



IEA Bioenergy
Technology Collaboration Programme



Country report Sweden

IEA Task 33 - Gasification of biomass and waste

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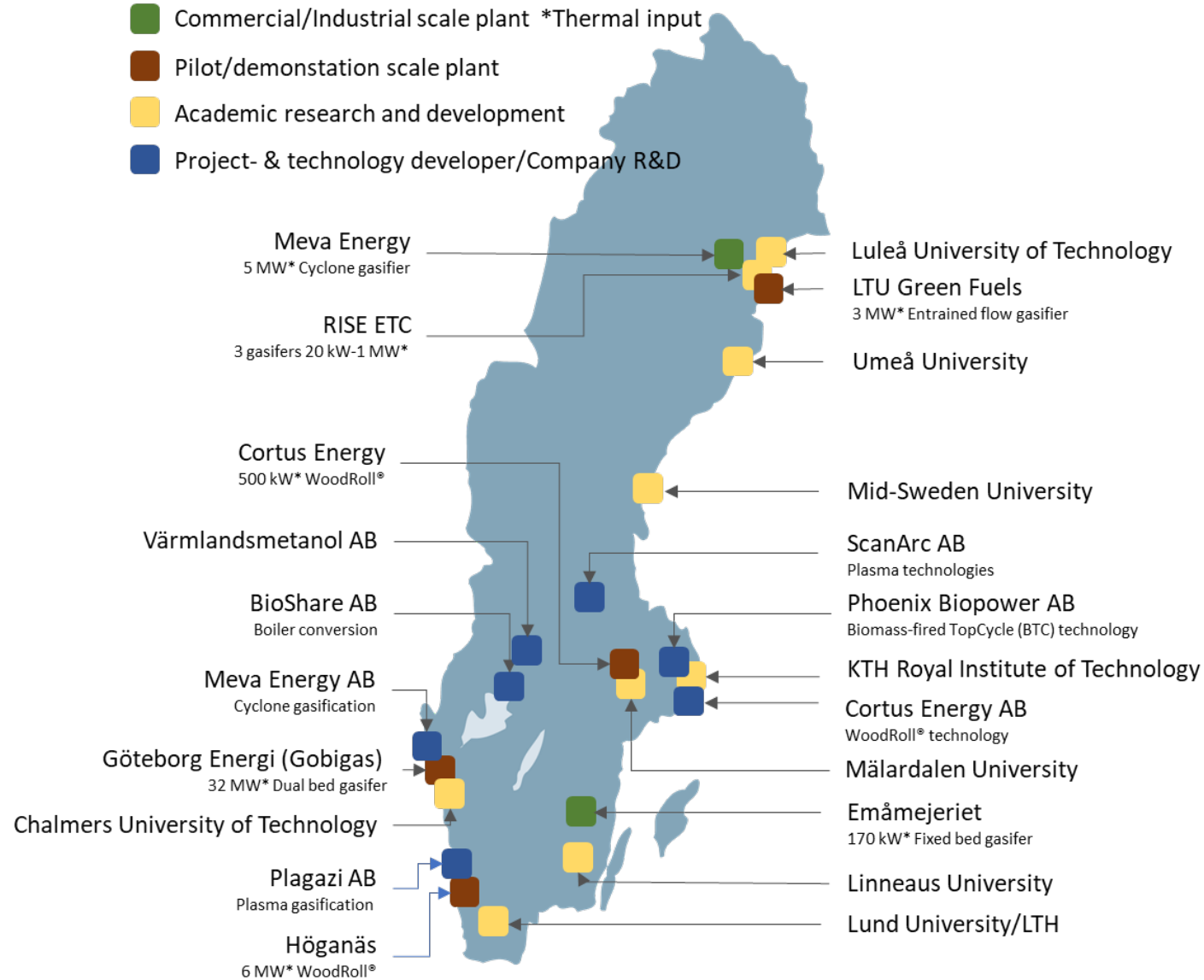
Online meeting, June 2021

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Technology Collaboration Programme

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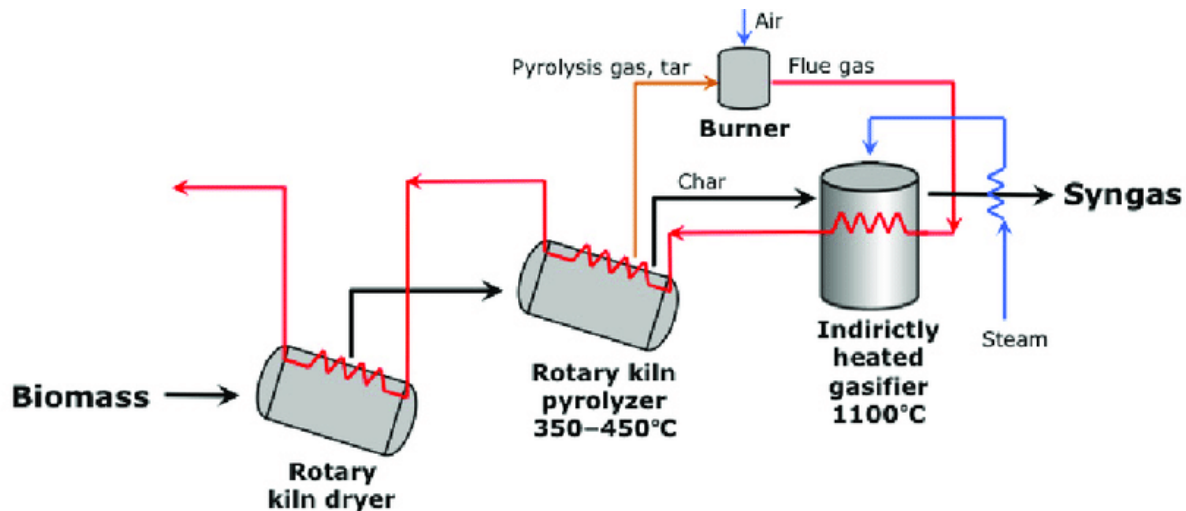
- Commercial/Industrial scale plant *Thermal input
- Pilot/demonstration scale plant
- Academic research and development
- Project- & technology developer/Company R&D



Cortus 6 MW WoodRoll® gasifier at the Höganäs steel plant



- Problems with particle build-up in the pyrolysis gas pipes now seem fixed.
- The different processes of the reconstructed plant are currently being tested
 - Dryer and pyrolyzer tested, now gasifier is in operation
- 7 days of continuous syngas production with the integrated process is the next Milestone (3)



Picture from and more info at <http://cortus.se>

Cortus WoodRoll® in Mariposa (US)

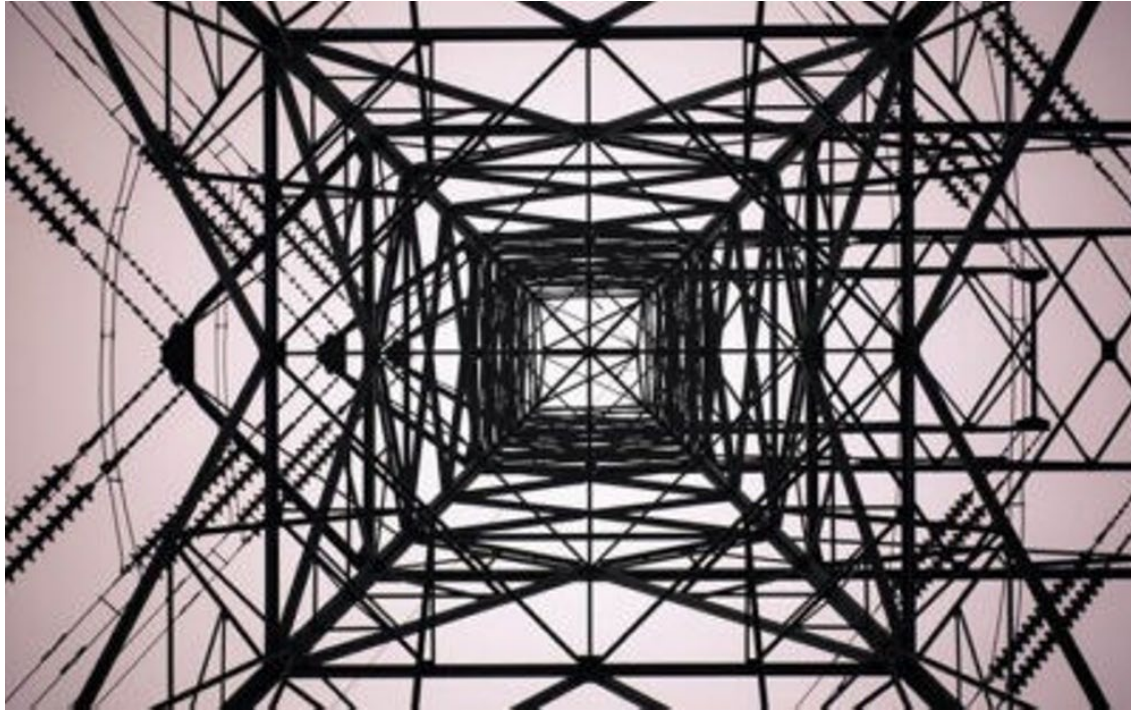


Photo from <http://cortus.se>

- Pacific Gas & Electric (PG&E) has approved Cortus and the Mariposa-project for delivery of 2,7 MW electricity.
- Cortus can now participate in forthcoming auctions within the BioMAT-program
- Cortus has **decided to await** the development of Covid-19 and the implementation of **Milestone 3** before starting any further activities.

More info at <http://cortus.se>

* Bioenergy Feed-in Tariff Program, https://www.cpuc.ca.gov/SB_1122

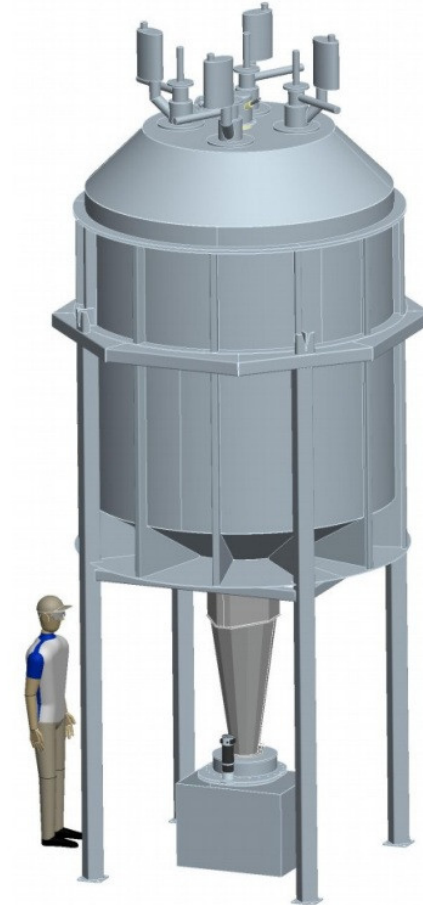
Cortus WoodRoll® & ENGIE (Fr)

- Collaboration project (WoodHy) initiated 2019 on biomass-to-hydrogen project in Bordeaux, France
- An order from **Engie Cofely** worth 135 000 € to carry out an **Advanced Feasibility Study** of a plant for hydrogen and CO₂ production
- **No further activity until Milestone 3** in Höganäs is fulfilled.

More info at <http://cortus.se>

**Woodroll
Gasifier**

 **CORTUS**



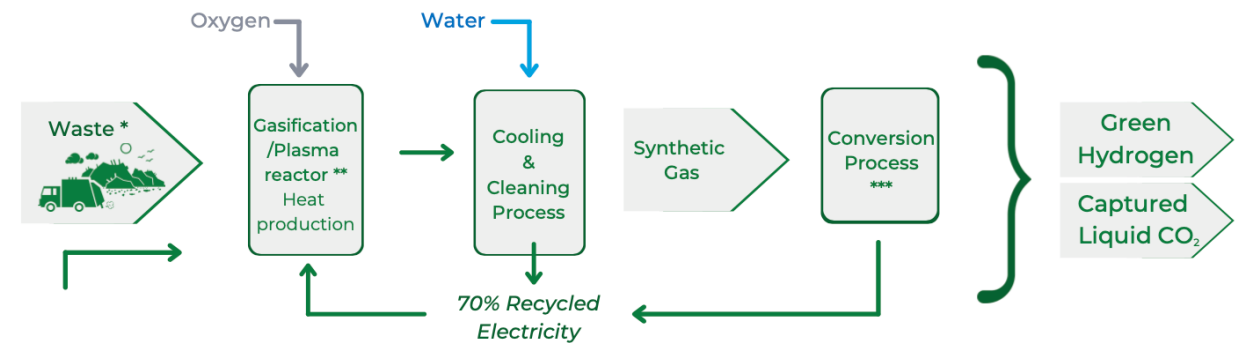
MEVA CHP-plant in Hortlax



- Entrained flow cyclone gasifier emanated from research at Luleå University of Technology
- Energy outputs 1.2 MW_{el} and 2.4 MW_{th} . Small fraction fuels (sawdust, wood fibers and agricultural residues)
- Applications: CHP, fossil process gas replacements and industrial drying processes
- Joint project with Andritz-Enviroburners - A complete gas burner test facility to enable complete engineering of industrial burner installations for process heat generation
- **News will soon be released**

Plagazi AB

- Plagazi AB has a concept for transforming waste into hydrogen through plasma gasification.
- Neue Energien Premnitz and Plagazi have completed the Basic Engineering phase of a project to build the first Plagazi plant in Europe. Planned start Q2, 2023.
- Plagazi has also signed a partnership with the Dutch engineering company Dordtech Circular Energy Solutions.



* Any type of waste: Auto Shredder Residue, Car Tires, Plastic, Household-, Industrial-, Hazardous- or Medical Waste.

** Exposed to Temperatures > 3000°C in a Plasma Reactor, where the waste is broken down to atomic level.

*** The Product is then rebuilt to form *Green Hydrogen and CO₂*, which the latter is captured directly.

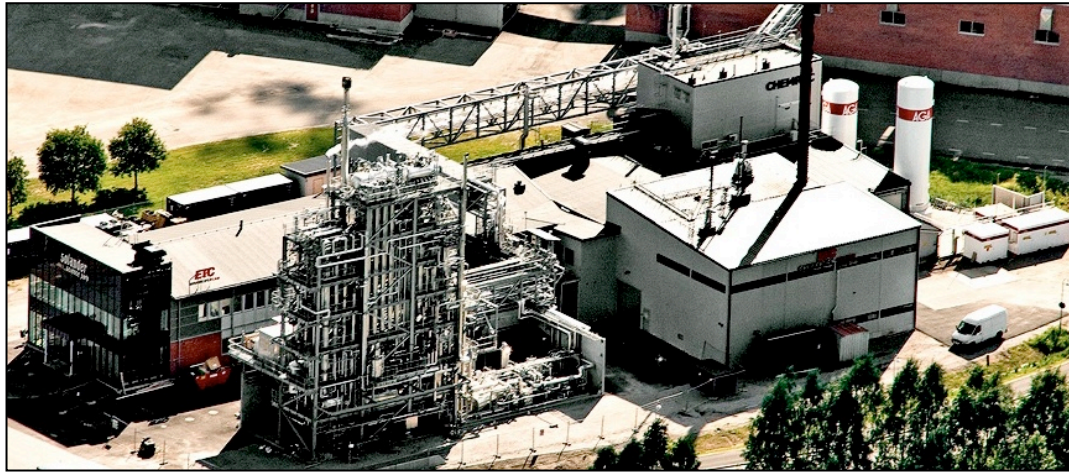
More info at <http://www.plagazi.com>

The Gobigas plant in Gothenburg



- The plant will be dismantled!

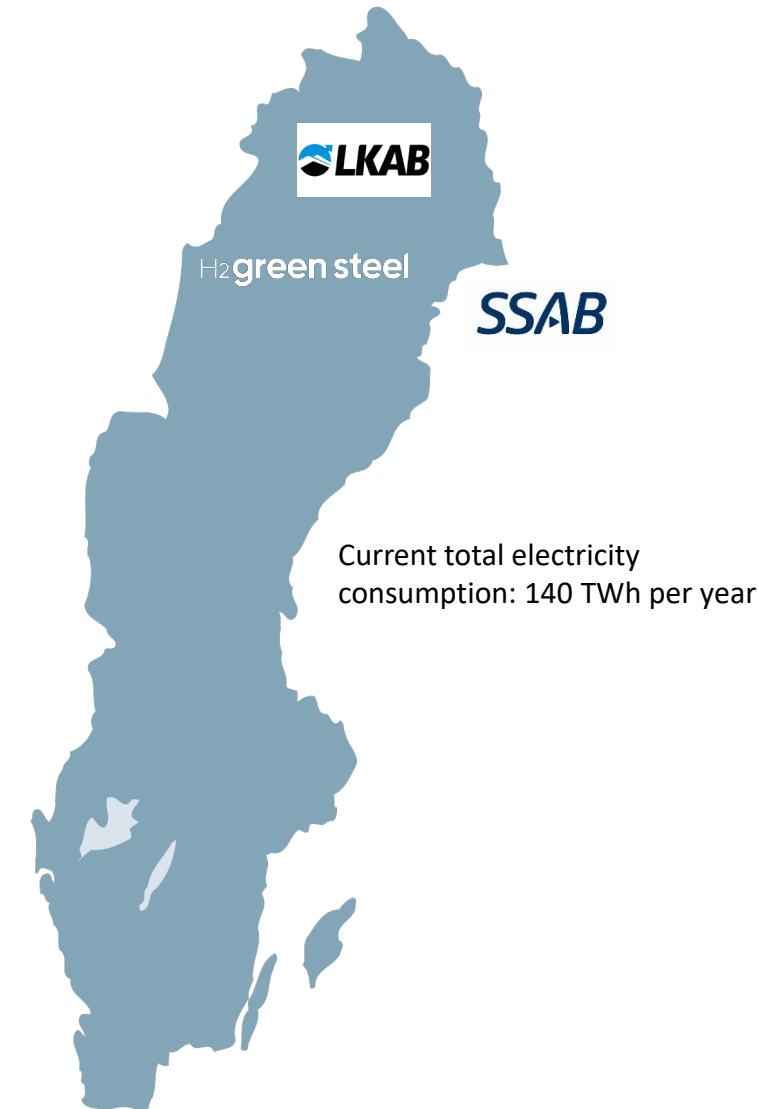
LTU Green Fuels plant



Pilot BL gasification	Pilot methanol + DME	Field testing
3 MW, 20 t DS/d	4 t/d methanol/DME	Volvo Trucks DME
>28 000 h since 2005	>12 000 h since 2011	8 trucks, >1 500 000 km
Recovery of cooking chemicals without difficulties		DME and methanol in industrial applications
Opportunities for exp. campaigns 24/7, high availability		

Large industrial transformation in Norrbotten, SWE

- **SSAB** in Luleå produces 2 million tons per year of steel. 2026 the first fossil-free steel will be produced and 2040, SSAB will be fossil free = >0.1 billion kg of H₂ = **>5 TWh of electricity**
- **LKAB** mines one of the world's richest iron ore deposits (27.2 million tons per year). They are now making the biggest industry investment ever in Sweden through the shift from iron ore pellets to **CO₂-free sponge iron**
- Assuming that all iron ore pellets are converted into sponge iron via a H₂-only DRI process = 1 billion kg of H₂ = **53 TWh of electricity**
- The company **H2 Green Steel** have started developing a completely new steel mill in Boden. The annual production at full capacity in 2030 will be 5 million tons steel. Making the same assumptions as for the SSAB, H₂ demand leads to an annual electricity need of **13.9 TWh**.
- **Large increase in renewable power production** within the next 10-20 years will be needed.



LTU Green Fuels plant - CH₂ESS

- CH₂ESS - Centre for Hydrogen use in industry and the Energy System Sweden.
- An extensive research and education investment in close collaboration with leading basic industries and energy companies.
- The focus is on hydrogen in industrial processes and energy systems.
- The core is LTU Green Fuels - great opportunities for combining electrolysis and biomass gasification
- Open for collaborations and new partners.
- MoU's with GTI and NTNU H₂-team



Ongoing Swedish gasification-related R&D programs

- **Swedish Gasification Centre (SFC): 2011-2021, total budget 54 M€ , see www.sfc-sweden.se**
 - Coordinates Swedish gasification R&D
 - 19 companies, 8 universities and one research institute
 - New proposal for continuation is under development - **SFC RECAP, 2022-2028**
 - Broadened scope and increased industrial relevance
 - Industrial case studies combined with underpinning research

- **Swedish Knowledge Centre for Renewable Transportation Fuels (f³): ends in 2021, budget 3.3 M€, see www.f3centre.se**
 - Proposal submitted to the Swedish Energy Agency for a f³ Centre-of-Excellence, annual budget 5 M€



Policy issues influencing gasification technologies

- The **reduction obligation for transport fuels** forces fuel distributors to blend in renewable fuels into fossil diesel and gasoline to reach pre-determined CO₂-reduction levels or pay large fines
- In the Budget Bill for 2021, the Government has proposed gradually increasing reduction quotas for 2021-2030 (**6 % CO₂-reduction for gasoline, and 26% for diesel in 2021; 28% CO₂-reduction for gasoline, and 66% for diesel in 2030**)
- The reduction obligation is good, but in the current form, it **fails to promote domestically produced biofuels**
- Sweden has become a **very large importer of HVO**, which is, in the long term hardly sustainable. SFC has published a position paper in the matter, see www.sfc-sweden.se

Policy issues influencing gasification technologies

- The Government commissioned the Swedish Energy Agency to investigate the need for additional policy instruments to promote domestic production of biofuels with new technologies
- Preliminary proposal from the Agency
 - **Investment support** combined with instruments that increase the willingness to pay for the product.
 - **A targeted quota** in the reduction obligation for raw materials based on lignocellulose.

Thanks!

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