

An innovative ultraclean syngas process is set take bioenergy forward

Roll on wood

Swedish cleantech company Cortus Energy develops and markets a biomass gasification process called WoodRoll. WoodRoll is a breakthrough technology with a number of distinct technical solutions that are different from traditional gasification processes. Traditional gasification or state-of-the-art gasification is characterised by a number weaknesses. For instance, the traditional process has been designed for specific types of feedstock that need pretreatment. The syngas also needs to be cleaned from tar. Gas cleaning is expensive and requires a lot of energy to do, which results in a low yield. All in all, state-of-the-art biomass gasification cannot deliver a compelling renewable energy solution.

The WoodRoll process is a three-step innovation in which the process steps – drying, pyrolysis, and gasification – interact but are physically separated from each other. This is one major difference compared to state-of-the-art gasification. Other significant differences are included in figure one.

The WoodRoll process has been assessed by a number of international consultancy companies and has been classified as “beyond state-

of-the-art”. The WoodRoll solution creates a number of important advantages including the following:

- Feedstock flexibility and enabling the use of local low-grade (and cheap) biomass, which is a key parameter in building a solid business case. Typical feedstocks that are feasible for WoodRoll are forest products and residues, agricultural and industrial waste like glue- or paint-contaminated wood chips, and various types of sludge like fibre sludge from a pulp mill. Feedstock with a moisture content of up to 40-45% can be handled without any need of pretreatment.
- Ultraclean syngas free from tar impurities directly from the gasification, which eliminates the need of costly downstream gas cleaning equipment.
- High efficiency, typically 80% of the energy from the biomass is converted into syngas.
- Favourable gas composition (relation H₂:CO) to further refine the syngas into other energy products, such as ethanol, synthetic natural gas (SNG), renewable hydrogen, or biodiesel.

The WoodRoll process has been developed at laboratory, pilot, and demonstration scales. A 500kW gasifier has

Typical applications for WoodRoll

- Syngas can replace fossil fuels used in high intensive energy processes, such as steel mills, lime kilns, or paper mills. Syngas is also used as green feedstock in the petrochemical industry.
- The syngas is fed into a gas engine (cogeneration set) that generates renewable power and heat in a so-called combined heat and power (CHP) application.
- The syngas is upgraded via a catalytic process to renewable natural gas (SNG or biomethane) that is injected into the gas grid. Up to 80% of the syngas is converted to SNG (and 10% heat can be recovered).
- The syngas is upgraded to renewable hydrogen that is used in fuel cell applications for both stationary and automotive uses. Up to 90% of the syngas can be converted into renewable hydrogen.

been in operation in testing campaign mode since 2011. The complete demonstration installation in Sweden has been built up over the years. The first fully integrated process that generated an ultraclean syngas from wet biomass was performed in November 2015.

The first industrial WoodRoll size is set to 6MW syngas capacity. Such an installation needs to be fed with 36 dry tonnes of feedstock every 24 hours. In a CHP application such an installation would generate 2.4MW of renewable power and 3.5MW of heat.

The technology is based on set sizes and a modular design. A WoodRoll plant consists of a number of different modules,

one for each one or several process functions. The modules are manufactured and the process equipment is installed and fully tested at a dedicated factory in Sweden. Upon a full factory acceptance test the modules are sent to site, where they are assembled into a complete plant. The advantages with fixed sizes and a modular design include:

- Drive quality improvements as built-up experience and competence is reused
 - Drive cost reductions as design and deliveries are repeated
 - Faster ramp up of delivery capacity
 - Minimal disturbance at project site
 - The technical lifetime of the plant is secured as the plant can be moved
- WoodRoll is a competitive renewable energy solution with potential to replace fossil energy in applications where a renewable alternative has been lacking.

For more information:

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	State-of-the-art gasification	WoodRoll
Need of feedstock pretreatment sizing	Drying, sorting and strict particle	Sorting and moderate particle sizing (drying integrated)
Components that form the syngas	Pyrolysis gas including the tars and air or steam	Char and steam
Elimination of syngas impurities	After gasification	Before gasification
Internal generated energy that drive the process	Char	Pyrolysis gas including the tars
Residues	Char and ash	Ash only

Differences between WoodRoll and traditional gasification