation in one customer value-adding entity
  - The acquisition makes Valmet more stable and more profitable
New Biomass Conversion Technologies

Secured performance through step-wise development

- CFB gasification technologies for biomass and waste gasification
- Pyrolysis solutions for bio-oil production
- LignoBoost system for extracting lignin from kraft black liquor
- Complete production lines for steam treated pellets and revamps of existing white pellet plants
- Solutions for prehydrolysis of biomass to sugars and lignin for further refining to fuels or chemicals

Facts
- Commercial scale gasification of biomass and waste since 2011
- Bio-oil pilot production since 2009, first demonstration scale plant in operation in 2013
- World’s first commercial lignin separation installation in operation since 2013
- Several prehydrolysis pilot scale deliveries. First demonstration scale plant in operation in 2012. Commercial scale being offered.

Results
- New revenue streams for pulp mills and biomass power plants
- Reduction of emissions
- From fossil fuels to utilization of sorted waste and biomass
- Alternative renewable fuels
### Six full-scale new biotechnology projects

<table>
<thead>
<tr>
<th>Technology</th>
<th>Project Details</th>
<th>Description</th>
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<tbody>
<tr>
<td>Biomass gasification</td>
<td>Vaskiluodon Voima, Vaasa, Finland</td>
<td>140 MW gas to replace coal in PC boiler</td>
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<tr>
<td>Waste gasification</td>
<td>Lahti Energia, Lahti, Finland</td>
<td>2*80 MW Waste</td>
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<tr>
<td>Biomass indirect gasification</td>
<td>GoBiGas Göteborg Energ, Sweden</td>
<td>20 MW SNG</td>
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<td>Integrated pyrolysis</td>
<td>Fortum Joensuu, Finland</td>
<td>30 MW bio-oil</td>
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<td>Lignin extraction</td>
<td>Domtar Plymouth, NC, USA</td>
<td>25 000 ton/a lignin</td>
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<tr>
<td>Lignin extraction</td>
<td>Stora Enso Sunila mill, Finland</td>
<td>50 000 ton/a lignin</td>
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New biorefinery solutions for energy producers

- Integrated pyrolysis
- Black pellet production
- Gasification
Bio-oil

Integrated pyrolysis

• Production of renewable liquid fuel with an add-on process to a fluidized bed boiler
• Utilizing waste heat for feedstock drying
  – Increase in plant efficiency
• Applications:
  – Replacing fossil fuels in burner applications
  – Heat/steam generation
  – Lime kiln and industrial ovens
• 30 MW oil demonstration project with Fortum ongoing
• Commercial offering:
  – Pyrolysis piloting trials
  – Studies for customer sites
  – Pre-engineering
  – Burner systems
Bio-oil production technology

Automation system -> High pressure steam -> Turbine

- Electricity
- District heat

Forest residue -> Drying

Condenser

Non-condensible gas

Fluidized bed boiler -> Pyrolysis unit

Bio-oil

Valmet
Pyrolysis integrated to a CHP-boiler
Joensuu 30 MW\textsubscript{oil}, 50 000 t/a bio-oil production plant
Biocoal

Production of black pellets

- Material handling
- Pre-drying
- Thermal treatment
- Post drying
- Densification

Bio fuel → Energy Island → Flue gases → Steam → Flue gases
Black pellets replaces coal up to 100%

Successful full-scale testing by utility customers

- Several full-scale tests complete in European and Asian coal units (80-500 MW)
- Co-fired up to 70% in larger units, up to 100% in smaller units
- Success grinding in existing coal mills (ball and roller), some up to 100% Black pellets
Biogas as replacement for fossil fuels

CFB gasification

- Cyclone
- CFB reactor
- Fuel feeding
- Product gas line
- Product gas/gasification air - heat exchanger
- Bottom ash removal
### CFB gasification references

<table>
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<tr>
<th>Waste Gasification</th>
<th>Coal Replacement</th>
<th>OKI Lime kiln gasifiers</th>
<th>Äänekoski (LOI) Lime kiln gasifier</th>
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<td>2012</td>
<td>2013</td>
<td>2016</td>
<td>2017</td>
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#### Cumulative Capacity / MW

- **Lime Kiln Gasifiers**
  - Start up year: 2016
  - Capacity: Cumulative

- **CFB gasification**
  - Start up year: 2012
  - Capacity: Cumulative

- **OKI Lime Kiln Gasifiers**
  - Start up year: 2016
  - Capacity: Cumulative

- **Äänekoski (LOI) Lime Kiln Gasifier**
  - Start up year: 2017
  - Capacity: Cumulative
GoBiGas

Plant in operation

- Indirect gasification
- High quality gas for further refining
  - SNG (biomethane - GoBiGas)
  - Liquid fuels (Fischer-Tropsch)
New technologies to the market

• Business potential
• Predictability
• Synergy
• Partnering
• Public funding
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