



IEA Bioenergy
Technology Collaboration Programme



Country report Sweden

IEA Bioenergy Task 33 - Gasification of biomass and waste

Joakim Lundgren

Professor, Energy Engineering, Luleå University of Technology LTU

Guest professor, Process Technology, Royal Institute of Technology KTH

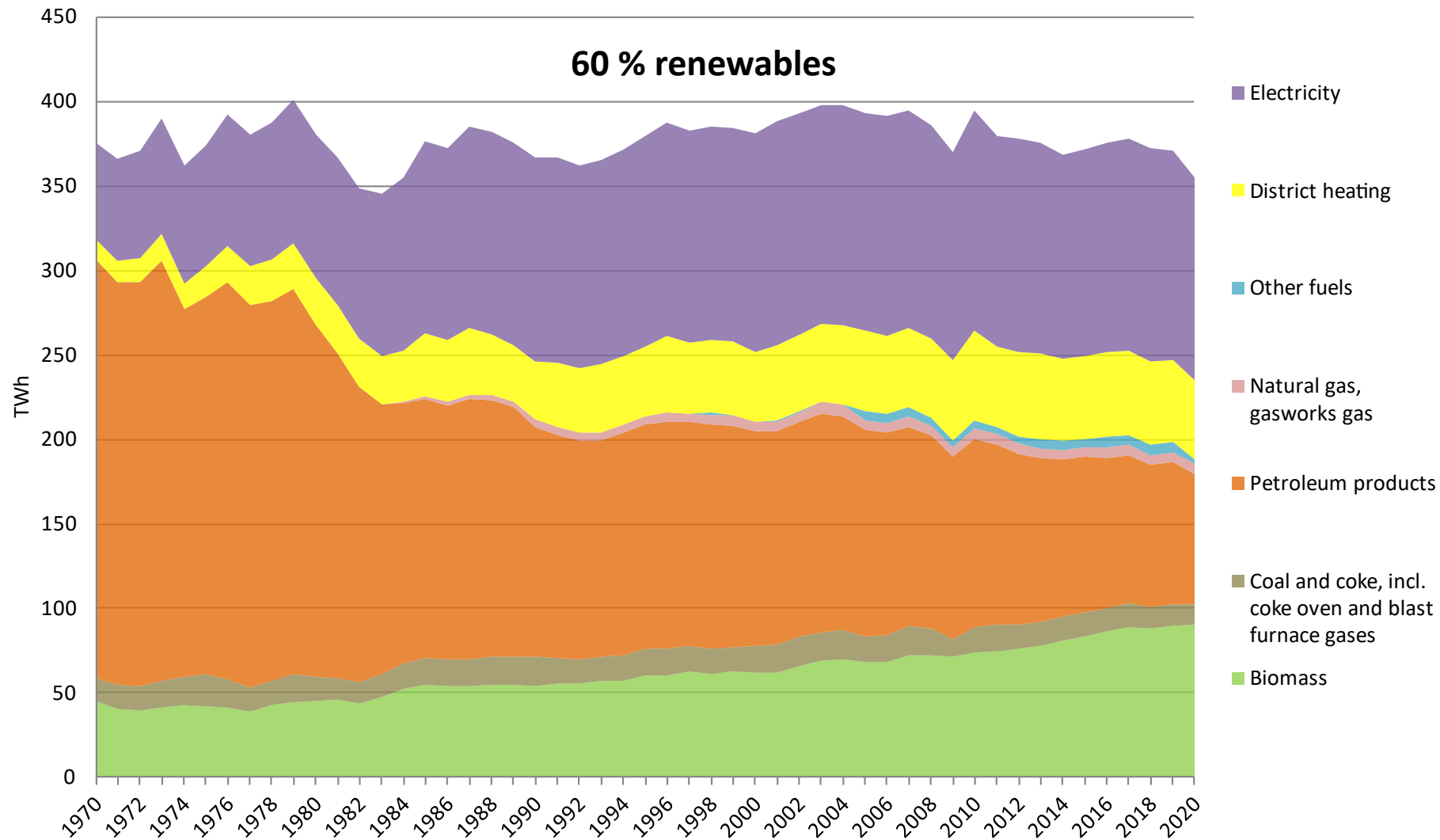
Task meeting, Vienna, 18-20 October 2022

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Technology Collaboration Programme

by **iea**

Total final energy use in Sweden (TWh per year)

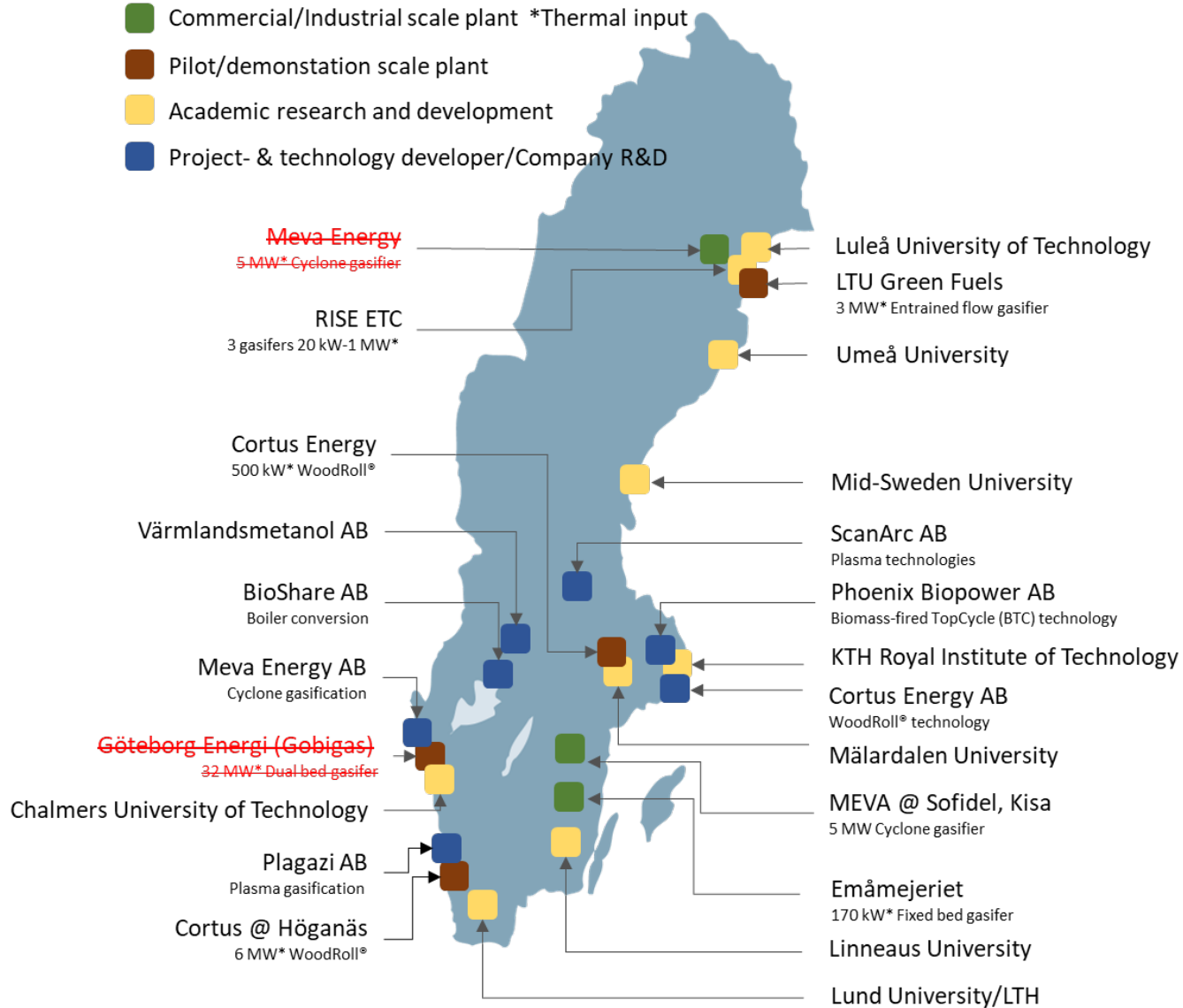


Policy update relevant for gasification

- A reduction obligation for transport fuels that forces fuel distributors to blend in pre-determined and annually increasing shares of renewable fuels into fossil diesel and gasoline was introduced
- Even if it fails to directly promote domestically produced biofuels, it promotes fuels with high GHG-performance
- The new government now proposes to radically lower the shares

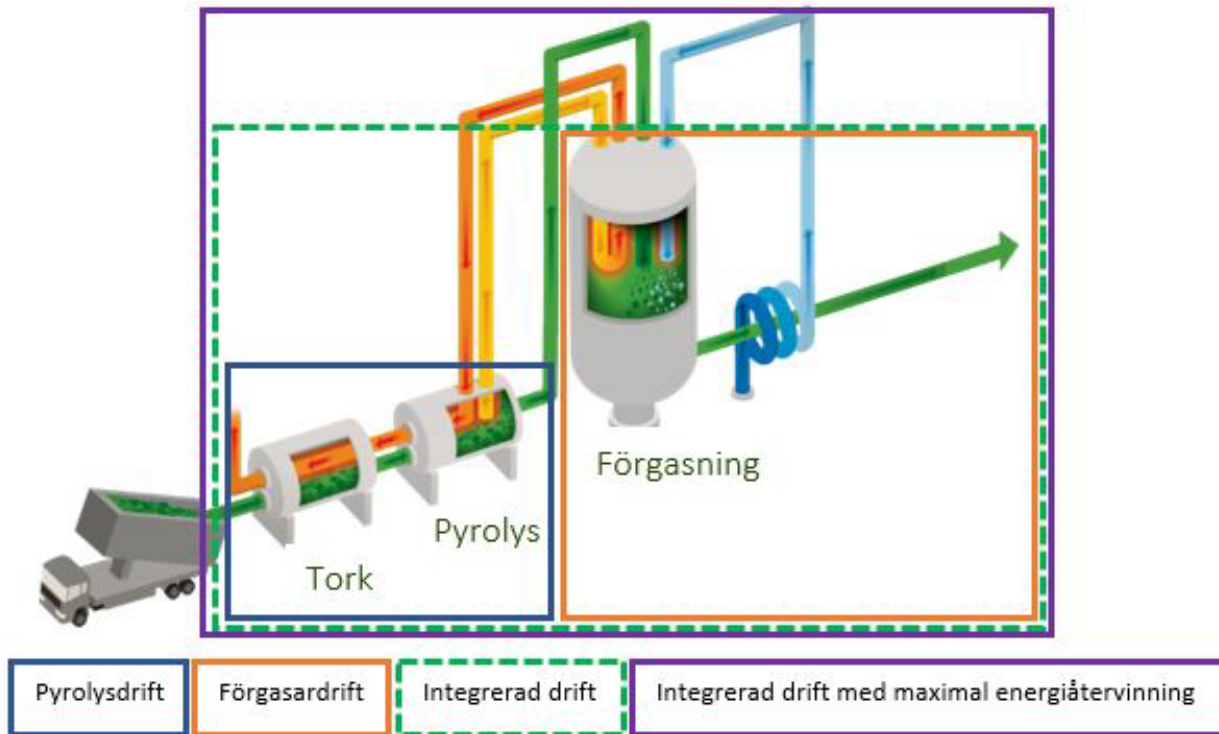
Year	Petrol	Diesel
2021	6 %	26 %
2022	10 %	30 %
2030	28 %	66 %

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



Company updates

Cortus 6 MW WoodRoll® gasifier at the Höganäs steel plant



- The problem with char particles in the pyrolysis gas clogging pipes seems solved.
- Integrated operation during > 60 hours was recently performed.
- Integrated operation with maximum energy recovery* during 7 days of continuous syngas production (MS3).

* more than 90% of the energy comes from pyrolysis gas.

Ref: <http://cortus.se>, 2022-10-17

Other Cortus WoodRoll® news



- Cortus AB recently got orders for two gasifiers from blueFLUX Energy AG and Holzner Druckbehälter GmbH in Germany.
- Engineering work has started - gasifiers to be delivered in Q1 and Q2 in 2023.
- The first project is for hydrogen (0.5 MW) and the second for fossil gas replacement in heating furnaces in the brick industry (6 MW).

Other Cortus WoodRoll® projects



Photo from <http://cortus.se>

- Engineering study for a future plant for green diesel production with the Norwegian company Biojet AS.
 - Planned plant capacity = 750 tonnes of biomass per day = several parallel WoodRoll® needed (20 times larger than Höganäs).
- A term sheet (preliminary agreement) with the Norwegian company Glocal Green AS on gasification of forest residues for the production of renewable methanol for shipping.
- New order of an engineering study on a 6 MW WoodRoll® gasifier in Ireland for RNG-production

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

MEVA Energy



- Entrained flow cyclone gasifier emanated from research at Luleå University of Technology
- Small fraction fuels (sawdust, wood fibers and agricultural residues)
- Applications: CHP, fossil process gas replacements and industrial drying processes

MEVA Energy



- Renewable gas replacing fossil LPG for tissue drying at Sofidel mill in Kisa, Sweden
- Approx. 4 MW = 1300 kg/h wood-pellets
 - Ready for cold tests Q1 2023
 - First gas deliveries end of Q2 2023
 - Fall 23 and Spring 24, plant optimization and evaluations



Pictures from and more information at <http://mevaenergy.com>



More information at <http://mevaenergy.com>

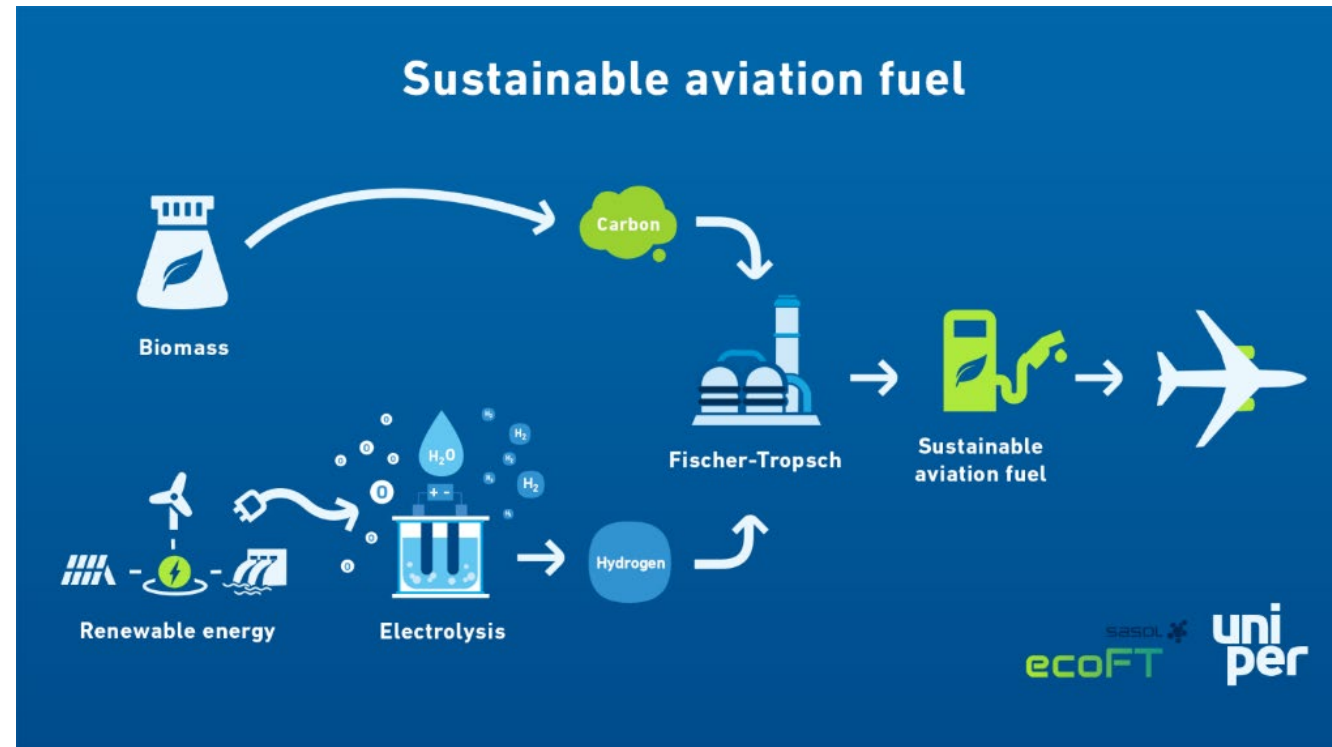
- Low value residues from furniture manufacturing, board, MDF to renewable gas and power (2.4 MW) at IKEA Industry production unit in Zbaszynek, Poland
 - 2*1220 kg/h fuel (twin gas trains with shared auxiliary systems)
 - 1.2 + 1.2 = 2.4 MW of green electricity, possibly use of residual heat for heating Ikea's nearby buildings
- Initial process design work completed. Now detailed design initiated.
- Start procurement of time-critical equipment in spring 2023 with start-up of the facility Q3-Q4 2024.
- Environmental impact assessment in progress

Uniper and Sasol ecoFT - SkyFuelH2

- Sasol ecoFT has signed a Lol with Sollefteå municipality in collaboration with Uniper
- An industry-scale production facility for sustainable aviation fuel

100 000 ton SAF per year = ca 150 MW = 200 MW power + 100 MW biomass

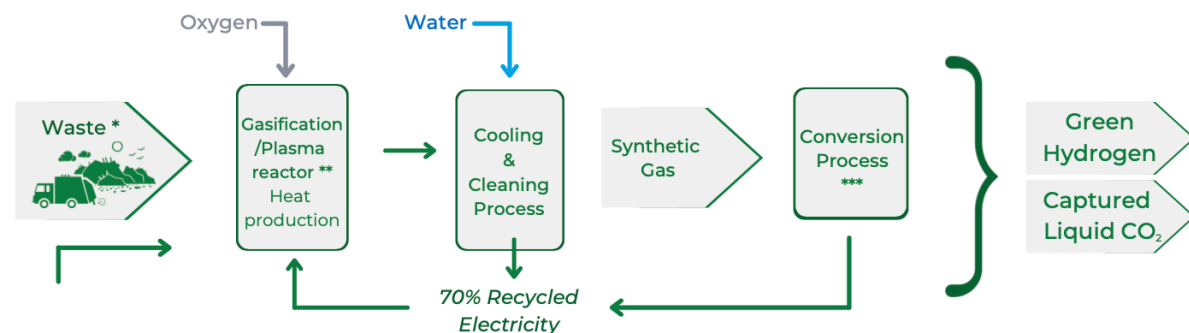
- Proposal for a feasibility study recently submitted to the Swedish Energy Agency (Total budget 53 M€ (50 % from SEA))



Reference and more info at <https://www.uniper.energy/sweden>

PLAGAZI AB

- The patented PLAGAZI ® process for transforming waste into hydrogen through plasma gasification. Several projects in pipeline:
 - Köping Hydrogen Park - Three Plagazi plants to recycle 66.000 tonnes of waste annually for production of 12.000 tonnes (51 MW) of hydrogen.
 - Planned to be operational in 2024
 - German project “Havelstoff” located in Brandenburg run together with Neue Energien Premnitz
 - LOI with WIRTZ Energie + Mineralöl GmbH with the intent to form a long-term offtake agreement of 4 000 tons of hydrogen
 - Planned start Q2, 2023



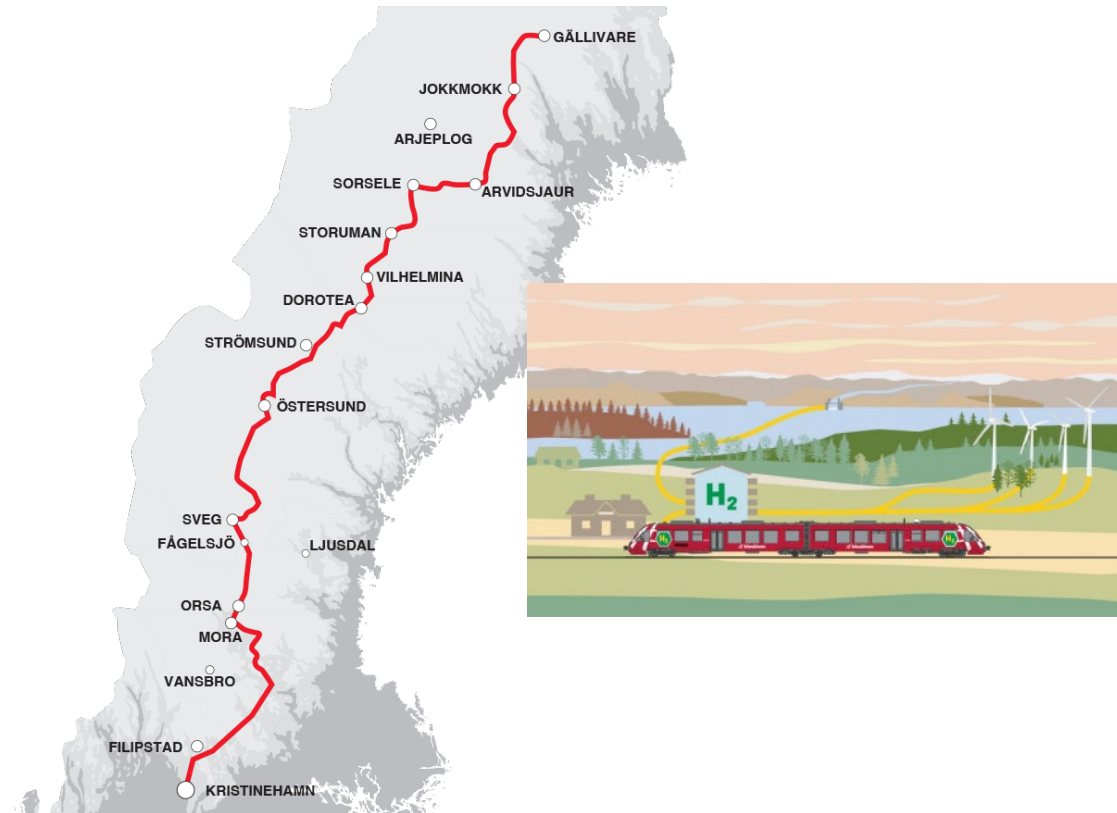
* Any type of waste: Auto Shredder Residue, Car Tires, Plastic, Household-, Industrial-, Hazardous- or Medical Waste.

** 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.

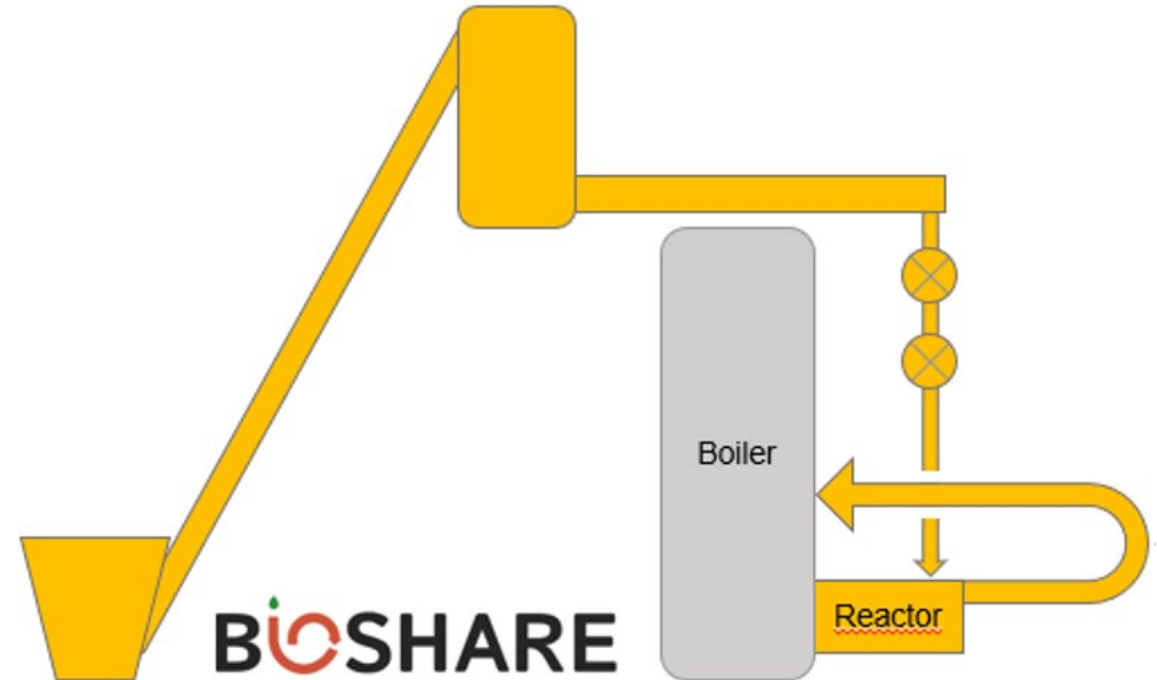
PLAGAZI AB

- LOI with Inlandsbanan AB (owned by the Swedish state) aiming at collaboration on production and distribution of H₂ based on non-recyclable waste.
 - Hydrogen-powered freight and passenger traffic on the track with a potential H₂ need of about 20,000 tonnes per year.
- A feasibility study for Migros industrie (a Swiss retail company)
- Potential collaboration with LanzaTech for circular plastics.

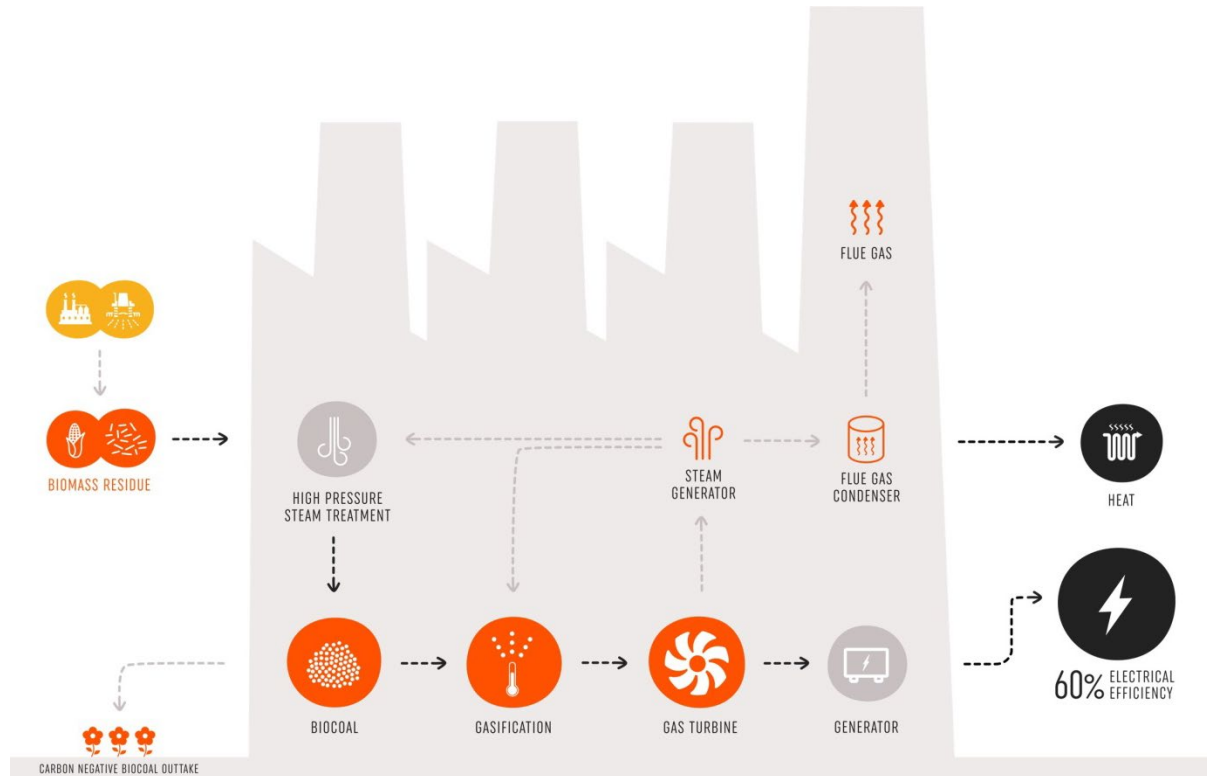


BioShare - Thermochemical co-production in a CHP plant

- The company BioShare was granted funding ($\approx 1,7$ M€, 2020-2024) to demonstrate integrated gasification and pyrolysis at a CHP-plant
- The reactor to be operated during three heating seasons to assess performance and gas quality with different feedstocks
- No updates reported



Phoenix Biopower



- The Biomass-fired TopCycle (BTC) - high-pressure steam treatment and entrained flow gasification
- Gas turbine for power generation
- Aiming at electrical efficiency of up to 60 %
- Two H2020-projects; EUCANwin! and BioFlexGen

More information at <http://phoenixbiopower.com/>

Selected gasification R&D projects

Circular and renewable feedstocks to the Swedish chemical industry

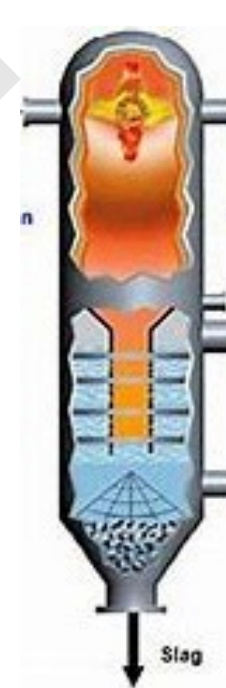


Pyrolysis

Pyrolysis liquid

Gasification

 Energimyndigheten
0.63 MEuro (3 yr)



Synthesis gas



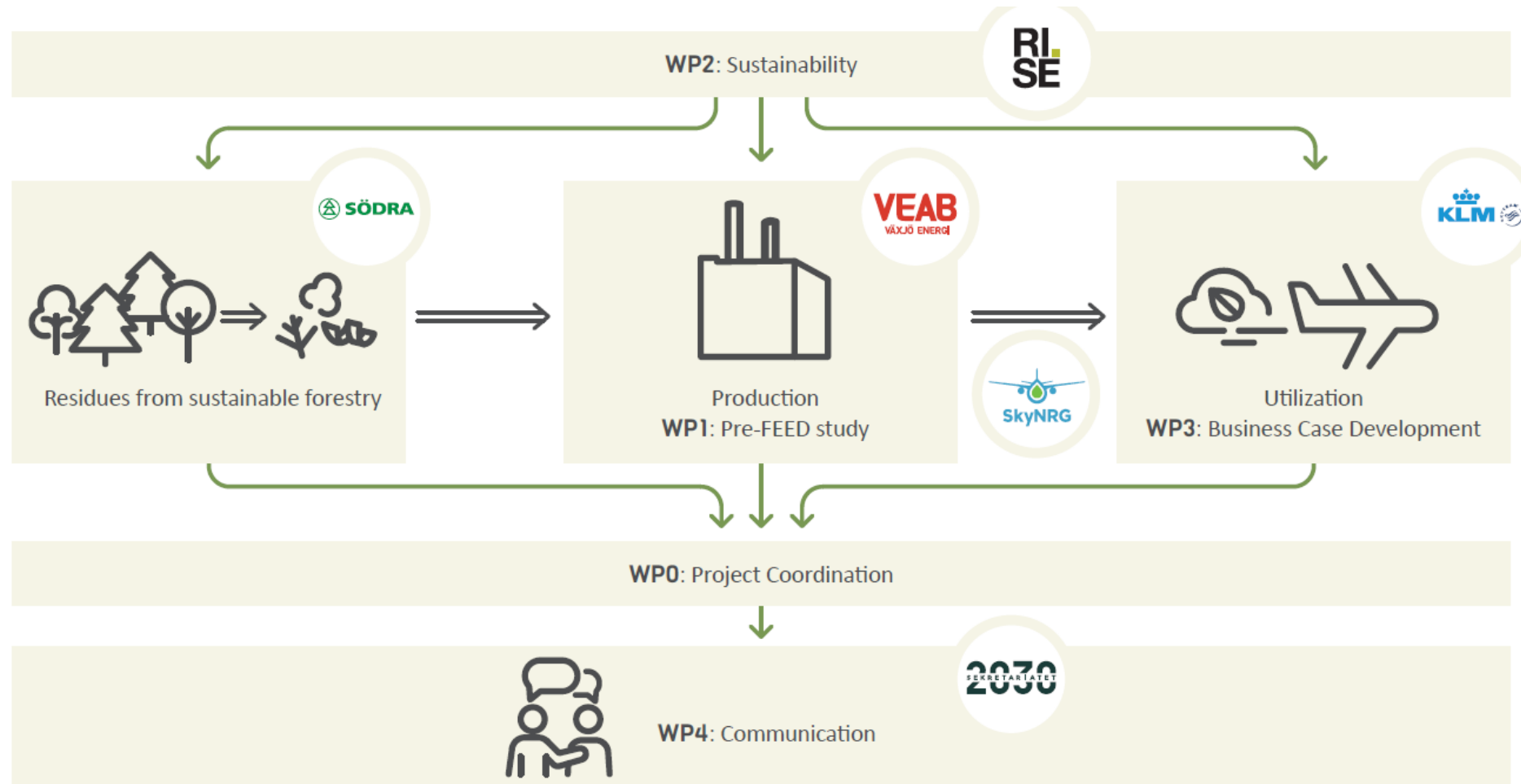
Josefsson Sustainable Chemistry AB

Recycled oil (Stena)

REJLERS



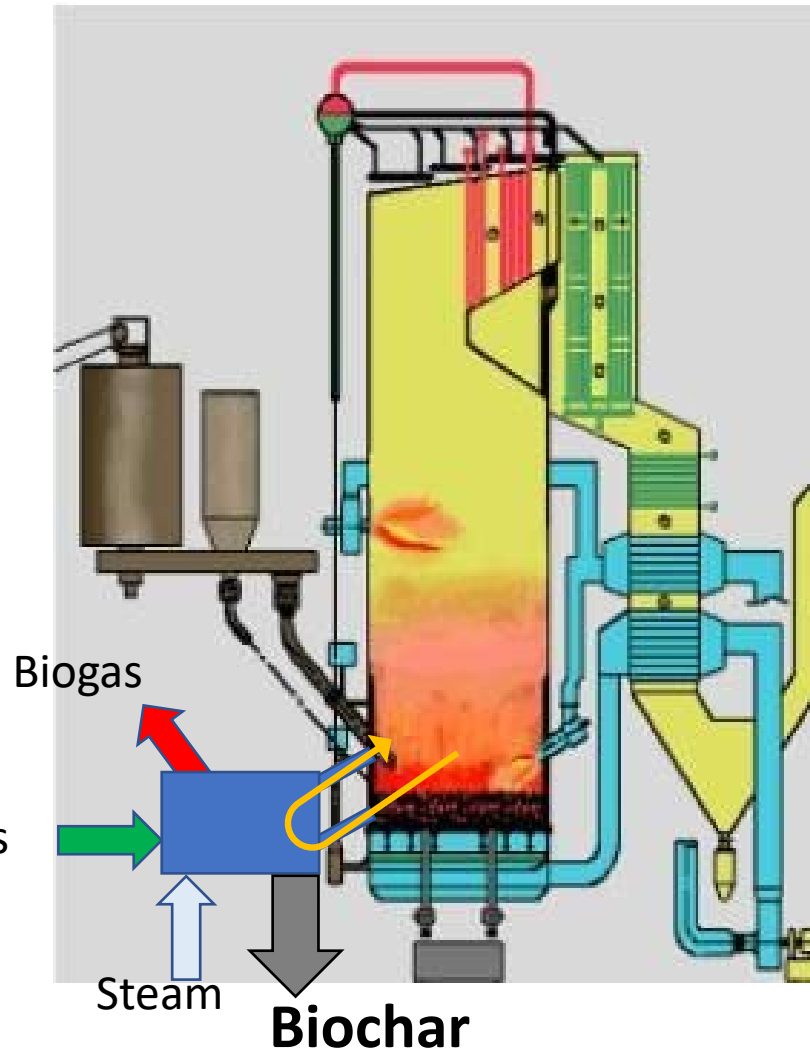
From Forest Residues to Sustainable Aviation Fuels (RE-SAF)



FerroSilva

- Project funded by the Swedish Energy Agency and an industrial and research consortium,
- Techno-economic conditions for production of sponge iron (DRI)
 - Several options for integrating the production of biogenic syngas with a reduction process with high utilization of the top gas of the DR-process
 - Great GHG-performance - CO₂-sink with CCS
 - Reduction with syngas from biomass seems competitive against all other current alternatives under Swedish conditions.
- The next step is to build a demonstration plant of 50 kton DRI.

Large-scale production of biocarbon as renewable feedstock in fossil-free value chains within the iron and steel industry



Aim: Develop a reactor concept enabling large-scale production of biocarbon and which can be integrated into existing fluidized bed boilers.

2022-2026

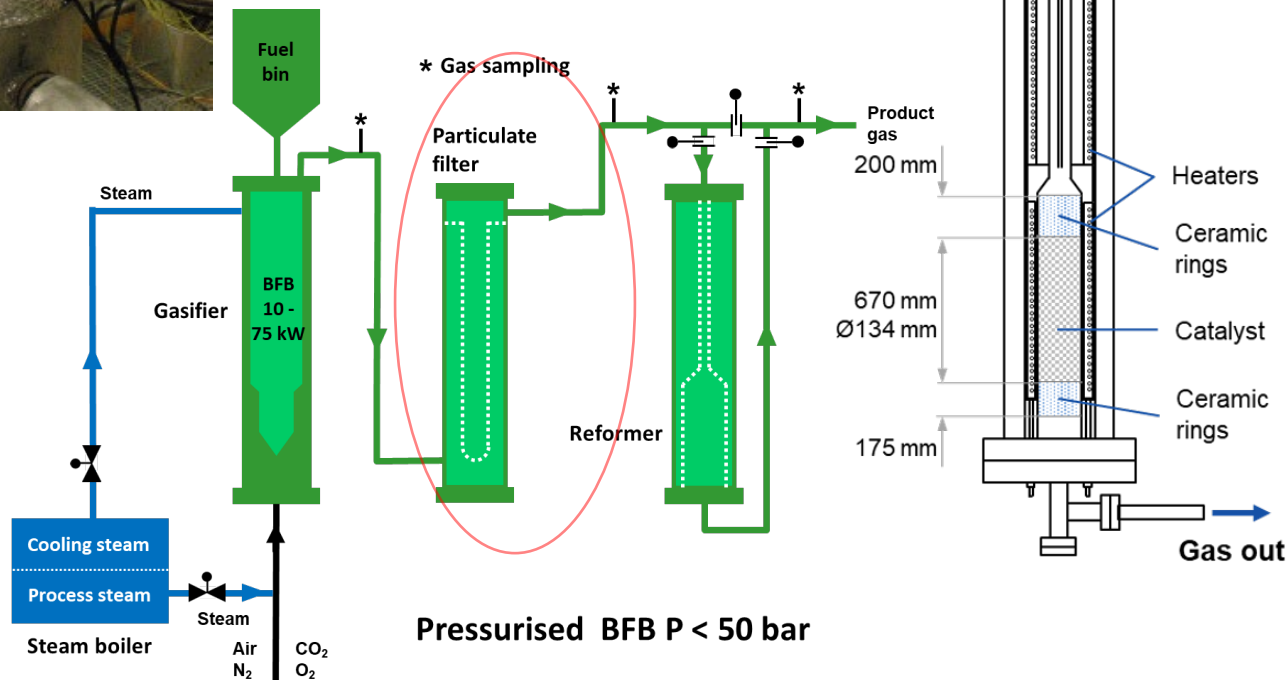
Funded by Swedish Energy Agency

Partners: Chalmers, Luleå University of Technology, RISE, BioShare, E.ON, Höganäs, SSAFE



CHALMERS
UNIVERSITY OF TECHNOLOGY

Catalytic steam reforming of tar and methane at high pressure for H₂ production



Increased the understanding of catalytic steam tar and hydrocarbon reforming of biomass gasification raw gas at pressurized conditions (10-20 bar)

- Tests to be performed in collaboration with Topsoe A/S and Phoenix BioPower AB
- Determine relevant operational conditions based on gas composition
- Determine catalytic reactor configuration
- Focus monolithic catalyst
- Test to be carried out during 2023

Thanks!

Joakim Lundgren,

Deputy Director, CH2ESS - Centre for Hydrogen use in industry and the Energy System Sweden

Professor, Energy Engineering, Luleå University of Technology

Guest professor, Process Technology, Royal Institute of Technology KTH



www.ieabioenergy.com