
CORTUS
CORTUS
ENERGY
Taking bioenergy forward!

CONTENT

CORTUS ENERGY

1. Cortus Energy

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Cortus Energy

Provide cost effective renewable energy gas for power, industrial and transport applications based upon the patented WoodRoll® technology

- 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 and traded under the name CE.
- The company has 15 employees and 10 consultants.
- The first industrial reference is under construction in Höganäs, SE.

- **WWF climate solver (2009)**
- **Top 25 Nordic Cleantech Open (2010)**
- **Top 25 Cleantech summit Geneva (2011)**
- **Classified as ”Beyond state of the art” by German consulting company (2010) and Chicago Gas Technology Institute (2011)**
- **Stockholm Cleantech hotlist (2013-)**
- **Seal of excellence, EU (2016)**

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WoodRoll® 500 kW/5 tpd test plant in Köping

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WoodRoll® test plant in Köping

- 500 kW Gasifyer started in 2011
- Combined dryer/pyrolysis in 2013
- Complete integrated plant 2015
- Operation on 3-shift (weekdays)
- >25 biofuels qualified for operation

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Modular 6 MW WoodRoll® plant is marketed now!

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2. The WoodRoll® technology

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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.

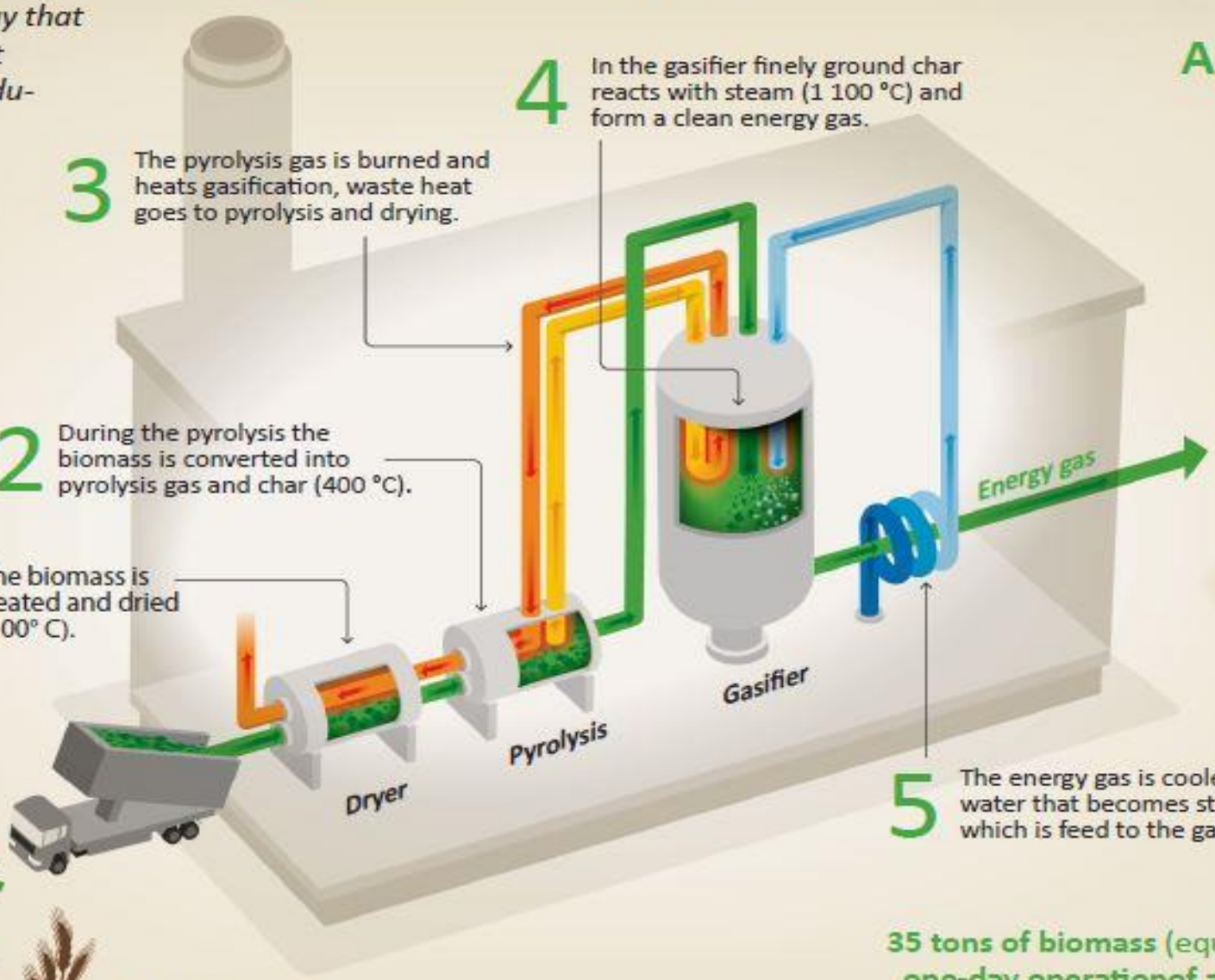
1 The biomass is heated and dried (100° C).

2 During the pyrolysis the biomass is converted into pyrolysis gas and char (400 °C).

3 The pyrolysis gas is burned and heats gasification, waste heat goes to pyrolysis and drying.

4 In the gasifier finely ground char reacts with steam (1 100 °C) and form a clean energy gas.

5 The energy gas is cooled with water that becomes steam, which is feed to the gasifier.



Applications

Biogas

Renewable power

Hydrogen

Industry

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

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Fuel flexibility

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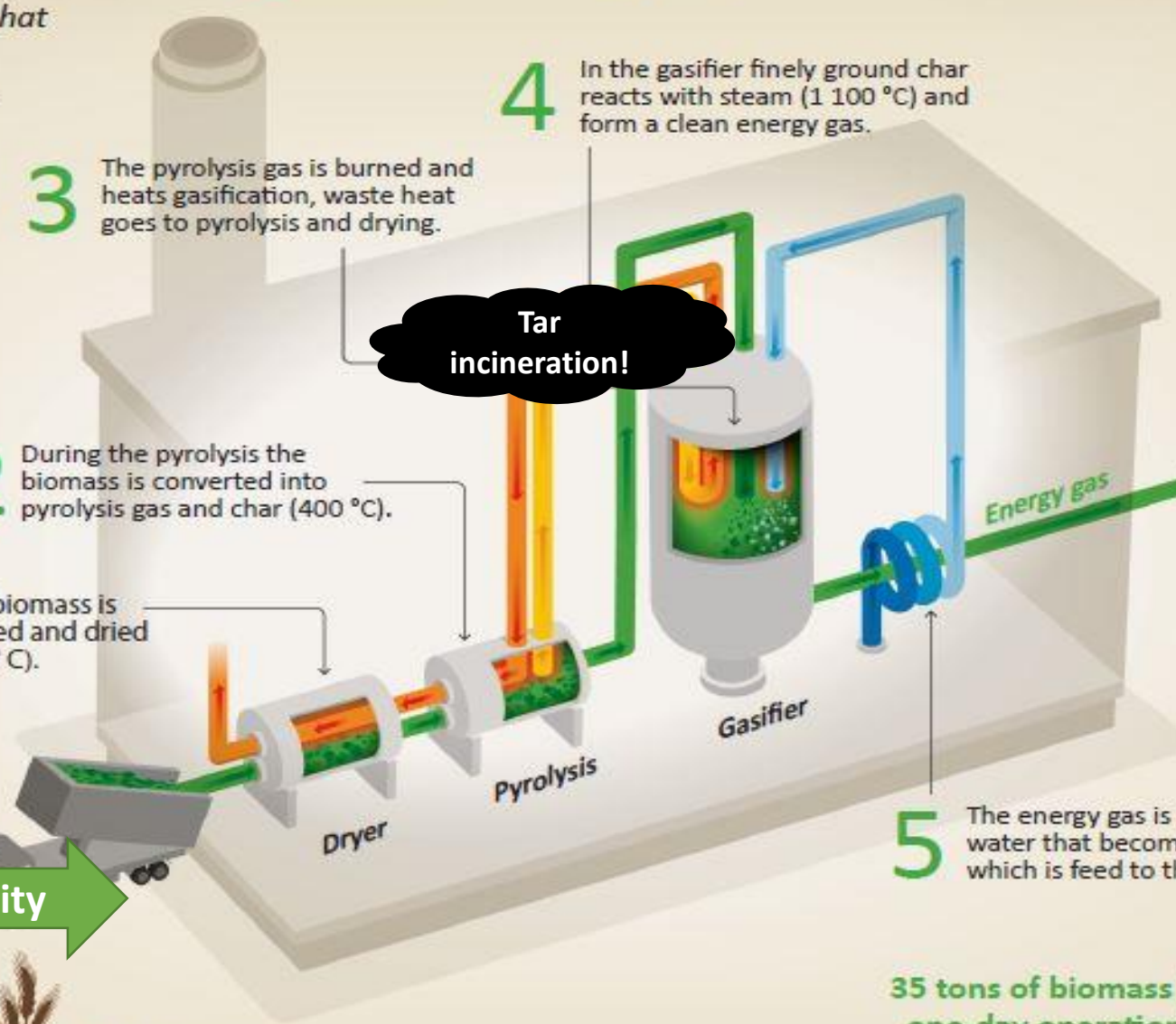
Tar incineration!



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Applications

Biogas

Renewable power

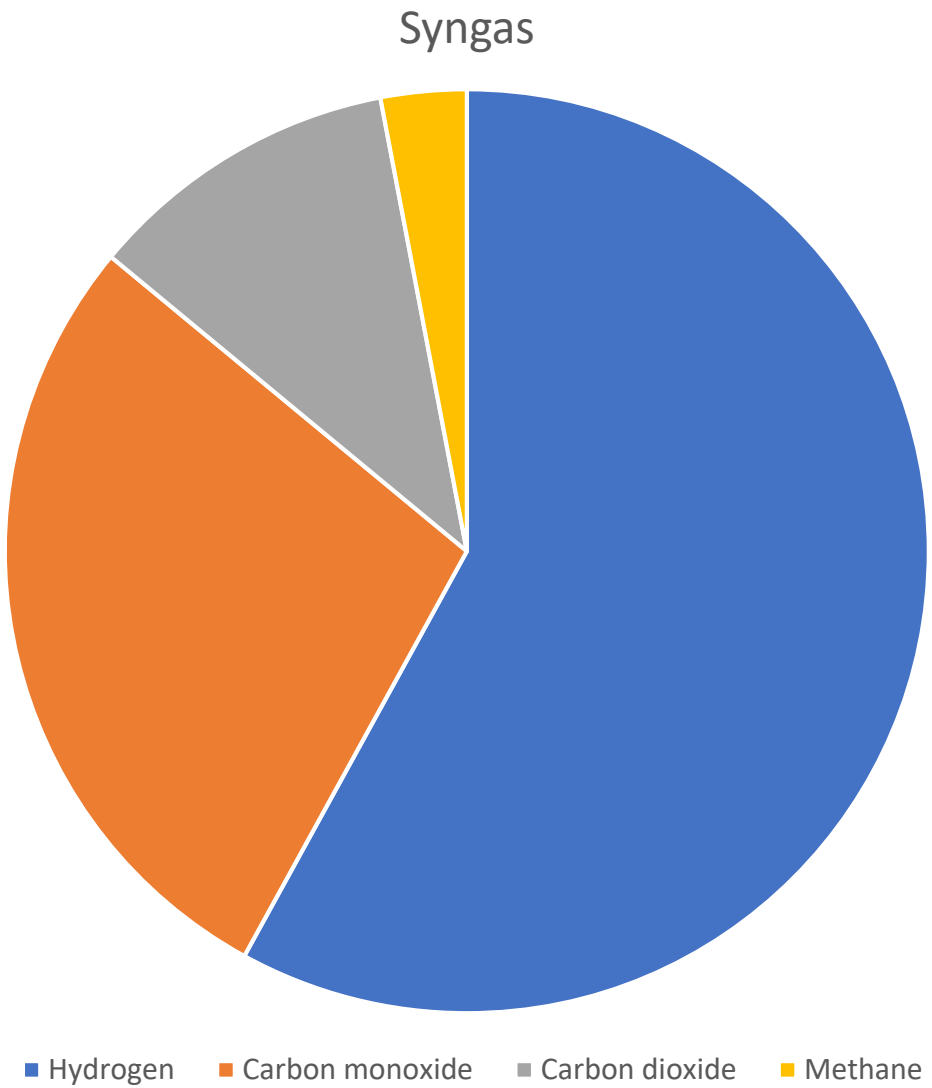
Hydrogen

Ultra clean syngas

Industry

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

WoodRoll® – clean versatile syngas



WoodRoll® – clean versatile syngas

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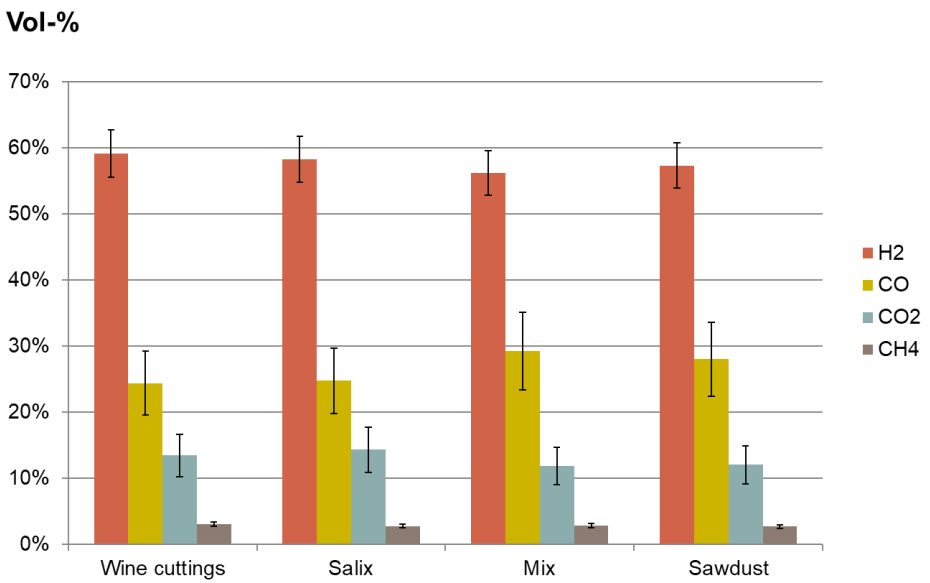
WoodRoll® – game changer for biomass gasification

- **Highest efficiency**
- **Feedstock flexibility**
- **Limited feedstock pretreatment required, integrated drying**
- **Delivers ultraclean, tar-free, syngas, with a high energy value**
- **Ideal syngas composition (H2:CO ⇔ 2:1) for downstream FT process**



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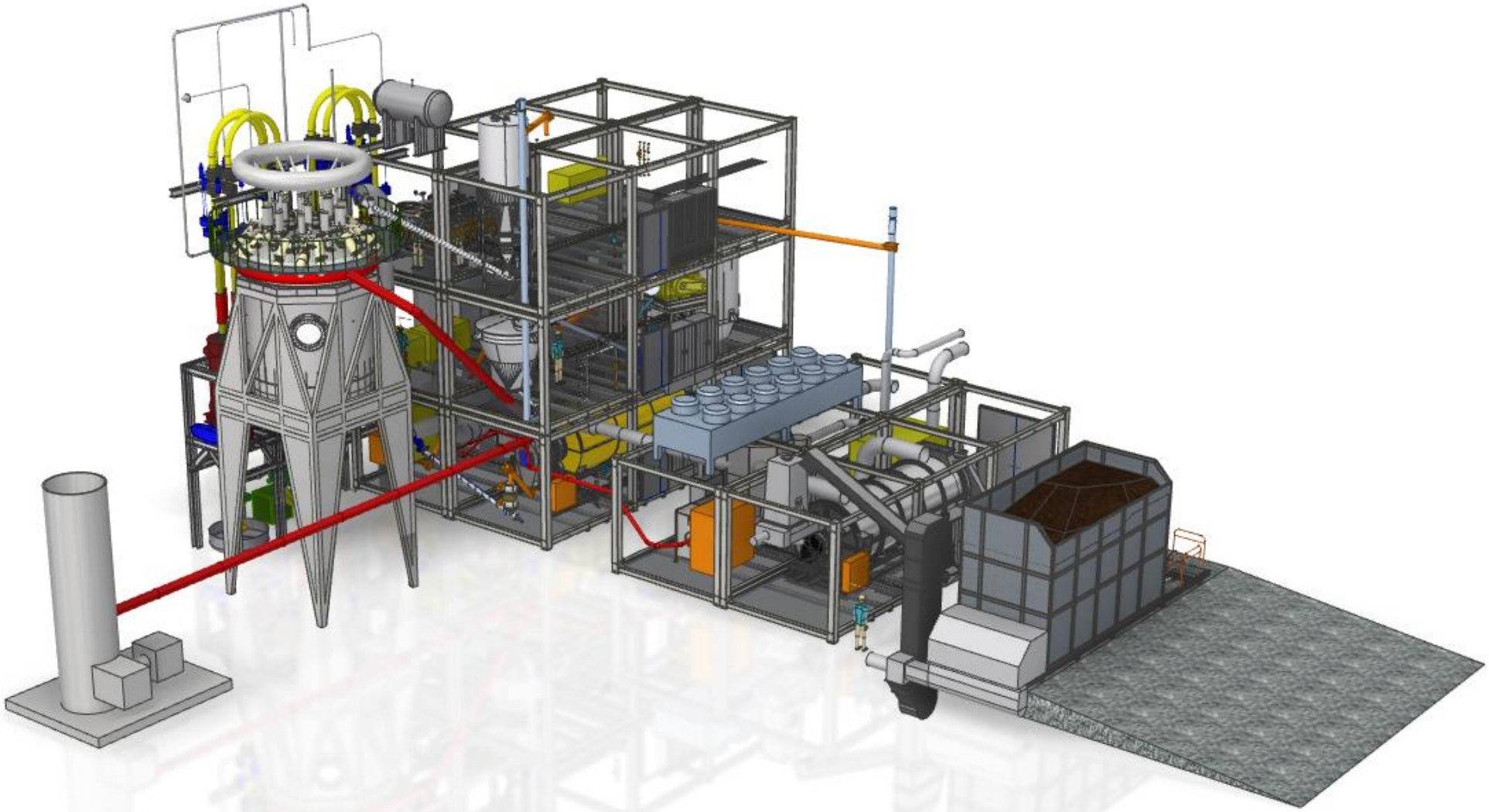
WoodRoll® – Modular concept



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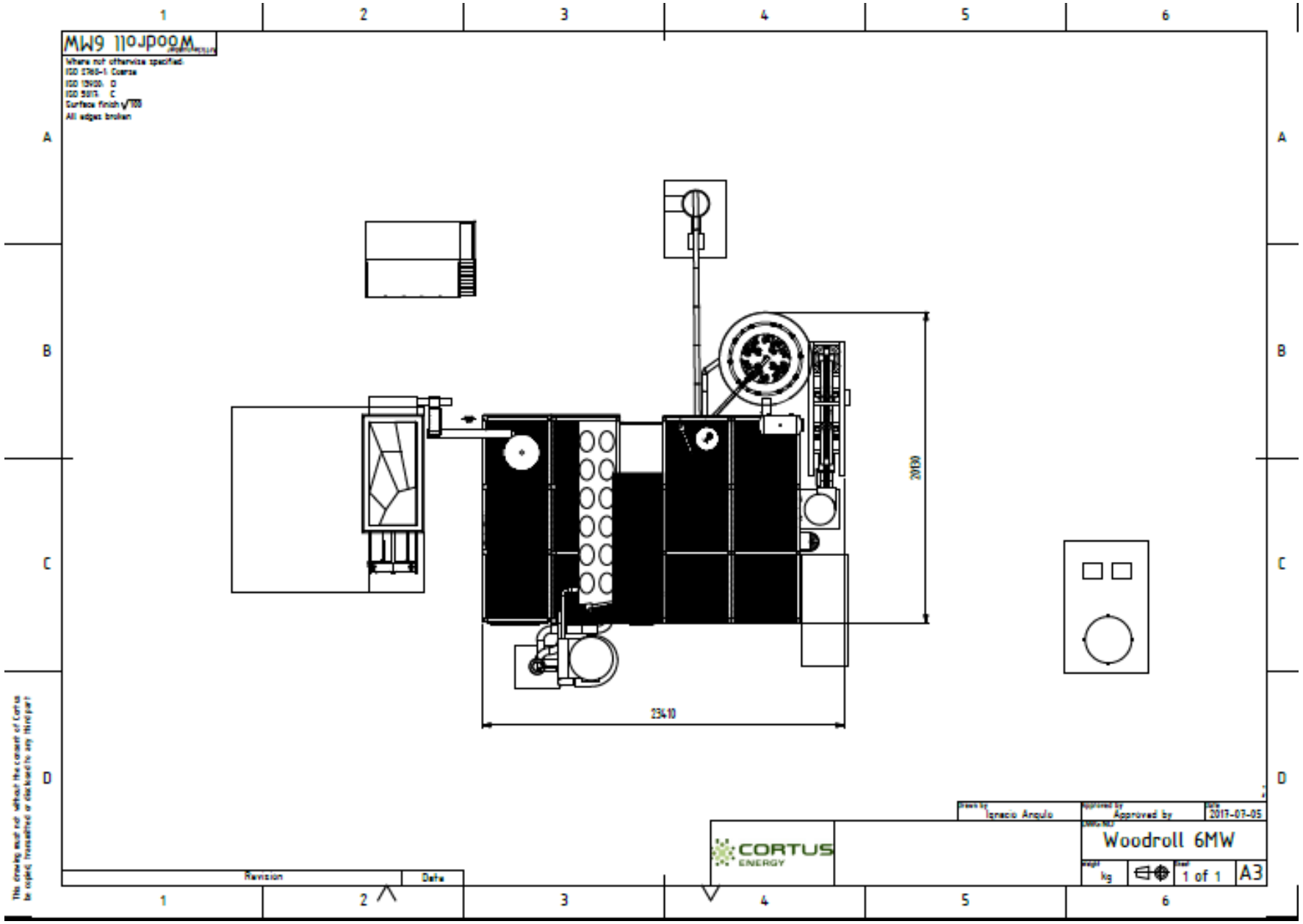
WoodRoll® – footprint (6 MW)



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3. Business

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Applications

Application	Description	Energy products
	Replace fossil fuels in industrial high temperature processes and feedstock to the petrochemical industry	100% Syngas (50% syngas & 50% biocoke)
	Combined Heat & Power via gas engines for the power grid and e.g. district heating net.	40% of power 50% of heat
	Catalytic upgrade to ”Biomethane” (SNG or biogas) and inject the natural gas grid	80% of SNG 10% of heat
	Bio-hydrogen through gas separation and upgrade for stationary and automotive fuel cell applications	>80% of hydrogen (liquid CO2 as by product) 10% of heat

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4. Projects

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Höganäs – first industrial WoodRoll®

- Renewable energy gas from WoodRoll® to replace natural gas in a process industry
- Höganäs AB and Cortus AB collaborate for renewable energy
  - Höganäs wants to be the first steel manufacturer to replace fossil energy
  - A cooperation has been running since 2012 within Jernkontoret (Swedish Iron and Steel Society).
- A pre-design (Basic engineering) was completed 2015/16 at a cost of EUR 0,9 million
- Pre design joint development; Industry, institutes and academy:
  - Manufacturing, installation, commissioning of a WoodRoll®- plant (Cortus/Höganäs)
  - Environmental impact study and life cycle analysis (Swerea)
  - Modeling, simulation and analysis of heating process impact in Höganäs (KTH)
  - Energy optimization of the system – gasification and furnace (KTH)
- Financing for a Cortus built, own and operated 6 MW WoodRoll
  - Total EUR 5 million grants from Swedish Energy Agenda and NEPA (Nov/Dec 2016)
  - In kind contribution from project partners
  - Bank loan and own equity
- The parties have entered a 20 year supply agreement for renewable energy products

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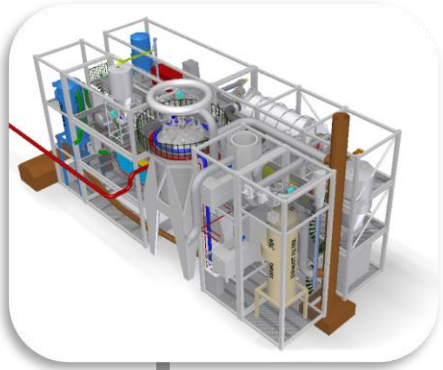
Project plan



Inaguration June 19

2017 Q1 Q2 Q3 Q4 **2018** Q1 Q2 Q3 Q4

- Start of detailed engineering Probiostål
- **Höganäs 20 years supply agreement**
- Start of procurement of process equipment
- Start of module Manufacturing and installation
- First spade in the ground ceremony Nov 28
- Site installation and checkout Höganäs
- Site acceptance test in Höganäs
- **Demonstration Höganäs**
- **Start of delivery in Höganäs**

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Höganäs project delivery

April 2017

Sep 2017

Dec 2017

Jan 2017

March 2017

April 2018

April 2018

April 2018

May 2018

May 2018

Forest Energy

- WoodRoll® for small scale biomass power (distributed generation)
- Japan has the strongest incentive program for small scale biomass power
- A strategic cooperation agreemeent was signed between Forest Energy and Cortus Energy in May 2016, including up to 25 plants whithin 5 years.
- Order on a Basic Engineering for the first common project in June 2016.
- Basic Engineering delivered December 2016.
- The objective of the Basic engineering is to establish a 6 MW WoodRoll template for small scale biomass power projects in Japan.
- Power feed in contract for 20 years supply (PPA) is available for a first project.
- New applications for feed in contracts will be made during 2018 and onwards.
- The projects are based on co-ownership and a structured finanzing available on the Japanese market.
- Order of the first plant is expected second part of 2018.

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Mariposa biomass project

- WoodRoll® for small scale biomass power (distributed generation)
- FIT 20 years, 2,3 – 2,4 MWel (SB 1122)
- Cooperation with local group no profit group “Mariposa Biomass Project”
  - Permits, CUP expected July 10
  - Grid connection
- **EPIC grant of USD 5 million** granted by California Energy Commission Technology demonstration grant.
- Majority owner Cortus Energy (Build – Own – Operate)
- Project development ongoing
- Basic Engineering scheduled to start H2 2018
- Project implementation require: full financing, local operational partner, long term feedstock agreements, permits and feed in tariff
- Objective investment decision late 2018

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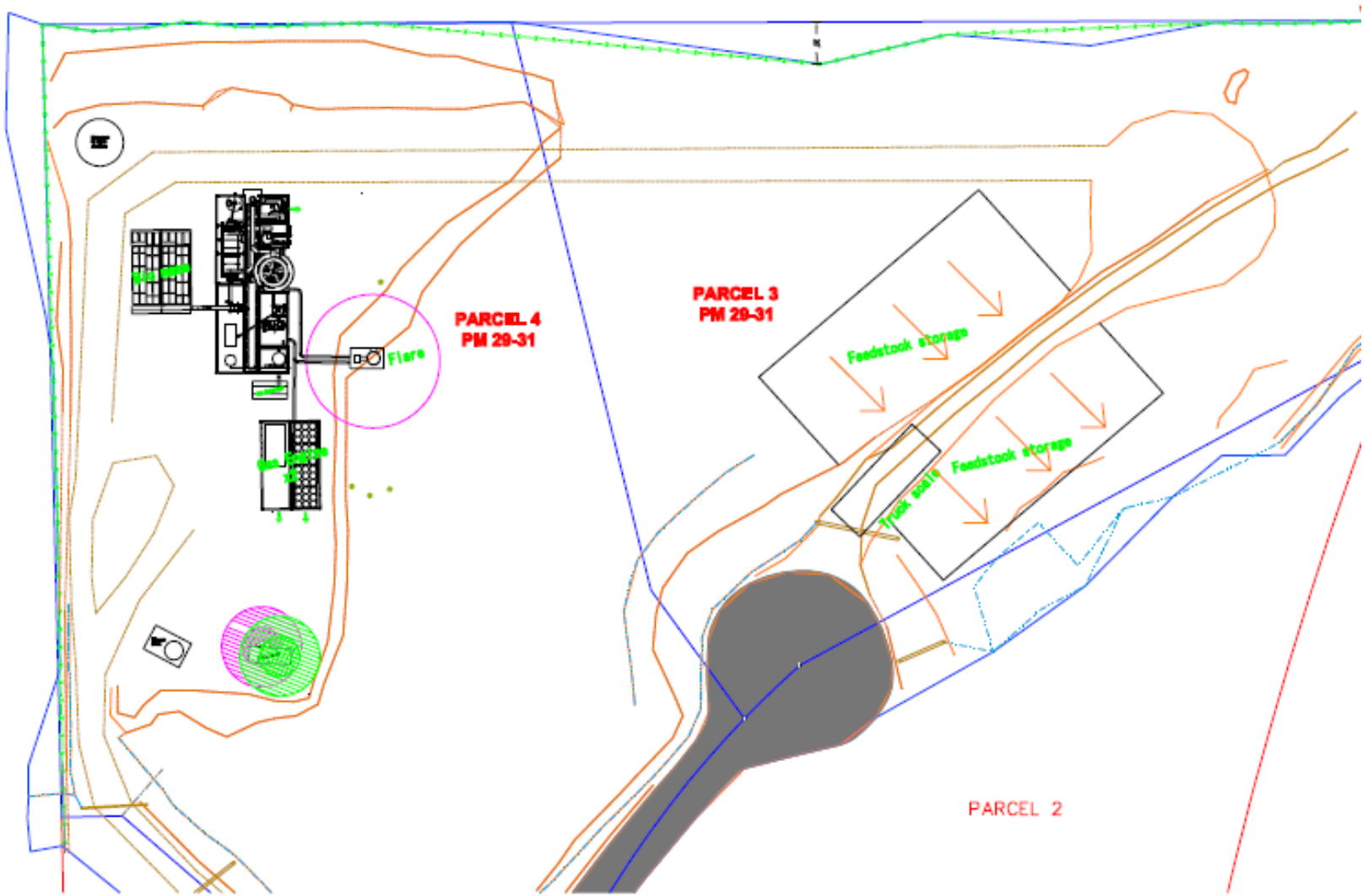
Site – Mariposa biomass project



5. Summary

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Summary

- WoodRoll® - a unique biomass gasification process, ultraclean syngas to replace fossil energy in numerous applications
- Organization ready to commercialize the patented gasification process WoodRoll® being developed under >10 years and 200 MSEK (25 MUSD) invested
- First industrial reference of modular 6 MW WoodRoll® is under construction for Höganäs AB, Sweden
- Project pipeline with roadmap for expansion established built on the existing and expected global expansion of the bioenergy

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