



**SmartCHP**  
COGENERATING A RENEWABLE FUTURE

**SmartCHP®**

**Cogenerating a renewable future**

---

Bert van de Beld

BLAZE-EUBIA Event

High efficiency and low emissions CHP technologies from biogenic residues

June 6, 2023 – EUBCE 2023



This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 815259.



## SmartCHP<sup>®</sup>: aim and impact

- The EU research project SmartCHP will develop a novel, flexible small scale **cogeneration unit** to produce heat and electricity from **sustainable biomass**.
- The main technical novelty is the use of **fast pyrolysis bio-oil** from lignocellulosic biomass in a **converted compression-ignition (CI) engine**.
- CI engines are **flexible**, characterized by **fast start-up**, and **fast response** to load changes.
- Suitable as **dispatchable power** and **complementary** to variable RES.
- This will help boost the use of renewables in the electricity and heating & cooling sectors, contributing to the **2030 climate and energy targets**.





# Project Partners and overview



**10 Partners**



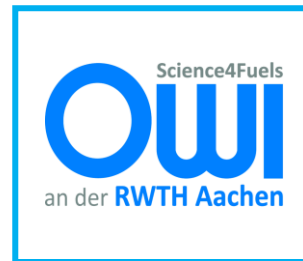
**6 Countries**



**54 Months  
since June 2019**



**4 m. euros**



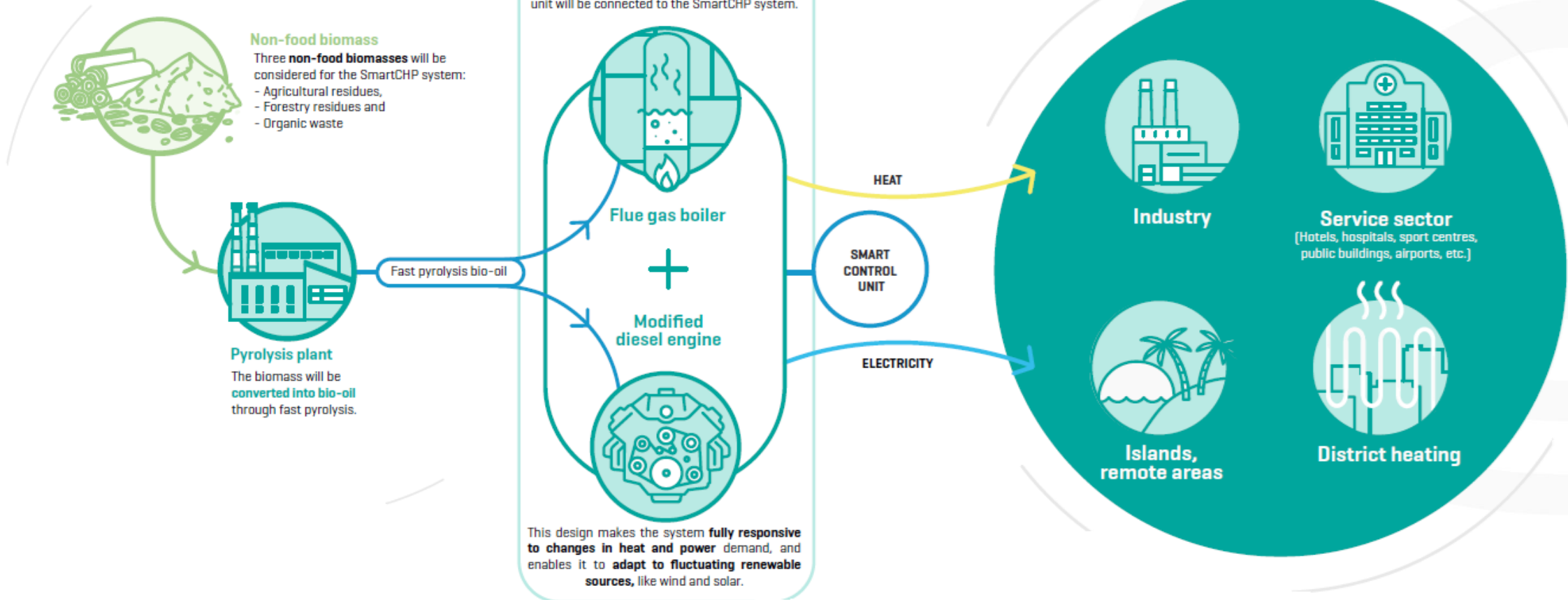


# SmartCHP® process

·From fields...

...to buildings.

Future users of the SmartCHP system







### Non-food biomass

Three **non-food biomasses** will be considered for the SmartCHP system:

- Agricultural residues,
- Forestry residues and
- Organic waste



Pyrolysis plant

## Fast pyrolysis

- © Thermal cracking/depolymerisation of organic material in absence of oxygen
- © Main product: liquid bio-oil (FPBO)
- © Other products: gas and char
- © Minerals recovered at low temperature

## Fast pyrolysis Process

- © Technology is maturing
- © Commercial plants in Netherlands, Finland & Sweden.
- © Feedstock: sawdust and woody residues

## Feedstocks tested in SmartCHP

- © Fast Pyrolysis oil from commercial plants (EMPYRO & GFN)
- © Fast Pyrolysis oil produced at BTG from Olive residues & Miscanthus

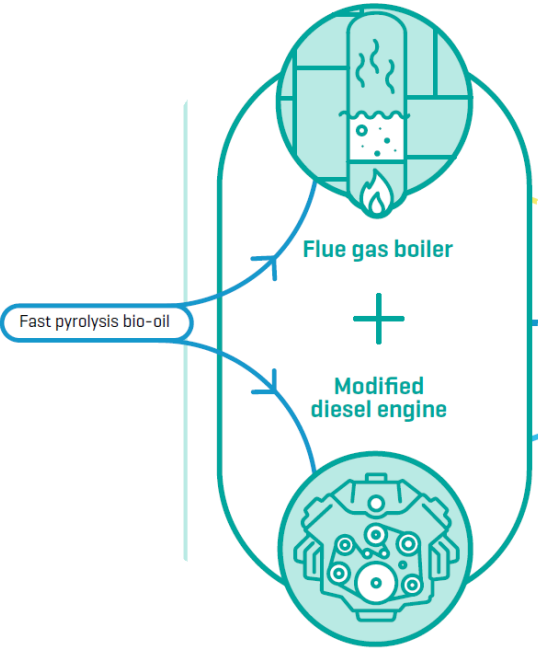
*Pyrocell fast pyrolysis plant (25 MW<sub>th</sub>) in Sweden*





### Fast Pyrolysis Bio-Oil (FPBO)

© FPBO is available & sustainable



Property	FPBO	Diesel	Unit
Water content	25	~ 0	wt%
Density	1,170	840	kg/m <sup>3</sup>
Heating Value	16	42	MJ/kg
pH	2.8	-	-
Viscosity (40 °C)	20 - 100	2 - 4.5	cSt
Cetane Number	0 - 20	45 - 55	-



### The challenge...

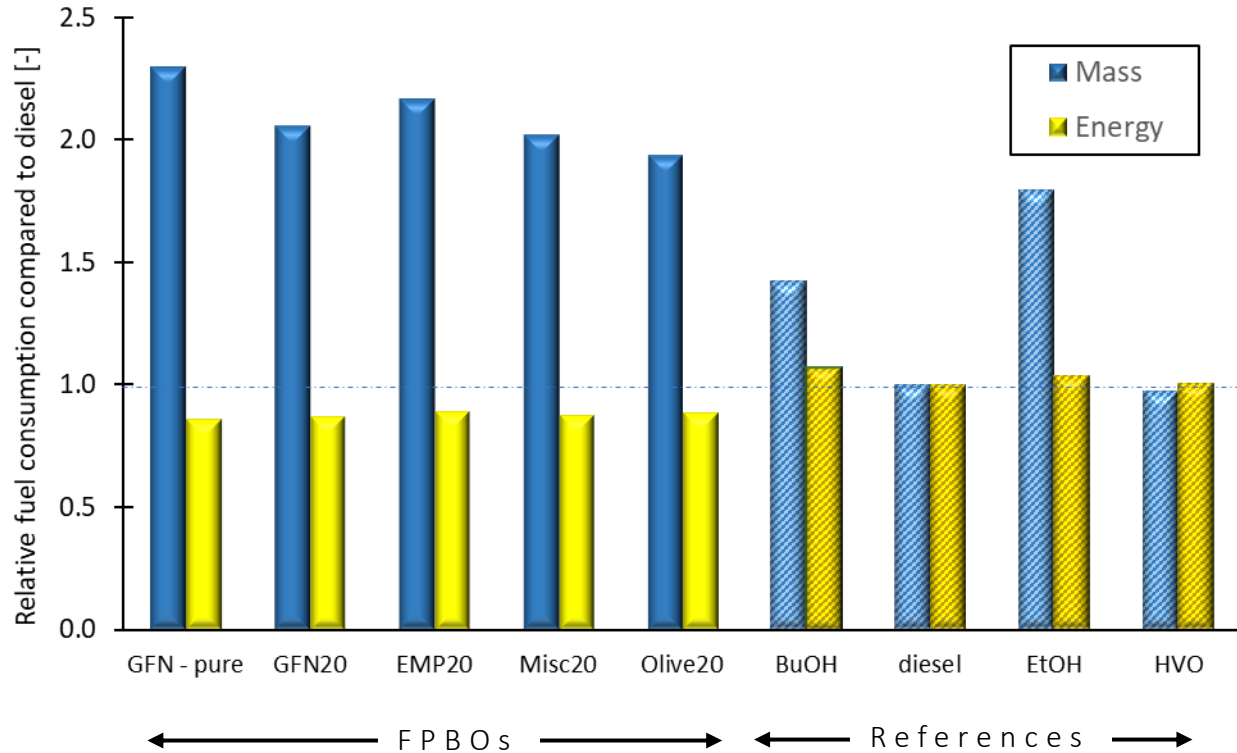
- © FPBO is not really an oil
- © FPBO is acidic, poor ignition properties, poor atomization,...
- © Consequently, the use of FPBO in standard CI engine is challenging....

### Engine testing on FPBO

- © 1-cylinder & 4-cylinder prototype have been modified to enable FPBO as fuel
- © Flue gas treatment added to achieve low emissions



Feedstock



1-cylinder test unit. Engine load = 1.6 kW<sub>e</sub>, Air inlet temperature = 115 °C; No flue gas treatment.

Emissions

COMPONENT	EXPERIMENTAL	REGULATION	
		European	Dutch
CO	18 - 56	-	-
NOx (as NO2)	43 - 80	190	150
SOx	0	120	65
PM	n.d.	20	20

Emissions after flue gas treatment and comparison with existing regulation (mg/Nm<sup>3</sup> @ at 15% O<sub>2</sub>).



## Further info

**Room:** AUDITORIUM EUROPA

**Date:** Thursday, 08 June 2023

**Time:** 10:15 – 11:30 CEST

**Session code** DP.1



**BERT VAN DE BELD**

BTG Biomass Technology Group, THE NETHERLANDS

Session reference: DP.1.1

**Keynote presentation**

► Smart and Flexible Heat & Power from Fast Pyrolysis Oil



[Pyromovies.PyroKnown.eu](https://Pyromovies.PyroKnown.eu)



[www.smartchp.eu](http://www.smartchp.eu)





# Thank you!

Bert van de Beld  
Project Coordinator  
vandebeld@btgworld.com

