High-value gasification solutions

The power of sustainable energy solutions
**What is gasification?**
Gasification is a process that can find new value in traditional fuels such as coal, wood and oil.

More impressively, gasification can unlock the energy value of waste materials such as waste wood from construction, forest, lumber and paper industries, as well as household waste from towns and cities.

The gasification process uses heat to break down solids and liquids into their basic gaseous chemical components.

A portion of these gaseous components consists of hydrogen and carbon monoxide, which are high value feedstocks for producing chemicals, liquid fuels and heat for production of steam and power.
Together with NSE Biofuels Oy Ltd., we have developed a CFB biomass gasification and syngas cleaning system which was part of NSE’s new-generation renewable diesel demonstration project at Stora Enso’s Varkaus Mill in Finland. This project demonstrated the conversion of biomass fuels into clean syngas that can be used to produce renewable transportation fuels.

Value Points
- Replaces fossil fuel needed for paper mill’s lime kilns with carbon neutral biomass
- Demonstrated the production of a carbon-neutral transportation fuel to reduce greenhouse gas emissions

Lahti: Co-firing carbon-neutral fuels at existing coal plant

The town of Lahti in Finland utilizes a pulverized coal (PC) power plant to produce electricity and district heat to power and heat the town. To reduce the carbon footprint of the plant and to utilize local biomass and waste materials, Lahti decided to add a gasifier to the existing PC plant. The gasification system allowed the plant to utilize local carbon-neutral fuels and waste streams resulting in reduced environmental impact of the plant, while meeting the energy needs of the community.

Value Points
- Reduces waste going to local landfill
- Reduces the town’s carbon profile
- Reduces the plant’s SOx and NOx emissions
- Saved the town from the large investment needed to build a new plant capable of burning the biomass and waste directly
We offer the most fuel-flexible gasification technology

Unlike other gasification technologies, our gasifiers utilize fuel-flexible fluidized bed technology.

Fluidized bed technology is the most fuel flexible gasification technology since it utilizes vigorous mixing and long particle residence times to efficiently gasify the feedstock. Other technologies use high temperature and short residence times, which is not as efficient, especially for lower quality fuels.

Another benefit of low-temperature fluid bed gasification technology is that the feedstock’s ash never melts, allowing the use of feedstocks considered too corrosive for other gasifier technologies.

Complete Customer Service
In addition to supplying the most advanced gasification technology, we also offer a full range of support services, such as:
- Overall flowsheet integration
- Energy optimization
- Selection of technologies
- Value engineering
- Reliability studies
- Cost estimates and economic analysis
- Control system philosophy

Among its many products, Stora Enso Oy produces juice containers with an inner aluminum liner. The Corenso gasification plant enables them to recycle the used containers into valuable steam needed to support their manufacturing process, while separating the aluminum for further recycling, allowing them to reduce their dependence on fuel oil, helping their bottom line and the environment simultaneously.

Value Points
- Innovative solutions for recycling juice containers into energy and an aluminum recycling stream
- Displaces expensive fossil fuels to help the company’s bottom line and the environment
- Reduces the company’s carbon footprint
- Reduces wastes going to landfills
Complete expertise

As a major player in gasification, we have the necessary in-house expertise located in our major engineering design centers around the world.

<table>
<thead>
<tr>
<th>Start-up Date</th>
<th>Customer</th>
<th>Country</th>
<th>Steam MWth</th>
<th>Primary Fuel</th>
<th>Application</th>
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<tbody>
<tr>
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<td>Biomass</td>
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<td>Finland</td>
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<td>Portugal</td>
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<td>Biomass Derived Lime Kiln</td>
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<td>Misc.</td>
<td>Test Facility</td>
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* A. Ahlstrom Corp. Technology

RECENT PROJECTS

**Electrabel**
- Location: Ruien, Belgium
- Start-Up Year: 2002
- Capacity: 8-30 MWe (50 MWth)
- Fuel: Bark, wood chips, recycled wood and forest residue

**Corenso**
- Location: Varkaus, Finland
- Start-Up Year: 2000
- Capacity: 13 MWe (50 MWth)
- Fuel: Aluminum and plastic recycled juice containers

**Lahti**
- Location: Lahti, Finland
- Start-Up Year: 1997
- Capacity: 7.23 MWe (50 MWth)
- Fuel: Demolition wood, railroad ties, plastic, tires, RDF, bark, forest residue, sawdust

**Portucel**
- Location: Portugal
- Start-Up Year: 1985
- Capacity: 15 MWth
- Fuel: Biomass, bark

**Norrsundet**
- Location: Sweden
- Start-Up Year: 1984
- Capacity: 25 MWth
- Fuel: Biomass, bark, sawdust
Our vision is to provide sustainable energy solutions through decarbonization, decentralization and digitalization of the energy industry. Our capabilities cover customer needs in the fields of power generation utilizing circulating fluidized bed (CFB) technologies, long term energy storage, and related network services. We continuously broaden our portfolio of products and services by advancing our in-house technologies and developing further alliances with new partners.

Our Values

Respect for people. Valuing and inviting differing views and ideas

Committed to customers. Exceeding expectations and providing value

Safety, integrity and teamwork. Incorporating ethics in everything we do

Ownership of results. Personally ensuring that success is achieved

Passion to innovate and grow. Setting challenging goals for growth

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