



# INTEGRATION OF WASTE HEAT STREAMS INTO INDUSTRIAL CHPS OR DISTRICT HEATING UNITS

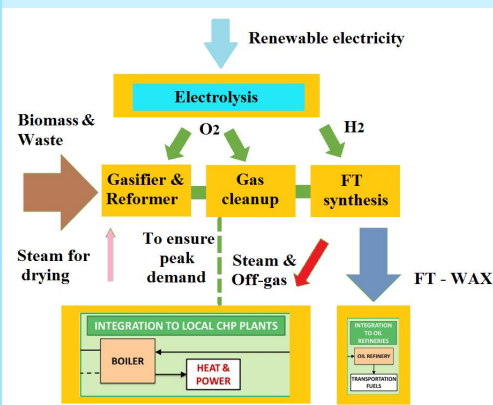
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## ABSTRACT

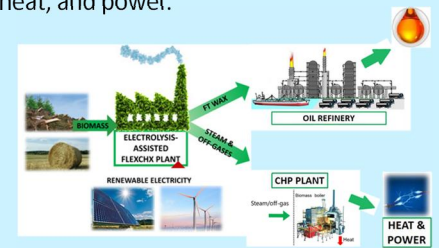
The European Horizon 2020 project FLEXCHX aims to develop a flexible and integrated hybrid process combining electrolysis of water with gasification of biomass and catalytic liquefaction. The gasification and FT process concept has many designs and operation alternatives, therefore in order to develop a hybrid process, there was evaluated different operating modes and conditions at which some amount of by-product heat is generated. This concept might allow more flexible and fast response to changes in consumer heat demand and might be capable of managing the energy system fluctuations on an hourly and daily basis. In this purpose, there was assessed qualitatively the various potential district heating and industrial CHP applications where the waste streams could be integrated considering the surrounding conditions of FLEXCHX process.

## CONCEPT OF HIGHLY FLEXIBLE COMBINED TECHNOLOGY (FLEXCHX)



The core of the plant is the FLEXCHX conversion unit, where solid biomass residues are converted to FT wax and by-product (off-gas and steam). Whereas within the FT synthesis step the intermediate product as waste steam and off-gases are generated, therefore might be delivered to the local CHP plant for heat and power generation increasing energy efficiency.

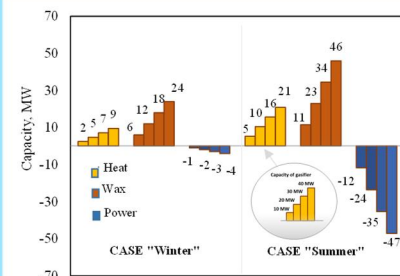
Studies on the integration of waste streams to local heat and power production systems are essential in designing a coherent production concept for cost-effective tri-generation of FT wax, heat, and power.



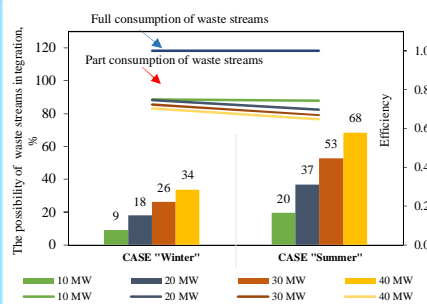
## INTEGRATION OF THE FLEXCHX PROCESS FOR POTENTIAL APPLICATION IN EXISTING CHP

There has been established that at all operating conditions of gasifier certain amount of by-product as a heat is generated considering the wax production.

Heat peak demand (6% of the total demand) can be covered directly burning syngas for heat production. Therefore FT-wax production wouldn't significantly affected.



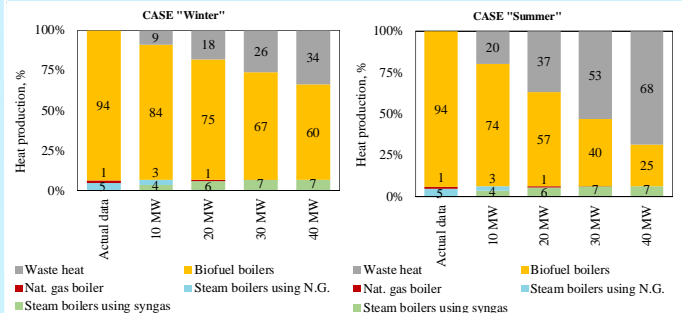
The capacity of the FLEXCHX plant was selected to be 10, 20, 30 and 40 MW.



The waste heat utilization efficiency 0.74-0.85.

If the price of the integrated heat would be competitive in the heat market, the efficiency might reach 1 and heat production can be increased by 35% of total heat.

Gasifier capacity	Heat potential	Heat content	Heat production	Efficiency
MW	MWh	MWh	%	-
Actual data				
CHP plant	-	172.672	-	-
„Winter“ season				
10	20716	15535	9	0.750
20	41432	30949	18	0.747
30	62148	45018	26	0.724
40	82865	58330	34	0.704
„Summer“ season				
10	45541	33885	20	0.744
20	91081	63516	37	0.697
30	136622	91409	53	0.669
40	182162	118145	68	0.649



## CONCLUSIONS

- The new FLEXCHX process concept allows to increase the revenue obtained from locally available biomass residues; and the use of electricity excess in the process enables to increase share of renewable energy in both, CHP and transport fuel market.
- Focusing on the heat fluctuations, the capacity of the gasifier was selected to be in the range of 10-40 MW; and therefore it was determined that at all operating conditions, the amount of by-product can generated from 2.36 to 20.79 MW of heat. Waste streams can be used all year-round, which gives the possibility of a flexible response to minor power fluctuations.

## ACKNOWLEDGMENT

# FLEXCHX

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### About the project:

FLEXCHX is an EU Horizon 2020 project, which develops a flexible and integrated hybrid process combining electrolysis of water with gasification of biomass and catalytic liquefaction. The work idea is focused on the development of flexible technology (FLEXCHX) in order to design combined production of Fischer-Tropsch (FT) reaction products and heat/power for a different type of CHP systems having different requirements set by the district heat network or industrial steam consumption.

### Project acronym:

FLEXCHX

### Coordinator:

Esa Kurkela, VTT Technical Research Centre of Finland Ltd

### EU contribution:

4 489 545 €

### Duration:

March 2018 - February 2021, 3 years

### Type of action:

Research and innovation

### Topic:

Developing the next generation technologies of renewable electricity and heating/cooling

FLEXCHX-project is organized in nine work packages. Read more: [www.flexchx.eu](http://www.flexchx.eu)