



# SmartCHP®

## Cogenerating a renewable future

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Bert van de Beld

**BioCogen 2030 Webinar**

**June 9, 2020**

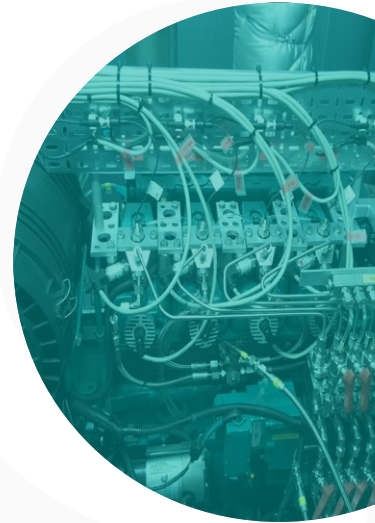


This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 815259.

## SmartCHP®: 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 diesel engine**.
- This will help boost the use of renewables in the electricity and heating & cooling sectors, contributing to the **2030 climate and energy targets**.

With a market potential of **€4 billion**, and an estimated **85 to 95% less GHG emissions** compared to fossil fuels, the installation of the SmartCHP technology in Europe can bring **new jobs**, more **renewables** and help mitigate **climate change**.



# SmartCHP® process

## From Fields...



### Non-food biomass

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

- Agricultural residues,
- Forestry residues and
- Organic waste



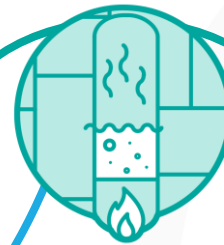
### Pyrolysis plant

The biomass will be **converted into bio-oil** through fast pyrolysis

Fast pyrolysis bio-oil

### SmartCHP System

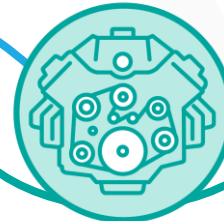
The fast pyrolysis bio-oil will be fed into a modified diesel engine and, depending on heat demand, into a flue gas boiler. A smart control unit will be connected to the SmartCHP system.



Flue gas boiler



Modified diesel engine



This design makes the **system fully responsive to changes in heat and power** demand, and enables it to adapt to fluctuating renewable sources, like wind and solar

**SMART  
CONTROL  
UNIT**



Fast pyrolysis bio-oil

## Fast pyrolysis

- ③ Thermal cracking/depolymerisation of organic material in absence of oxygen
- ③ Main product: liquid bio-oil (FPBO)
- ③ Other products: gas and char
- ③ Minerals recovered at low temperature

## Fast pyrolysis Process

- ③ Technology is maturing
- ③ Commercial plants in Netherlands & Finland, plant in Sweden under construction
- ③ European production capacity (2021) > 100 million liters annually



*Empyro fast pyrolysis plant (25 MW<sub>th</sub>) in the Netherlands*



Fast pyrolysis bio-oil

## Fast Pyrolysis Bio-Oil (FPBO)

© FPBO is not really an oil.....

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	-

## Fast Pyrolysis Bio-Oil (FPBO)

© FPBO is available & sustainable, but  
use of FPBO in standard diesel engine is a challenge.....



# SmartCHP® process

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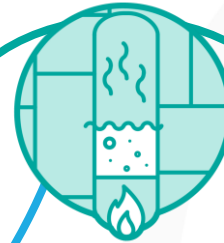
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Fast pyrolysis bio-oil

### SmartCHP System

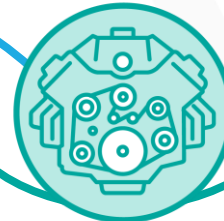
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Flue gas boiler



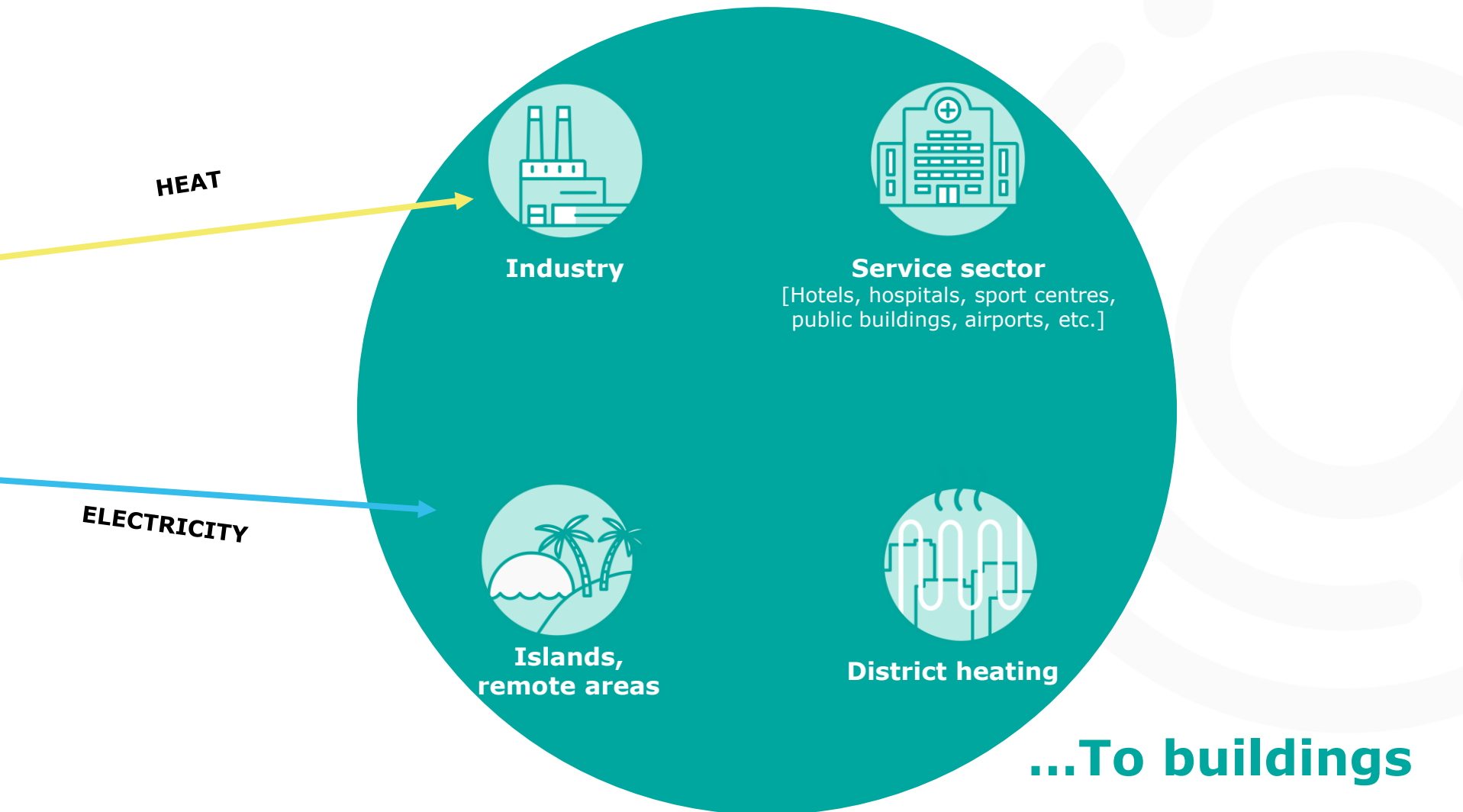
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**SMART  
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# Future users of the SmartCHP® system





# SmartCHP® Benefits



## More sustainable biomass

SmartCHP runs on **fast pyrolysis bio-oil** coming from agroforestry residues and organic waste, diversifying the supply of bioenergy for combined heat and power units.



## More efficiency

Due to its **extraordinarily high flexibility**, the system rapidly adjusts the fuel load and produce more electricity or more heat according to changes in demand.



## (Even) more renewables

Thanks to its flexibility, SmartCHP is ideally suited to use in combination with **fluctuating renewables**.

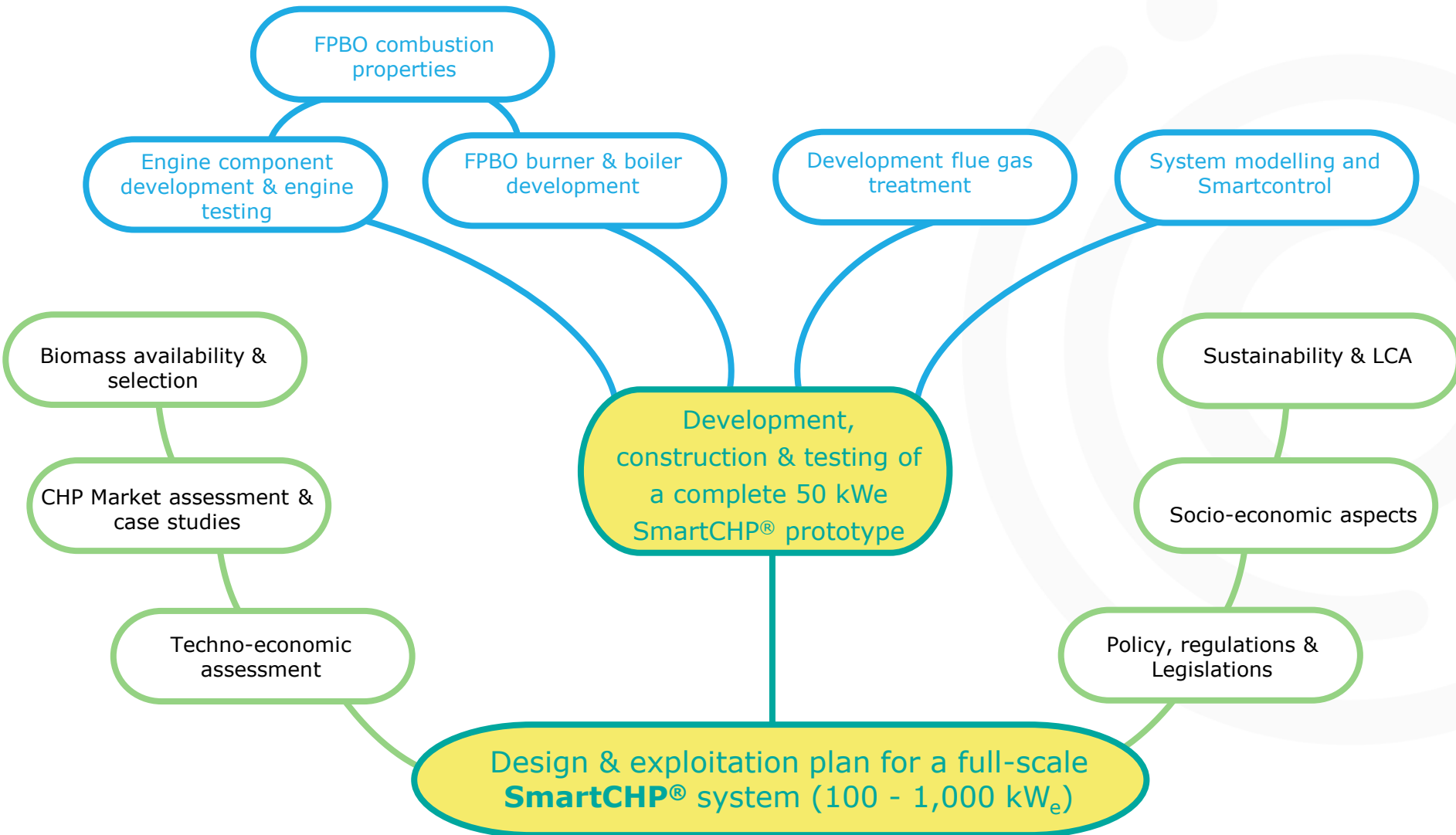


## Less greenhouse gas emissions

The use of SmartCHP for heating and electricity can **save between 85 and 95% greenhouse gas emissions** compared to fossil fuels.



# SmartCHP® project activities



# Project Partners and overview

- SmartCHP brings together European industrial companies, universities and innovation experts, and is coordinated by BTG Biomass Technology Group BV.



**10 Partners**



**6 Countries**



**48 Months  
since June 2019**



**4 m. euros**



# Thank you!

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