

WoodRoll® - breakthrough technology for cleanest energy gas from biomass!



**Small-scale gasification for CHP
Innsbruck, May 2017
Rolf Ljunggren**

CONTENT

1 Cortus Energy

2 The WoodRoll® technology

3 Operation in Köping

4 Business projects

5 Next step



1. Cortus Energy

1.1 Cortus Energy

- Founded in 2006 to develop and commercialize the patented gasification process WoodRoll®.
- WoodRoll® is a gasification process for biomass, producing clean energy gas with a high energy value.
- The purity and high energy value of the energy gas makes it suitable for replacing fossil fuels.
- Listed on Nasdaq OMX First North since february 2013.
- The company has 12 employees and 10 consultants.



1.2 WoodRoll® test plant in Köping



**1.3 Modular 6 MW WoodRoll® plant
is marketed now!**





2. The WoodRoll® technology

2.1

WoodRoll® – Versatile green Energy gas

WoodRoll® is a unique technology that replaces fossil energy by efficient gasification of biomass that produces green energy for vehicles, industry and power generation.

Feedstock

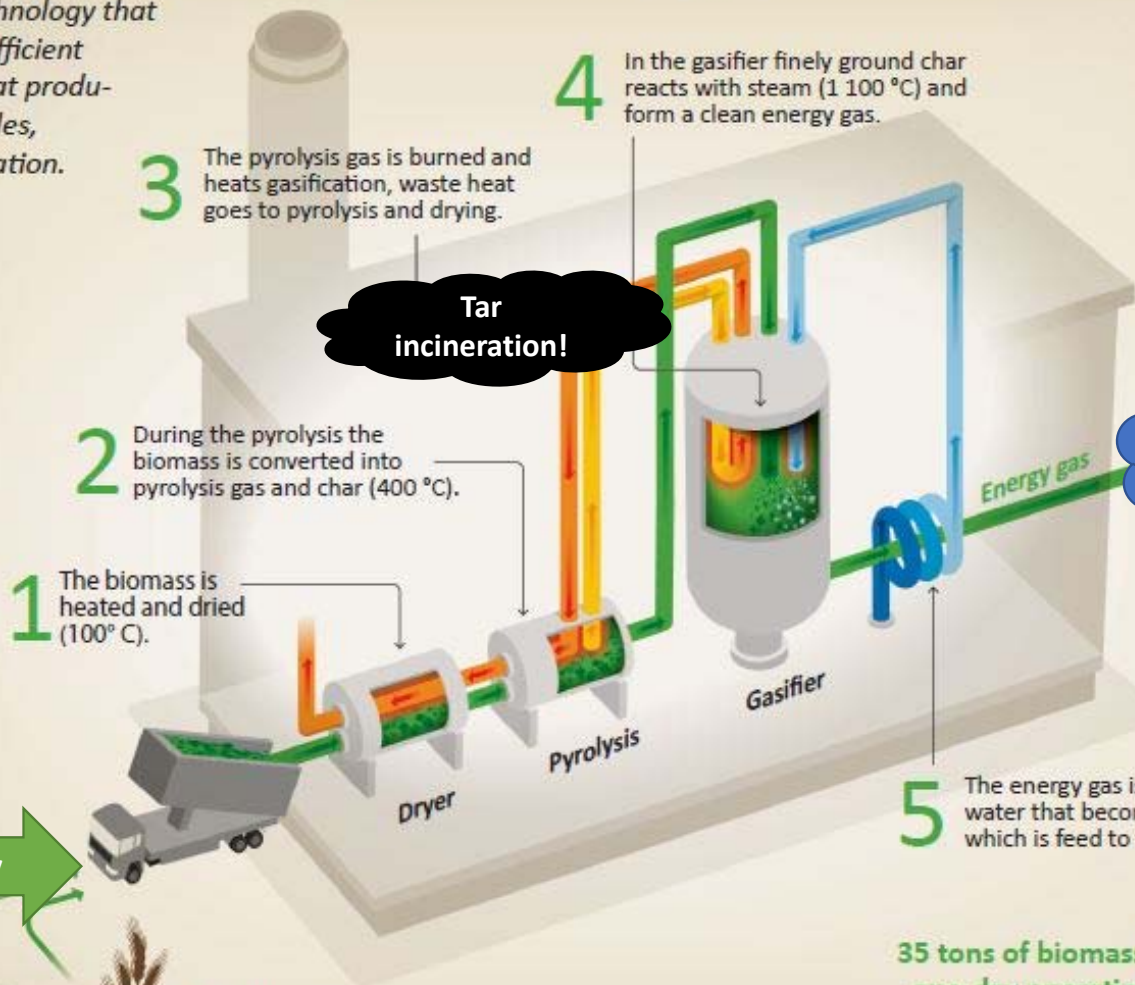
Forest-based feedstock such as forest residues and energy crops.



Waste from industry such as fiber sludge and construction waste.



Agricultural waste such as animal manure and crop residues.



Applications

Biogas



Renewable power

Hydrogen



Industry



35 tons of biomass (equivalent to a lorry with trailer) one-day operation of a WoodRoll® = 100 oil barrels



2.2 WoodRoll® – development until today!

500 kW_{thermal}
Test gasifier



Engineering of
5 MW WoodRoll®



500 kW_{thermal}
Installation integrated
WoodRoll® in Köping



WoodRoll®
Test plant



Tests of:

- Fuels
- Gascleaning
- Crackning



2007

2008

2009

2010

2011

2012

2013

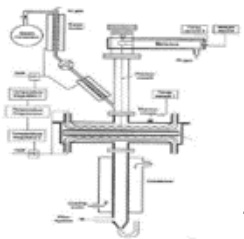
2014

2015

2016

2017-

Collaboration
with KTH for bio
fuels - Thermo
Gravimetric
Analysis (TGA)



150 kW gas
pilot tests



New TGA -
Close to 300 samples
of biofuels made
(Mar. -2017).



DemoSNG
Methanation
tested in Köping



New 6 MW_{th} modular
WoodRoll® plant



Projects

6 MW_{th} modular
WoodRoll® plant

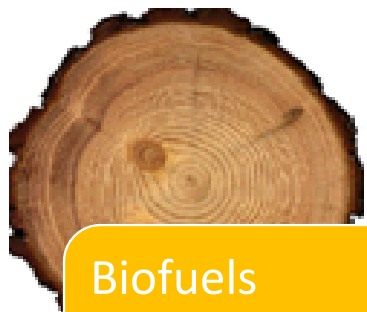
Höganäs



FOREST ENERGY

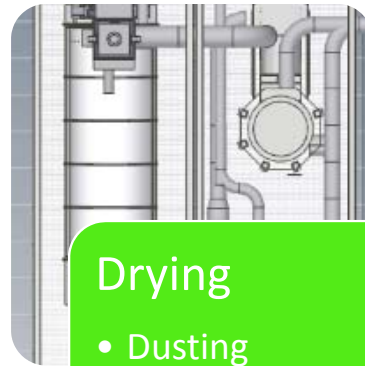
CORTUS
ENERGY

2.3 WoodRoll® – Fundamentals



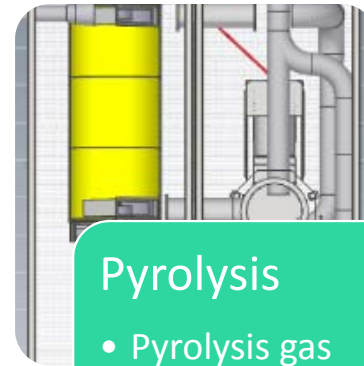
Biofuels

- Reactivity
- Ashes



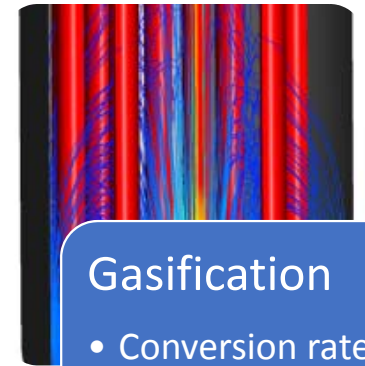
Drying

- Dusting
- Condensation
- Single percentage humidity



Pyrolysis

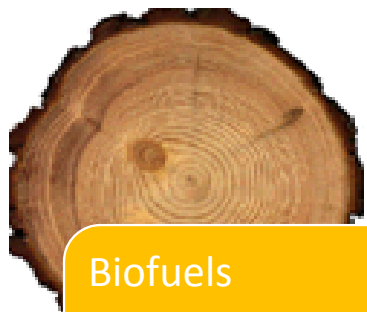
- Pyrolysis gas
- Combustion of pyrolysis gas
- Char yield



Gasification

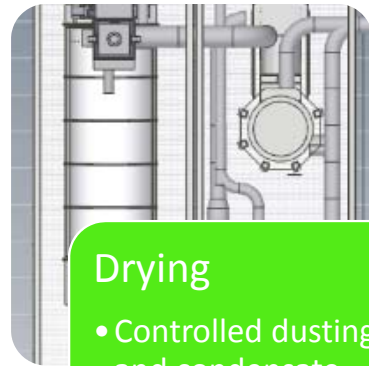
- Conversion rate
- Ash control

2.4 WoodRoll® – Achievements



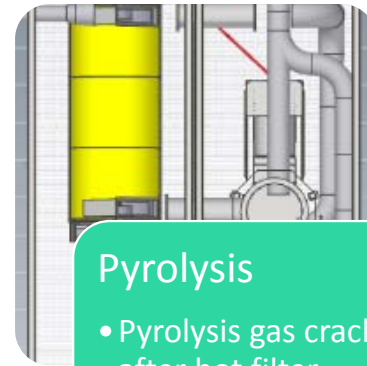
Biofuels

- 20 biofuels verified



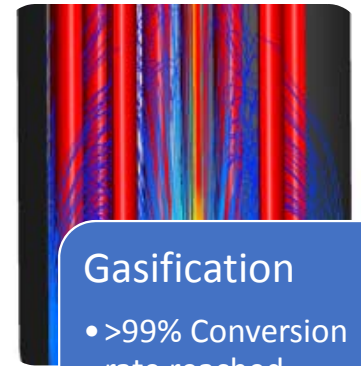
Drying

- Controlled dusting and condensate
- Single percentage humidity in operation



Pyrolysis

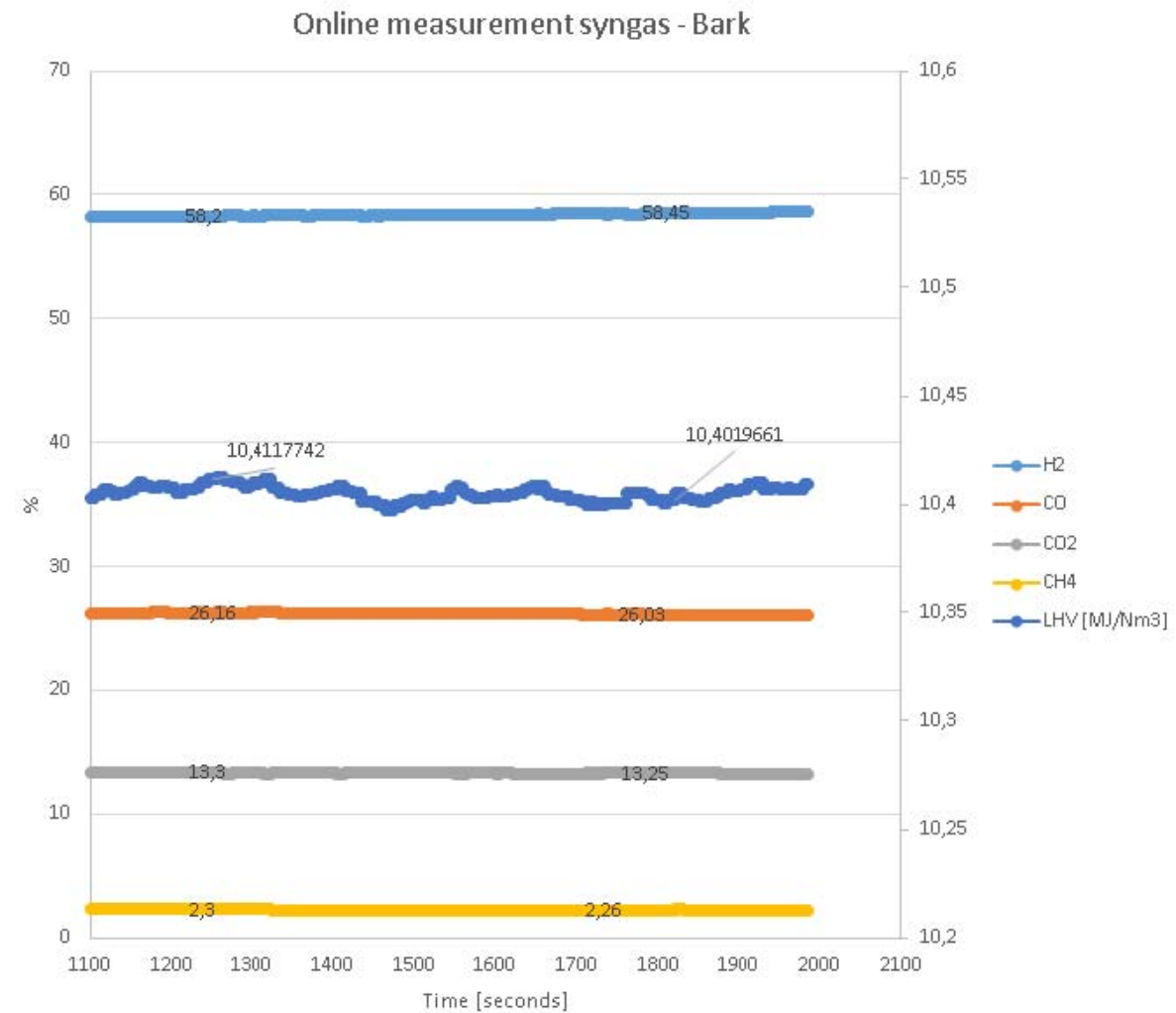
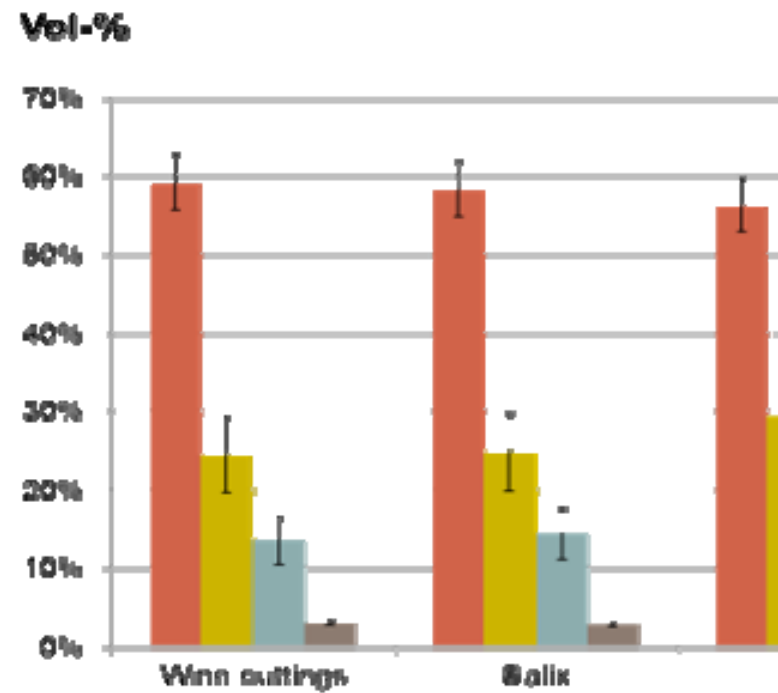
- Pyrolysis gas cracked after hot filter
- Combustion stable
- Char yield [T, X_i] 35% +/-10%



Gasification

- >99% Conversion rate reached
- Ash melting only for chemical sludge
- Ultra clean syngas

2.5 WoodRoll[®] – gas composition





3. Operations in Köping

3.1 Operations

2016

- Syngas cleaning for catalytic process:
 - Green gas fuel station
 - Biogas Expose
- Fuel tests:
 - Probiostål - Höganäs
 - Cheap biofuels - Biogas Expose
- Catalytic crackning
- Availability/Capacity/Yield

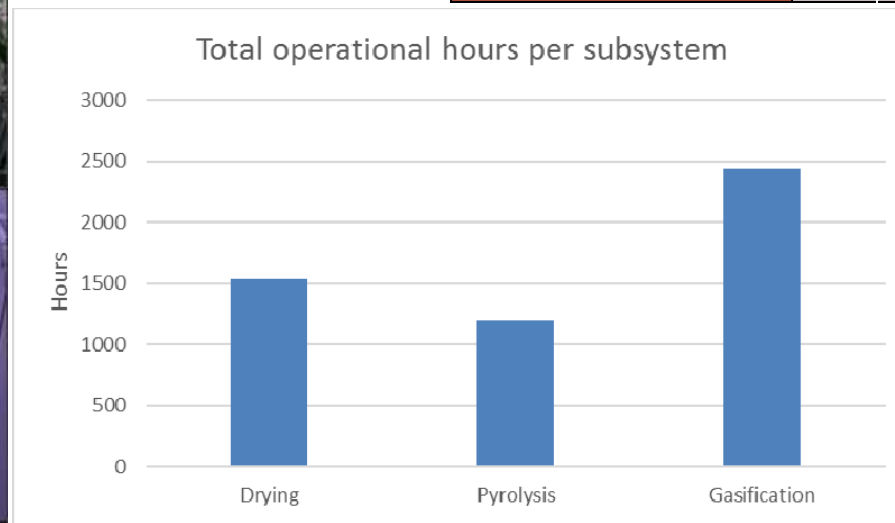
2017 and forward

- Biocoke
 - Höganäs
- Methanation
 - Biogas Expose
- Hydrogen
 - Fuel cells for heat and power
- Fuel tests:
 - Biofuels from Japan
 - Cheap biofuels - Biogas Expose
- Availability/Capacity/Yield

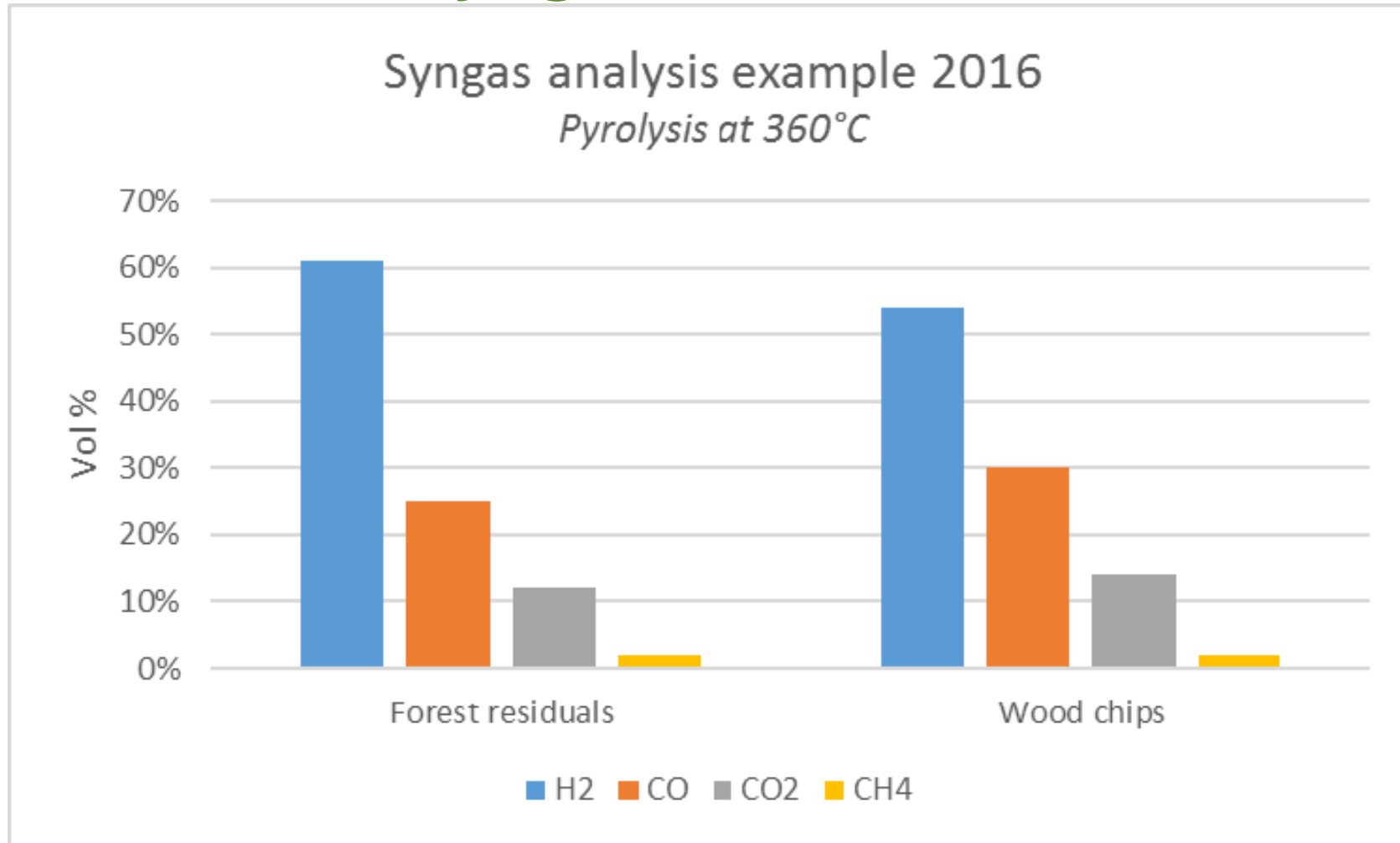
3.2 Test plant in Köping



Process Block	Year installed					
	2011	2012	2013	2014	2015	2016
01 Biomass handling						
02 Drying						
03 Pyrolysis						
04 Char handling						
05 Gasifier and cyclone						
06 Steam system						
07 Water treatment system						
08 Bottom ash handling						
09 Burner system						
10 Syngas flowtrain						
11 Syngas cleaning system						
18 Chimney						
19 LPG						
20 Flare						
21 Nitrogen						
22. Water						
32 Compressed air						
33. Cooling water						



3.3 Probiostål syngas



4. Business projects

1 Höganäs AB

2 Forest Energy

3 Mariposa



4.1 Probiostål project

Höganäs AB

4.1.1 WoodRoll® in Höganäs

Höganäs AB and Cortus AB collaborate for renewable energy under a 20 years renewable energy supply contract

- Höganäs wants to be the first steel manufacturer to replace fossil such as natural gas and coke with renewable energy to stay ahead of the competition
- Cortus has an excellent first commercial and industrial plant to operate in 2018
- A cooperation has been running since 2012 within Jernkontoret (Swedish Iron and Steel Society).

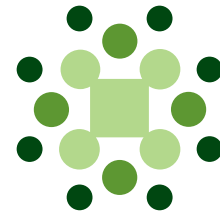
4.1.2 WoodRoll® in Höganäs - background

- A pre-design (Basic engineering) has been completed for Höganäs in 2015/16 at a cost of 8.5 MSEK, where industry, institutes and academy together have developed a basis for the introduction of renewable energy in the production facilities at Högnäs.
- The pre-design includes:
 - Manufacturing, installation, commissioning of a WoodRoll®- plant (Cortus/Höganäs)
 - Environmental impact study as a life cycle analysis (Swerea)
 - Modeling, simulation and analysis of heating process impact in Höganäs (KTH)
 - Energy optimization of the system – gasification and furnace (KTH)
- The parties are finalizing a 20 year supply contract.

4.1.3 Project partners



Höganäs



CORTUS
ENERGY

**OUTO
KUMPU**

SSAB

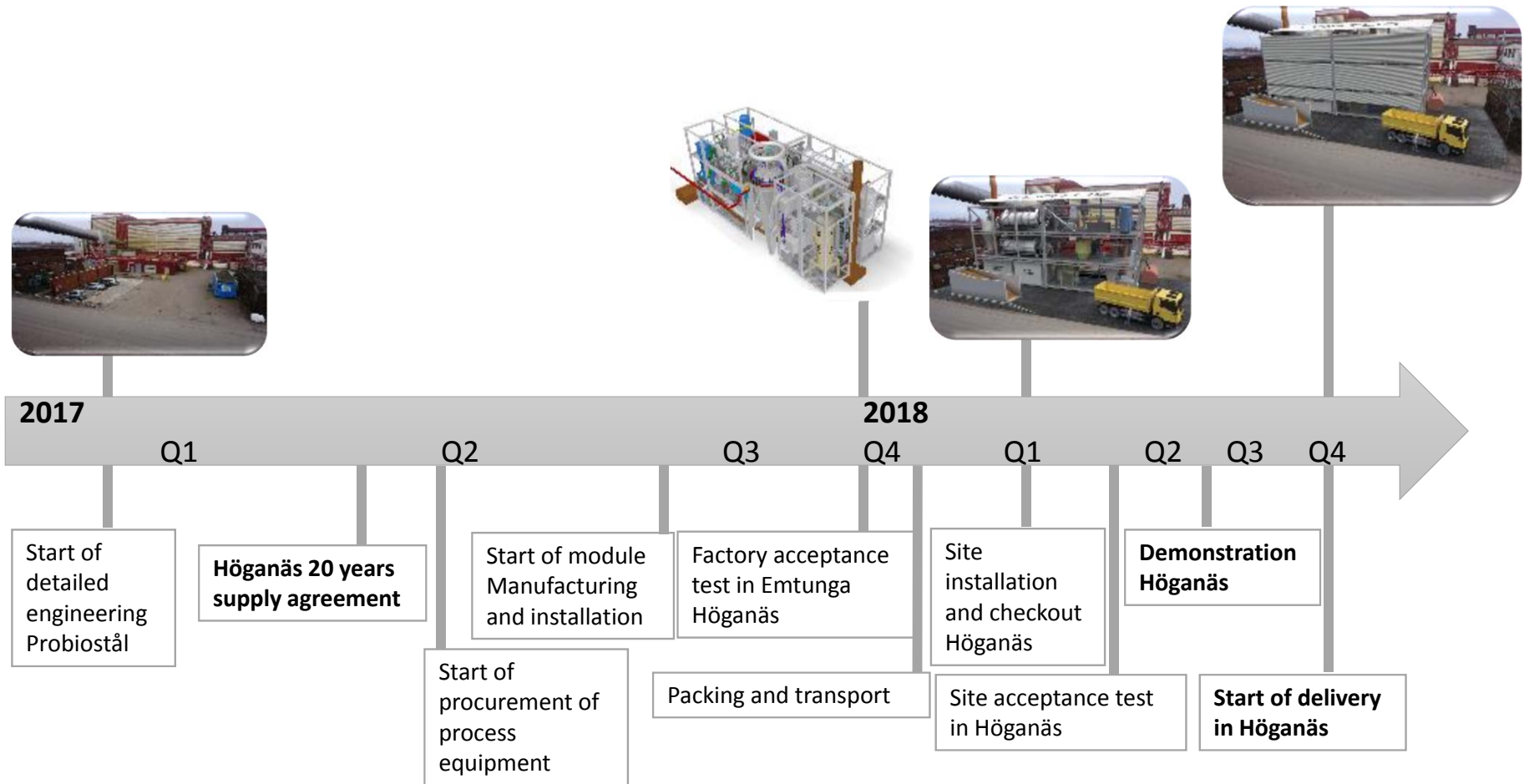


SVEASKOG



SÖDRA

4.1.4 Project plan



4.1.5 Modular 6 MW WoodRoll®

Engineering

- The plant is sectioned into function blocks
- Cortus is responsible for process engineering
- Design support from ÅF, WSP (AutoCAD Inventor)
- The engineering is based on the pilot plant in Köping
- Process equipment is bought from established suppliers
- The modules are manufactured in Emtunga

Modules

- The plant consist of 14 modules
- The basic module size is 4.45 m * 13.35 m * 4.00 m
- Each module will have its own electrical cabinet
- The process modules have integrated electrical and control cabinets
- Power and network connections to the modules

4.1.6 Planned structure for modular plant at site 2018



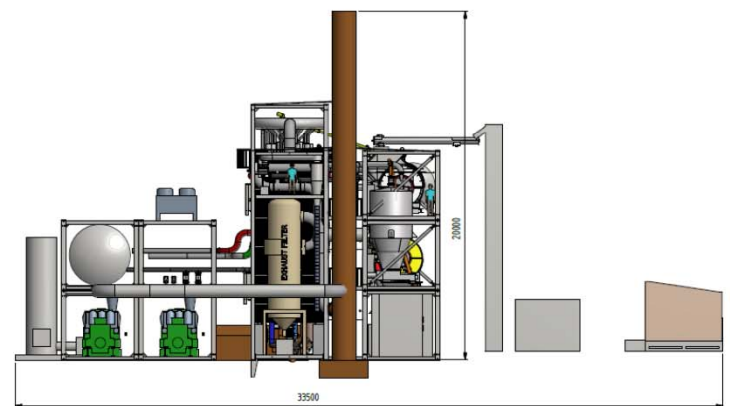
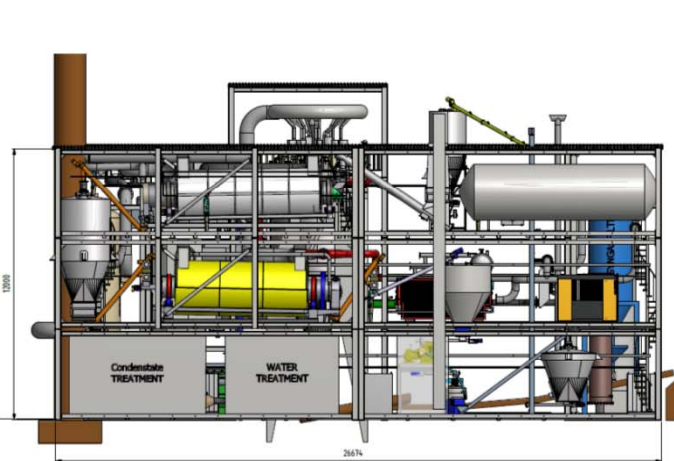
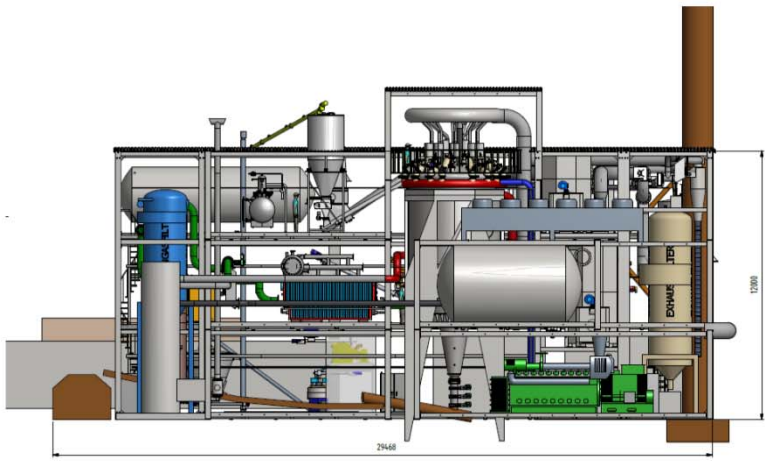
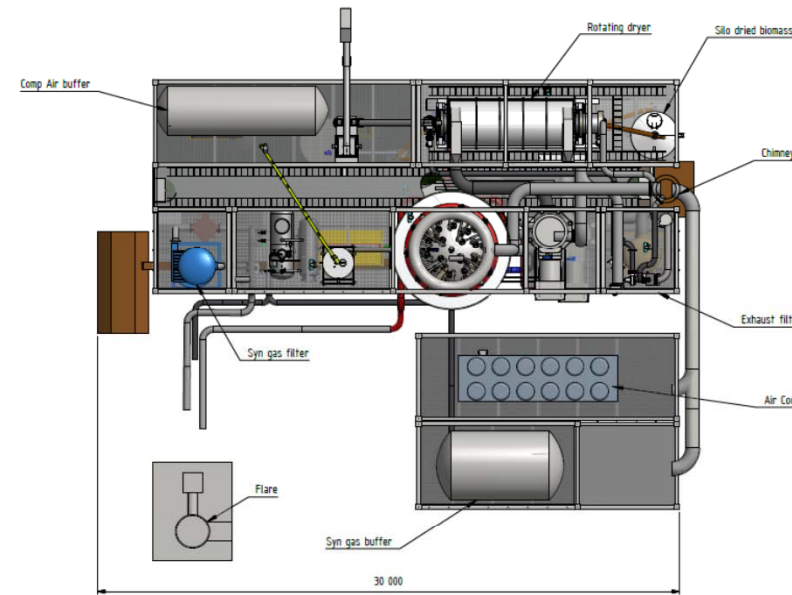
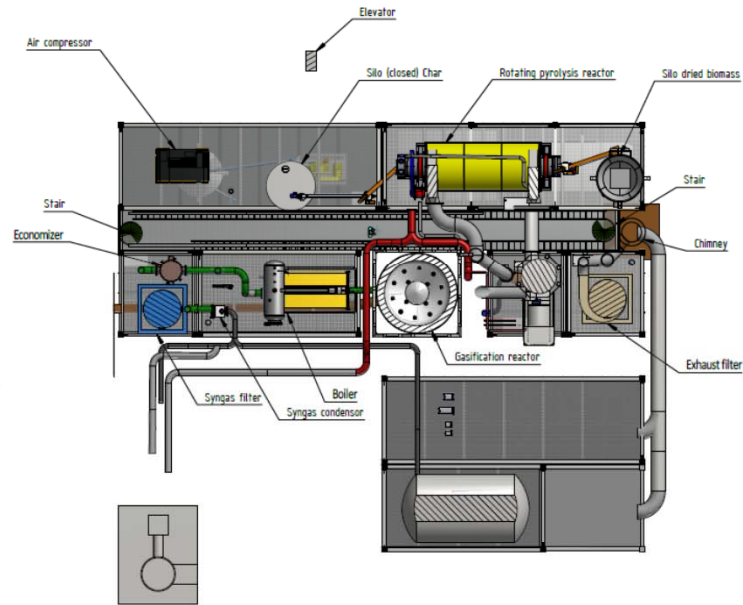
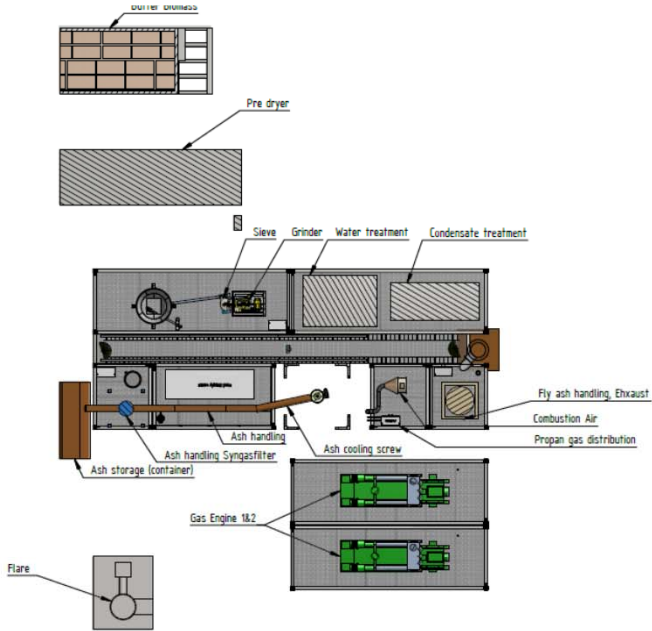


4.2 Forest Energy, Japan

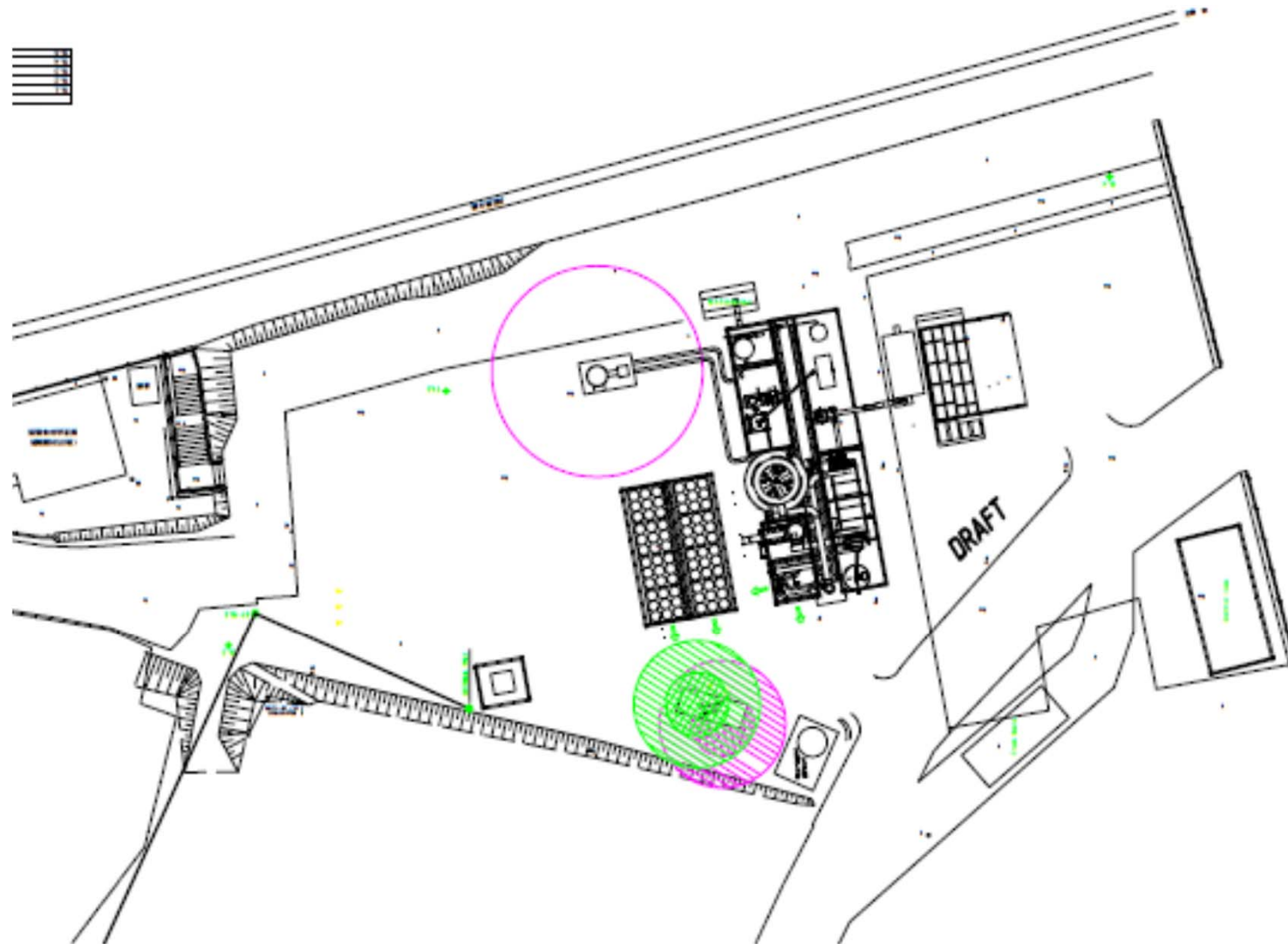
4.2.1 Forest Energy

- A strategic joint agreement was made between Forest Energy and Cortus Energy in maj 2016, including up to 25 plants within 5 years.
- Order on a Basic engineering for the first common project in june 2016. The work was finished in december 2016.
- The aim with the Basic engineering is to have a technical basis and documentation for new heat and power projects in Japan.
- The application for support of the 20 year electricity supply (PPA) for the first project is submitted.
- Applications for further projects will be made during 2017.
- The projects are based on co-ownership and a structured financing available on the Japanese market.
- Order of the first plant is expected before mid 2017.

4.2.2 First WoodRoll® plant in Japan



4.2.3 First WoodRoll[®] plant in Japan



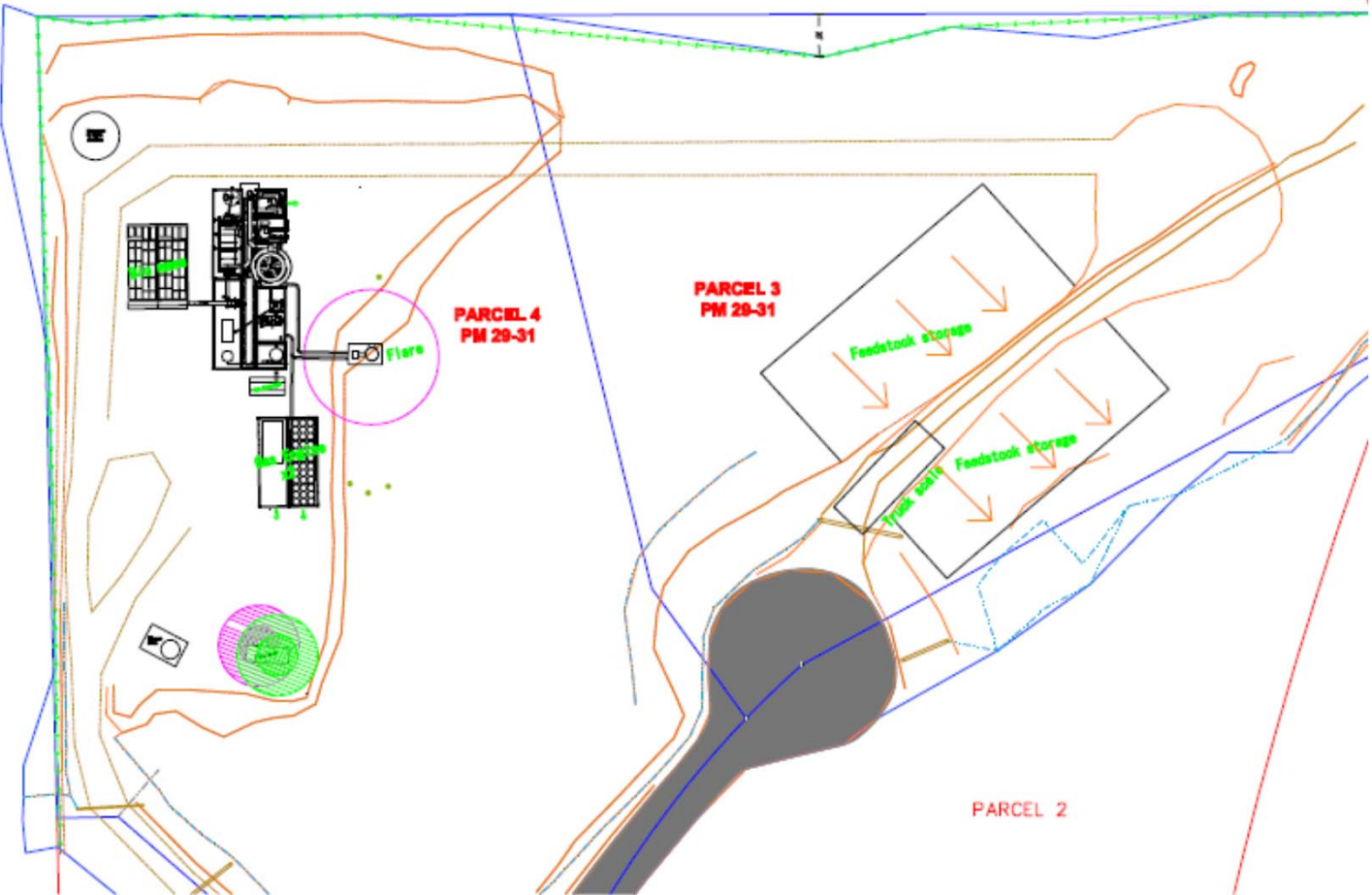


4.3 Mariposa, California

3.3.1 Mariposa biomass project

- An **EPIC grant of 5 MUSD** has been granted by California Energy Commission on the 24th of March 2017 for this project
- The project group has been working for nearly two years for a joint heat and power project in Mariposa (California) based on a modular 6 MW WoodRoll® with double gas engines and heat recovery
- In 2016 MBP received support from the state for a pre-design study of a biomass heat and power plant based on a modular 6 MW WoodRoll®
- Environmental permit application has been sent in (March 2017)
- For a realization phase of the project, possibilities for further collaborations with other parties in California are necessary and under investigation. This is a prerequisite for implementation of the project.
- Basic engineering will be started in the second half of 2017.
- A plant order is expected early 2018.

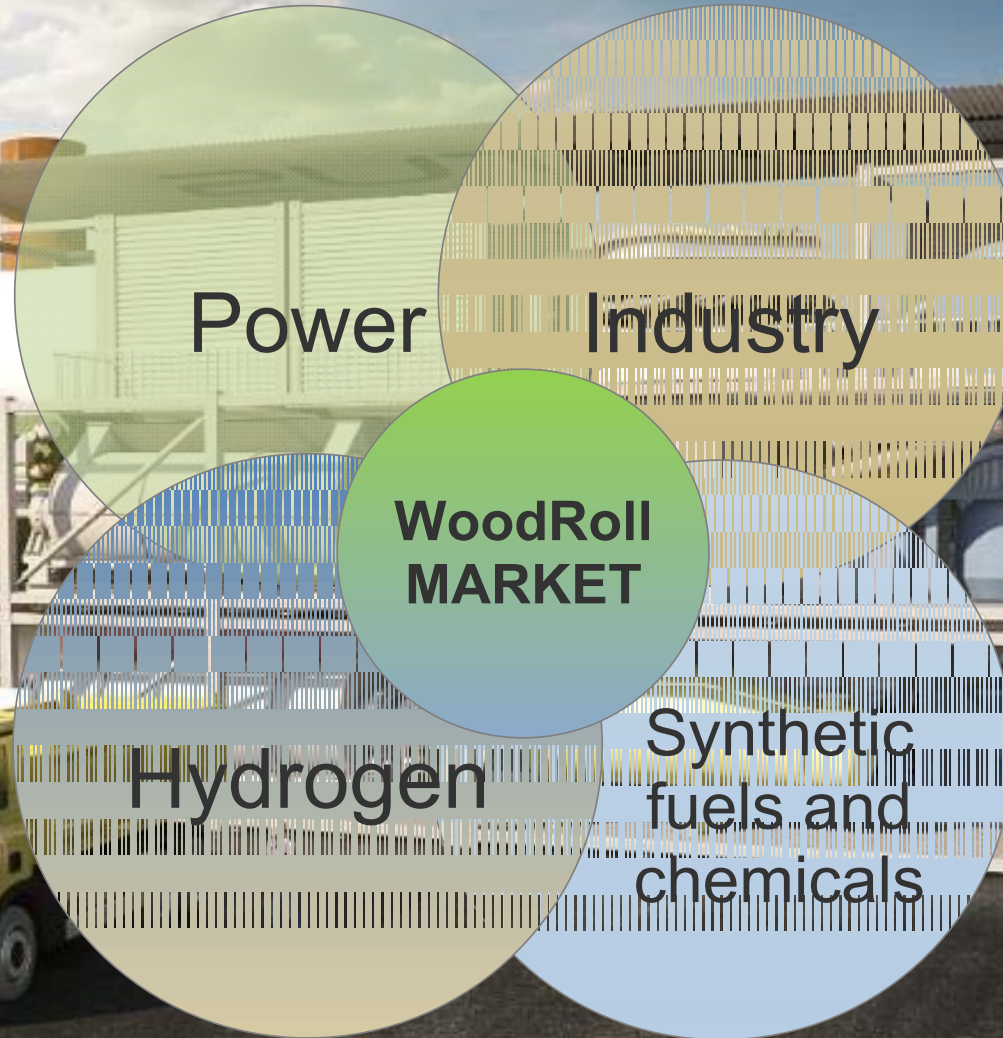
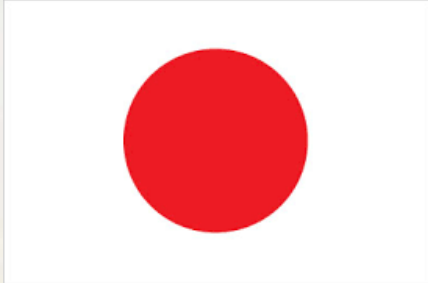
3.3.2 Mariposa biomass project





5. Next step

5. Next step



Word cloud featuring the phrase "thank you" in various languages and scripts, including: danke, 謝謝, ngiyabonga, teşekkür ederim, gracias, thank you, tapadh leat, hvala, obrigado, sukriya, terima kasih, merci, and many others.