



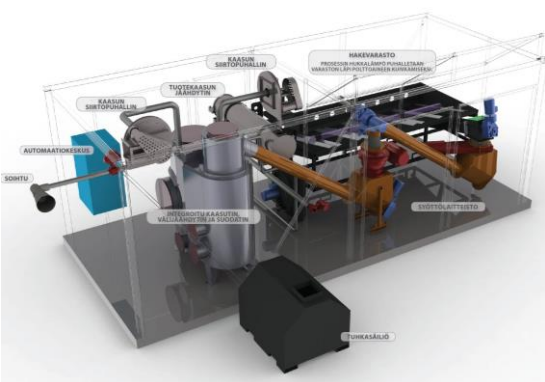
Puuukaasuauto 2006



Vesivoimalaitoksen kunnostus 2013 - 2015



1. Kaasutuskontti 2014



2. Kaasutuskontin suunnittelu ja toteutus 2015 - 2017



Happikaasuttimen suunnittelu ja toteutus 2016 - 2017

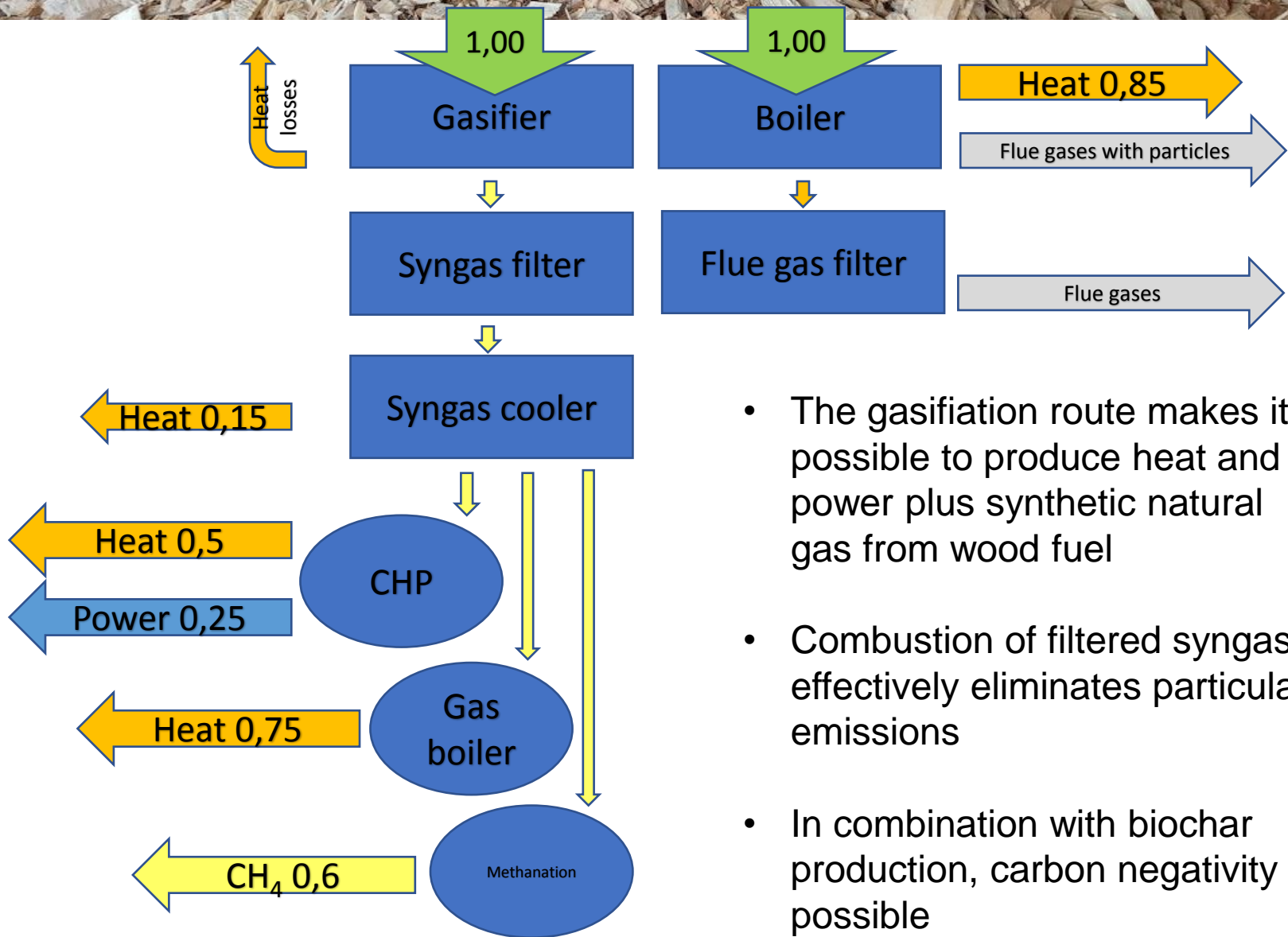


2. Kaasutuskontin muuttaminen happikaasuttimeksi 2018-2020



Leijukerroskaasuttimen suunnittelu ja toteutus 2020 ->

# Gasification vs combustion



- The gasification route makes it possible to produce heat and power plus synthetic natural gas from wood fuel
- Combustion of filtered syngas effectively eliminates particulate emissions
- In combination with biochar production, carbon negativity is possible



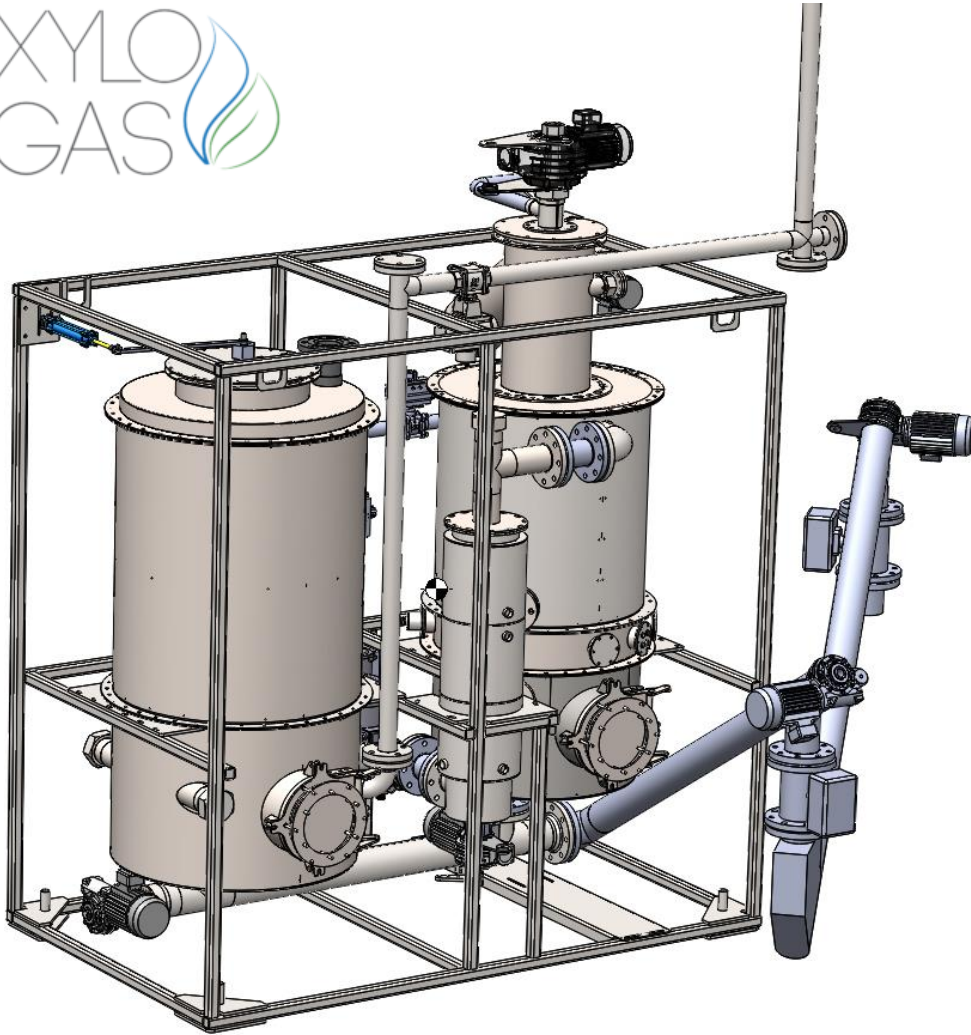






# Täysin automatisoidun happikaasutuslaitteiston toteutus 2018

XYLO  
GAS



Förverkligande av en helautomatiserad för syrgas planerad förgasningsanläggning 2018













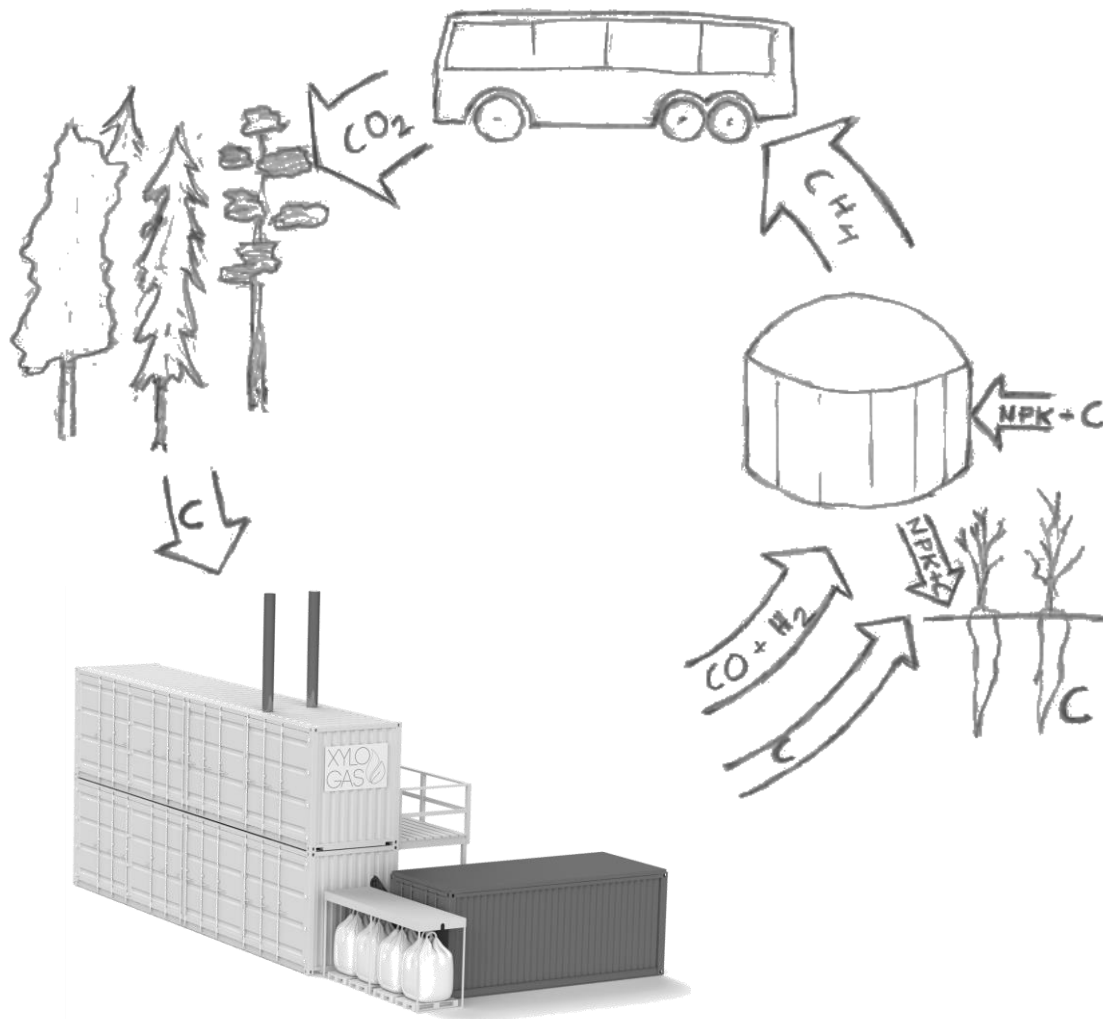




Uusi tekniikkamme skaalautuu megawattiteholuokkaan, Our new MW -range technology







The Wood2Biogas concept makes it possible to produce biomethane from forestry residue and recycled wood

This offers a cost efficient way to supply a biogas plant with energy

It takes less resources to produce woody biomass than energy crops

A forest is a far more natural and biologically diverse environment than a cultivated field

The possibility to use the same equipment for simultaneous production of biochar and product gas in an energy efficient process makes carbon negative energy production reality



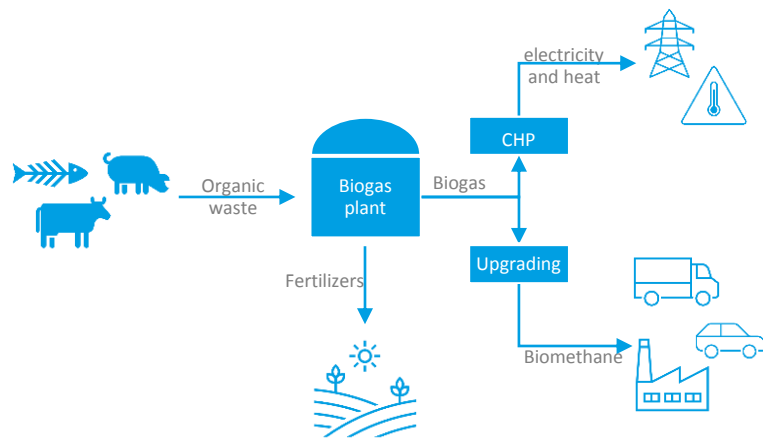






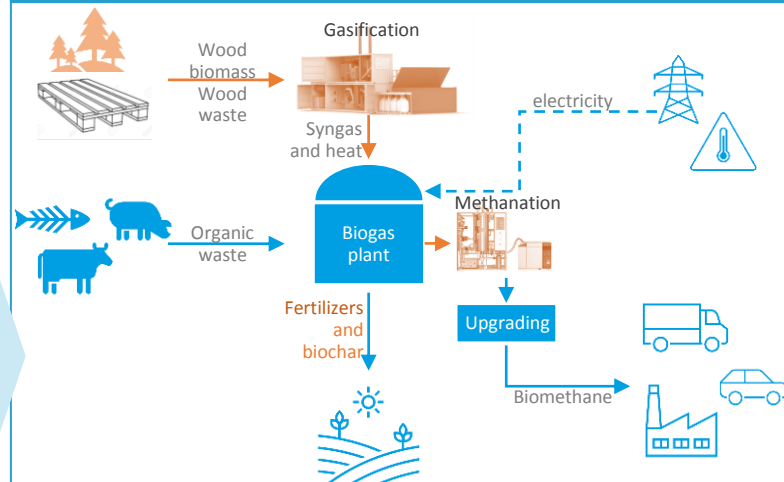
# WOOD2BIOGAS CONCEPTS ALLOWS BIOGAS PLANTS TO DOUBLE THEIR ENERGY PRODUCTION

## From producing biogas traditionally...



- Biogas is produced from organic waste and energy crops. Substrates define the **energy potential**.
- **Biogas is utilized** in CHP units to produce **electricity and heat** and/or upgraded to **biomethane** used as fuel for traffic and industry.

## ... to multiply energy production with Wood2Biogas

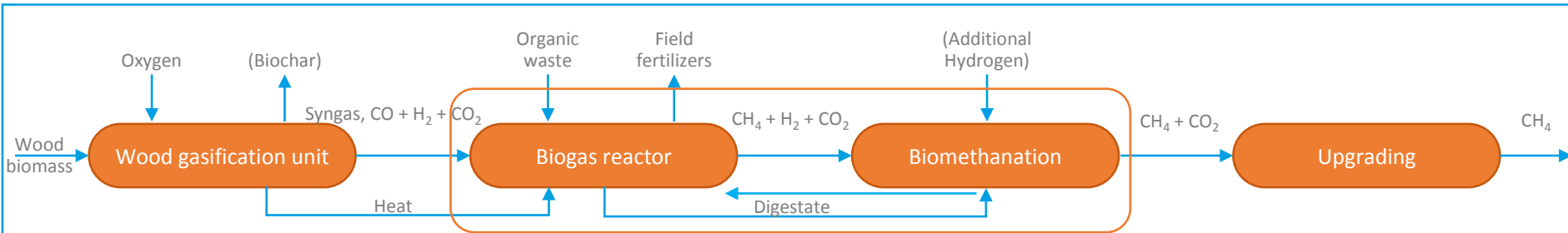


- **Wood biomass is gasified** in a proprietary thermal gasification process. Produced **syngas is injected into the biogas process**.
- Biogas yield may be **improved with** a separate **biomethanation** unit. The gas quality can be further improved with H<sub>2</sub> injection.

**Gas net production increases at least by 100 %**



# WOOD GASIFICATION AND BIOMETHANATION UNITS ARE HIGHLY SYNERGETIC WITH A STANDARD BIOGAS PROCESS



- The thermal gasification process is scalable and produces optimal tar free gas for biogas process; nitrogen content is very low.
- High percentage of  $\text{H}_2$  (30%) and  $\text{CO}$  (55%) ensures high conversion rate in further process steps.
- Wood fuel provides economical energy source for the following biological process.

- Syngas is processed through wet fermentation reactors or gas tight digestate silos. In this process an efficient conversion of  $\text{H}_2$  and  $\text{CO}$  into  $\text{CH}_4$  and  $\text{CO}_2$  takes place.
- $\text{CO}$  is converted into methane with acetate as an intermediate product.  $\text{CO}$  is also converted into  $\text{H}_2$  and  $\text{CO}_2$  in a water gas shift reaction followed by a Sabatier reaction where  $\text{H}_2$  and  $\text{CO}_2$  is converted into  $\text{CH}_4$ .
- The biomethanation process is operated in preferably thermophilic conditions. Depending on the biogas process, syngas introduction can be carried through either in a separate biomethanation unit connected to the biogas reactor or directly into the digestate reactor.

- After biomethanation, normal gas purification and pressurization process is utilized.
- Purified biomethane can fully replace natural gas.

Value chain is at minimum carbon neutral  
and through biochar even carbon negative

\*All processes also need electricity that can either be produced from syngas, biogas or purchased from grid.

## 1.0 MW DEMONSTRATION UNIT WILL BE BUILT

- As a next development step, the Wood2Biogas concept will be demonstrated in 1.0 MW (heat value of wood chips) size.
- The most potential demonstration place is located at Vehmaa, some 40 km from Turku to north-west.
- Vehmaa plant was built by Doranova and commissioned in January 2021.
- Plant currently processes 20 000 tons of pig manure annually but the amount will increase up to 35 000 tons next year.
- From next year onwards, the plant is producing 3,8 GWh of gas energy annually.
- With Wood2Biogas concept the biogas production can be raised by 100 %.





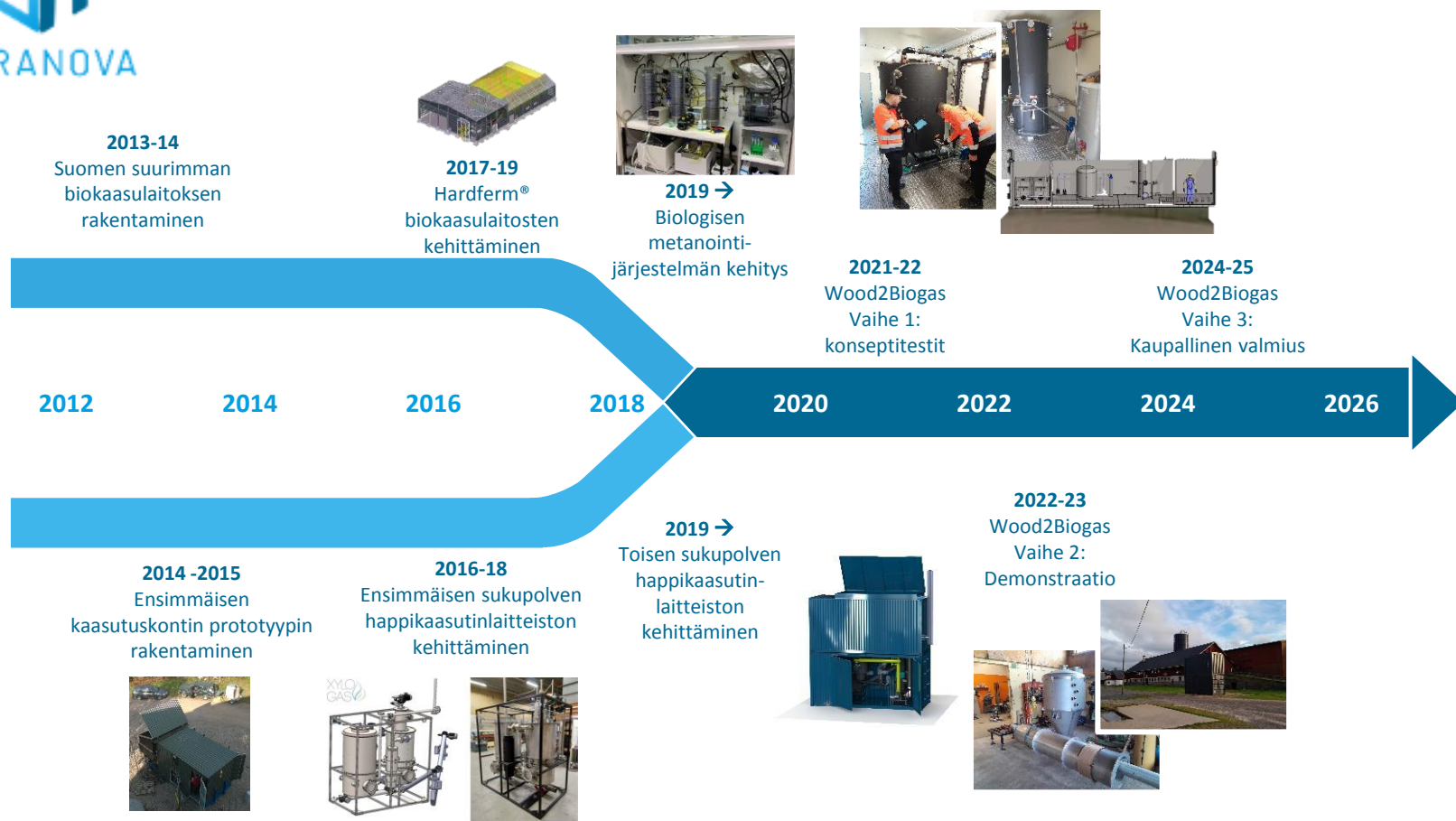
Wood2Biogas teknologian takana ovat Doranova Oy ja Xylo Gas Oy  
Tuotekehityksessä ovat mukana Hämeen Ammattikorkeakoulu, Biopir Oy sekä ProAgria Svenska  
lantbrukssällskapens förbund



Euroopan maaseudun  
kehittämisen maatalousrahasto:  
Eurooppa investoi maaseutualueisiin



MAASEUTU 2020



Kaupallien valmius on tarkoitus saavuttaa 2024 - 2025



Kiitos!

Ott Pärtel ja Fredrik Ek

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# XYLO GAS

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- Laitteisto on PROTOTYYPPI
- Laitosta saa käyttää ja huoltaa ainoastaan laitokseen perinpohjaisesti perehtynyt henkilö
- Tuotekaasun häkä ja vety muodostavat ilman kanssa räjähdysherkän kaasuseoksen
- Häkäsisäilön takia tuotekaasu on hengitettynä myrkyllistä
- Koneetta saa avata huoltotöitä varten ainoastaan tämän ollessa kokonaan jäähtynyt ja kunnolla tuuletettu
- Huoltotöitä tehdessä on käytettävä polyätyä suojaavaa hengityssuojainta (FFP2)

Koneen nimi:	XyloGas250-02
Valmistaja:	Xylo Gas Oy
Valmistajan yhteystiedot:	www.xylogas.net
Valmistusvuosi:	2019
Valmistusnumero:	5
Kokonaispaino:	10 t
Sähköliitäntä:	3 * 400 V/25 A
Ohjausjärjestelmä:	24 V DC
Polttoaine:	Puuhake G30-G50
Polttoaineen maksimikosteus:	15 %
Polttoaineosaston tilavuus:	10 m <sup>3</sup>
Nimellisteho (polttoaineteho):	250 kW
Hapetus:	Ilma tai happirikastettu ilma
Syöttöilman tilavuusvirtaama:	30 - 100 nm <sup>3</sup> /h
Happirikastetun syöttöilman tilavuusvirtaama:	10 - 16 nm <sup>3</sup> /h (suositus < 10 nm <sup>3</sup> /h)
Korkein sallittu kaasuttimen suolen ylipaine:	40 mbar
Korkein havaittu kaasutuslämpötila:	400 °C
Paineilmavirtauksen paine:	min 5.5 bar (max 8 bar)
Jäähdytysnestetilavuus (vesi/etyleeniglykoli):	300 l
Melutaso:	> 100 dB