



**POLITECNICO**  
MILANO 1863



# CONVERGE

**CarbON Valorisation in Energy-  
efficient Green fuels**

The CONVERGE project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement N° 818135



Main objectives

The consortium

The process

Innovative components

- Catalytic cracker of tars
- Sorption-Enhanced Reforming
- Electrochemical Hydrogen compression
- Enhanced Methanol Membrane

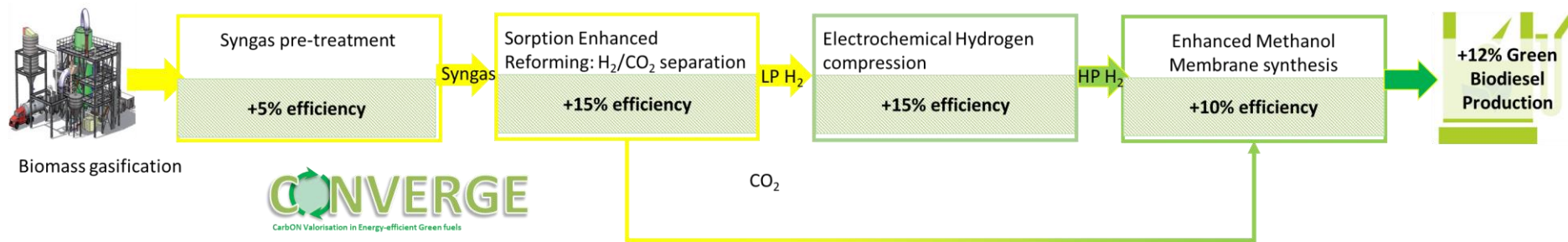
Smart targets

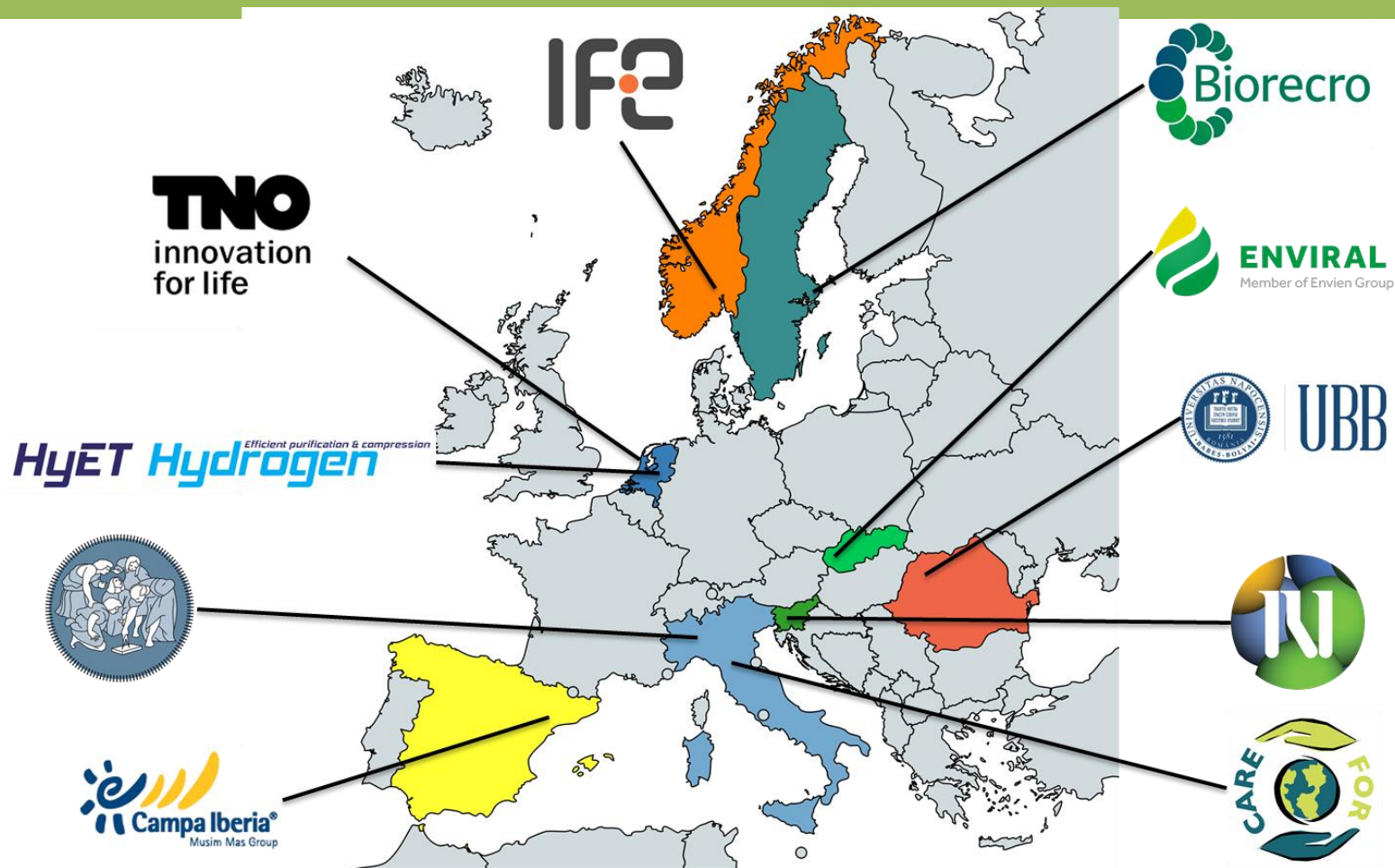
Supply chain optimization



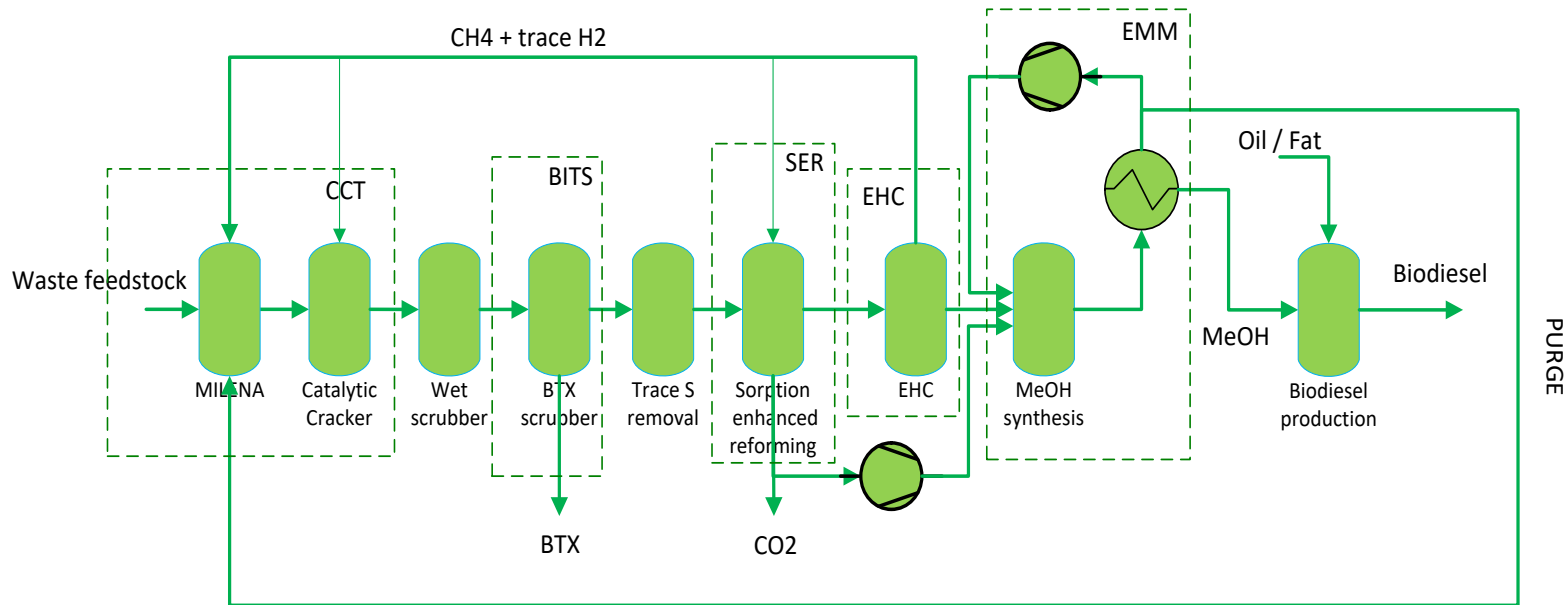
The **CONVERGE** project will validate an innovative process which will **increase the biodiesel production by 12%** per secondary biomass unit used and **reduce the CAPEX by 10%**

The **CONVERGE** technologies will be validated for more than **2000 cumulated hours** taking these from the discovery stage (TRL3) to development stage (TRL5).

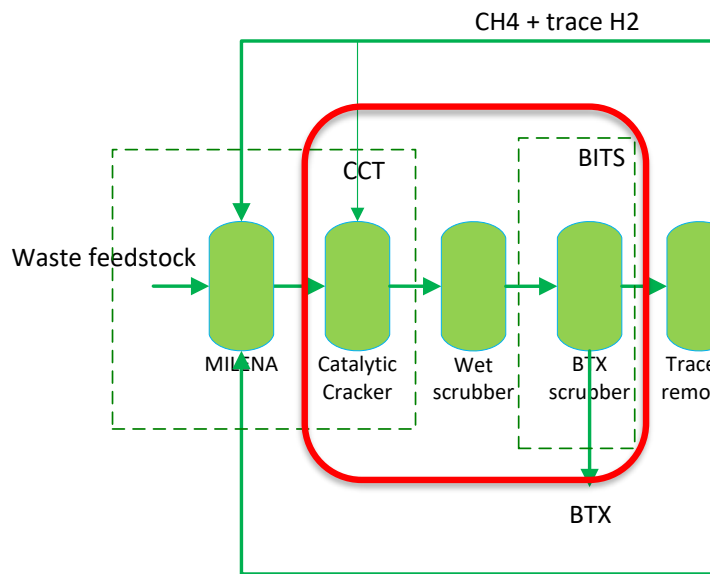




Two universities (POLIMI and UBB), three research organizations (TNO, IFE, and NIC), two SMEs (BioRecro and HyET), two large companies (Enviral and Campa Iberia) and a professional association (CFE)



- CCT: Catalytic cracking of tars from an indirectly heated gasifier to below green  $C_8$
- BITS: Recovery of refinery products including aromatics for green  $C_6$ - $C_8$  fraction (BTX)
- SER: Sorption-Enhanced Reforming of  $C_1$ - $C_6$  for excess-carbon removal, and  $H_2$  production
- EHC: Highly efficient electrochemical compression of green  $H_2$  with by-product fuel
- EMM: Enhanced Methanol Membrane to ensure efficient green biodiesel production

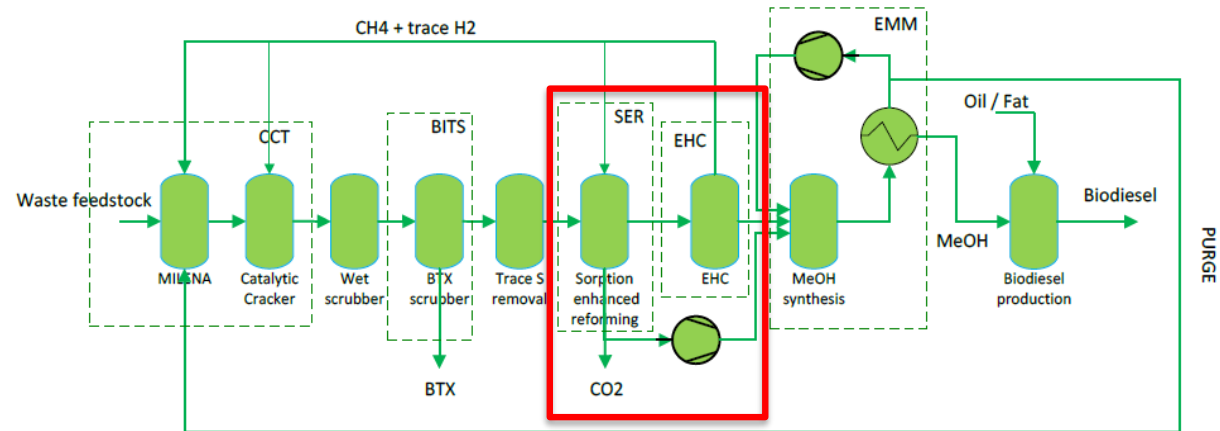


- Conversion of  $C_{9+}$  species from the producer gas at similar temperature to the gasification, avoiding exergy destruction
- **Development of a catalyst** that cracks tars to molecules **smaller than  $C_8$** , maximizing the BTX productivity
- **Design and build a system for the conversion of tar compounds**, without cracking the BTX fraction
- Mini pilot unit able to process  $5 \text{ Nm}^3/\text{h}$  dry product gas
  - BTX removal  $> 95 \text{ vol}\%$
  - Quantitative removal of higher aromatic compounds



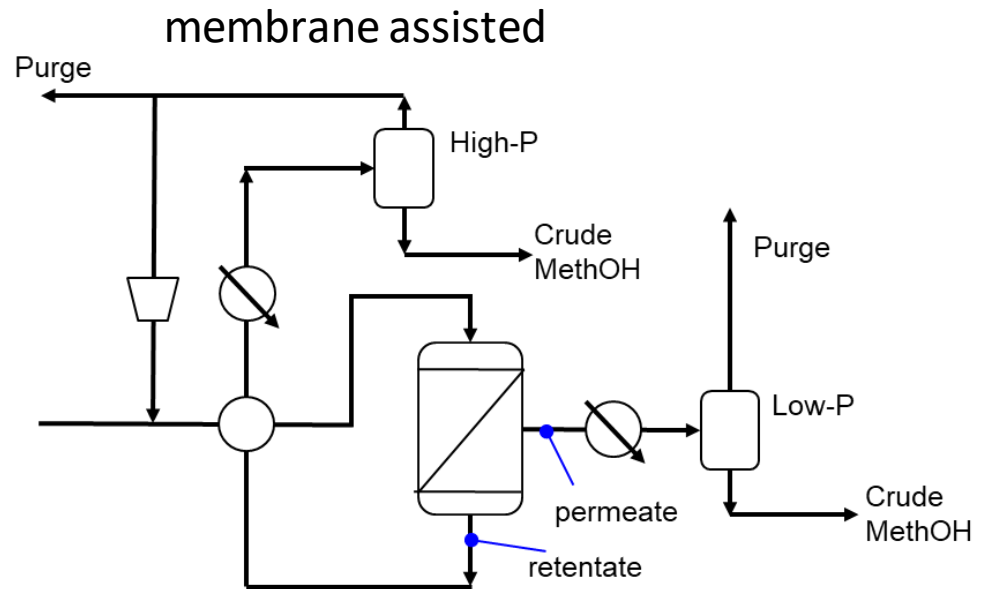
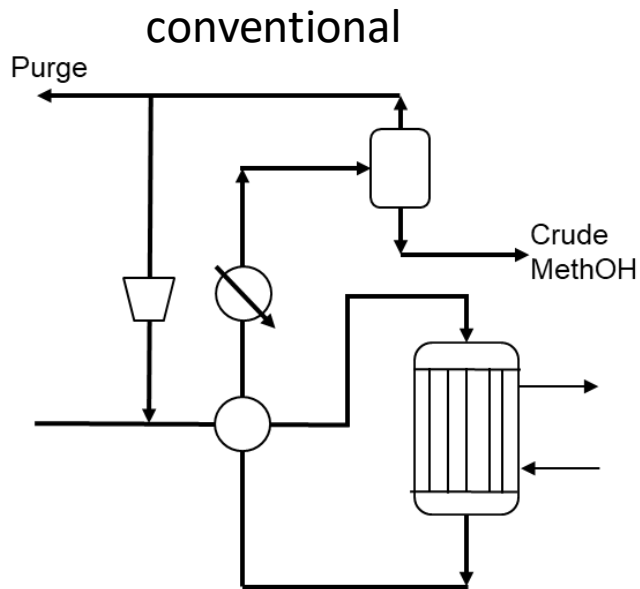
## Development of the Sorption Enhanced Reforming (SER) and Electrochemical Hydrogen Compressor (EHC) technologies at TRL5 :

- Reduce the energy consumption for hydrogen production, CO<sub>2</sub> removal and compression to 1.2 MJ/kg CO<sub>2</sub>
- Extract and compress H<sub>2</sub> at >99.5% purity, 50 bar and at a primary energy consumption of 12 MJ/kg H<sub>2</sub>
- Operate the SER and EHC for 500 hours on C1-C6 containing emulated syngas feed at 10 Nm<sup>3</sup>/hr H<sub>2</sub> production





- By incorporating a membrane into the methanol reactor, the selective removal of methanol and water boosts the driving force for methanol synthesis
- **Validate the Enhanced Membrane Methanol** synthesis with **single pass conversion > 33%** reducing the size of the methanol reactor





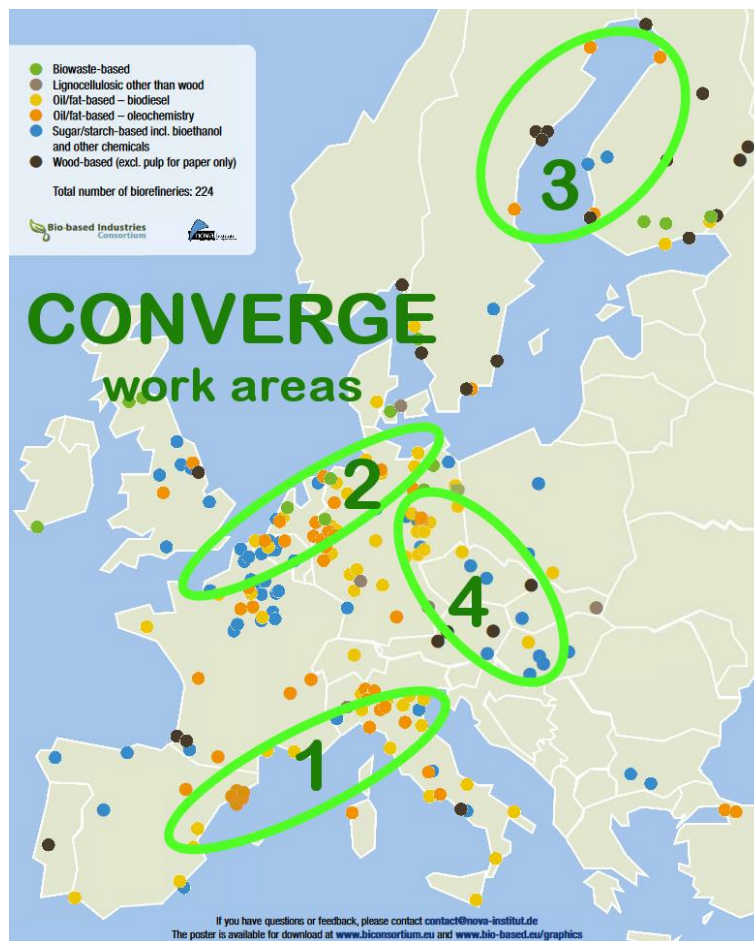


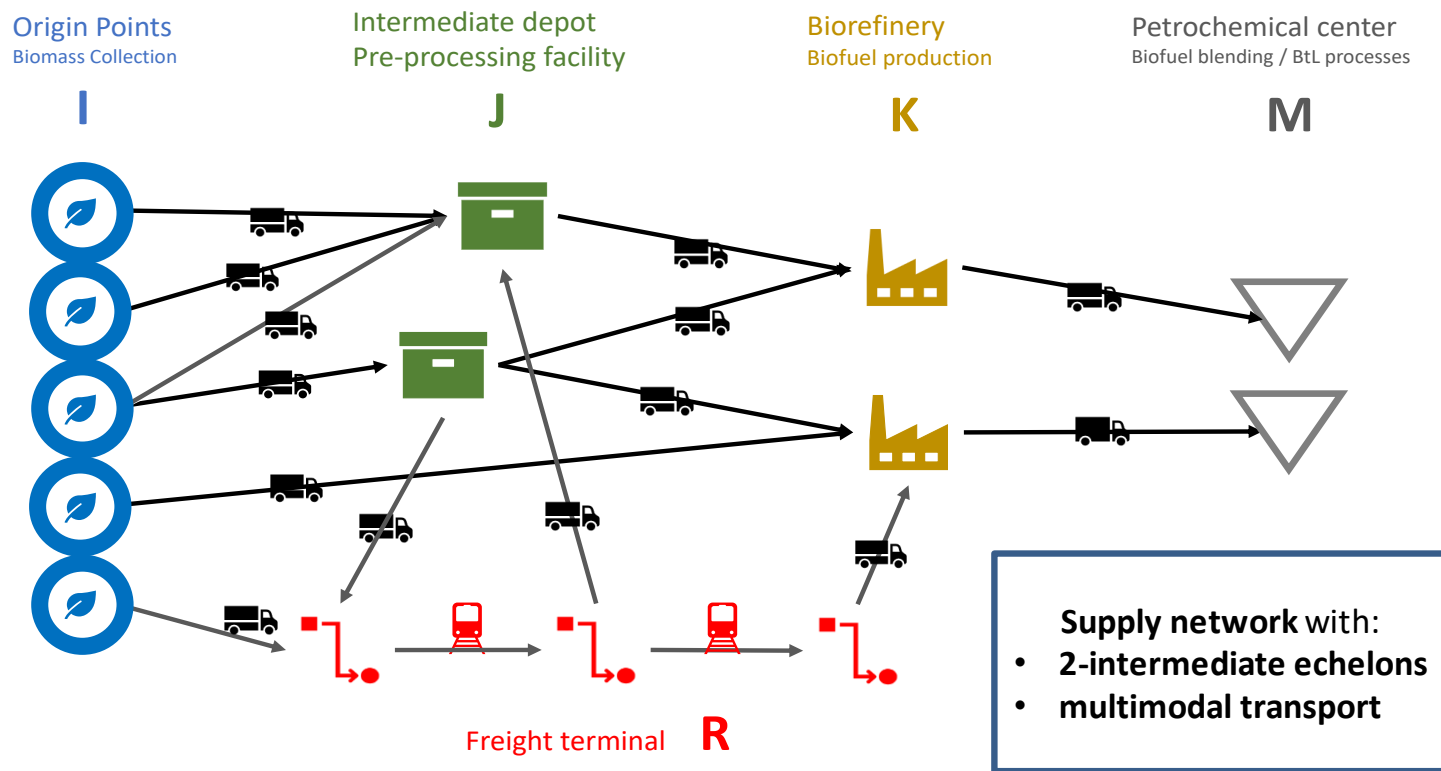
- **Reduce the CAPEX** of the overall process from biomass to methanol **by 15%** thanks to the equipment reduction;
- **Reduce the OPEX** as consequence of the more efficient production **by 10%**;
- **Reduction of CO<sub>2</sub> emissions by 0.2 kg<sub>CO2</sub>/kg<sub>MeOH</sub>** as consequence of higher production efficiency;
- **Specifically target the valorisation of remaining biogenic and purified CO<sub>2</sub>** produced from the SER either in BeCCS type applications, and as a green carbon source for other applications requiring non-fossil fuel-based carbon.

**BeCCS = Bio-Energy with Carbon Capture and Storage**



Reduce the biomass transportation costs as consequence of the process flexibility and supply chain evaluations for 4 distinct geographical regions;



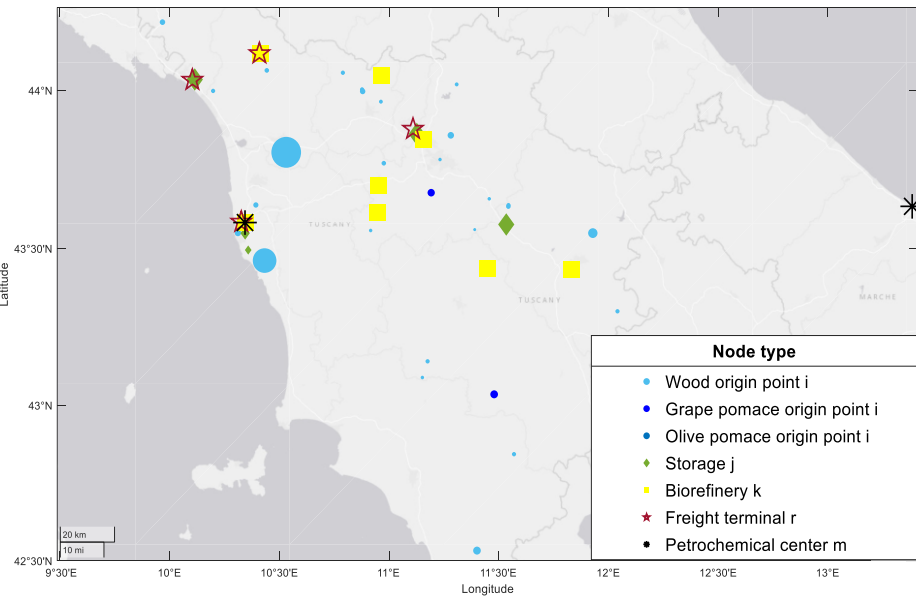




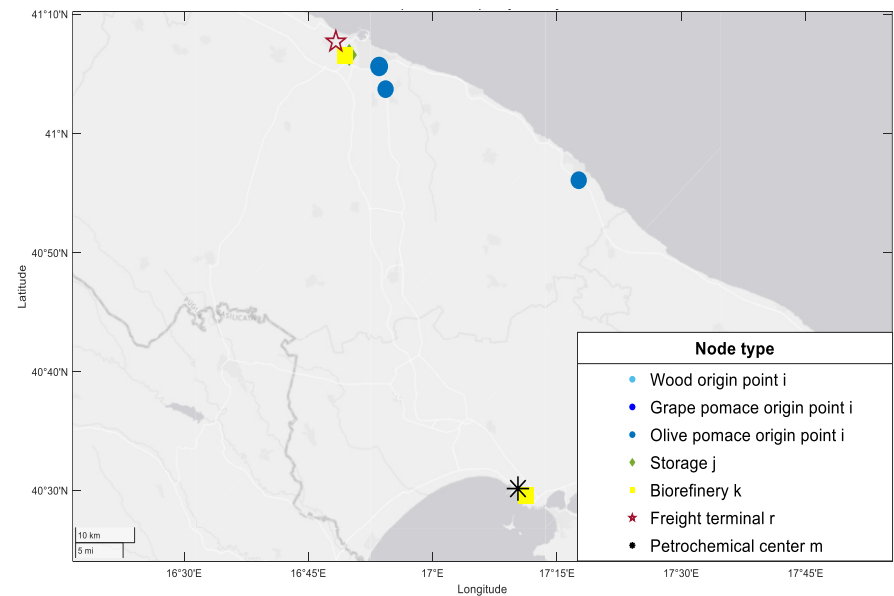
- Woodchips (Toscana) – 350 kton/y
- Grape Pomace (Toscana) - 19 kton/y
- Olive Pomace (Puglia) - 150 kton/y



## Toscana

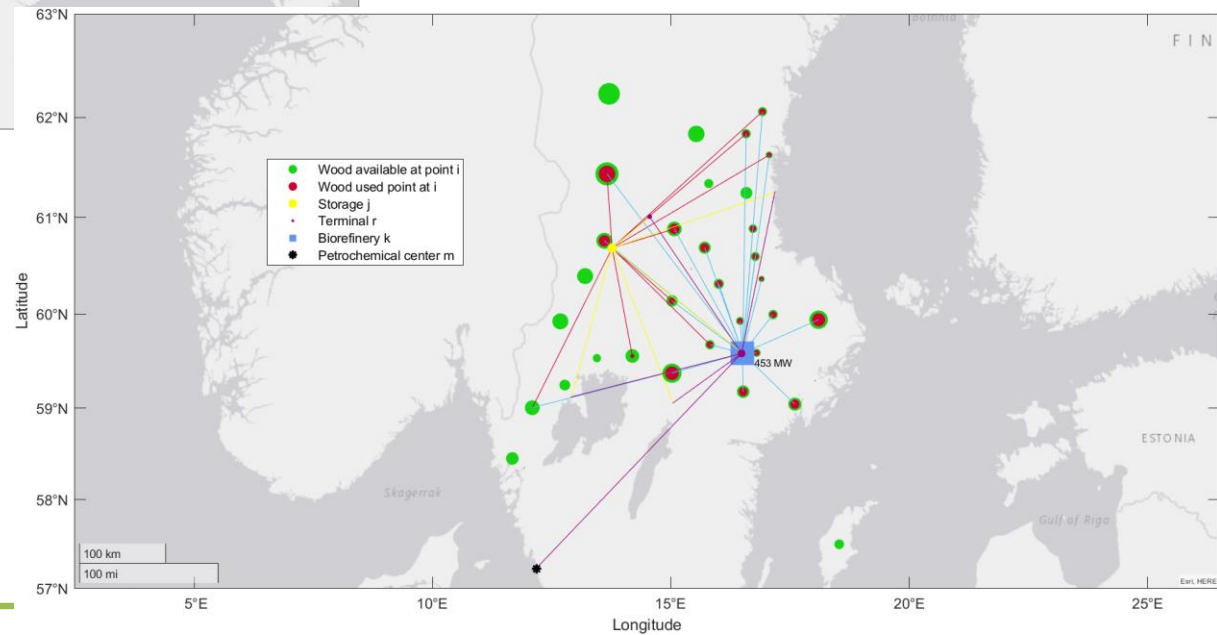
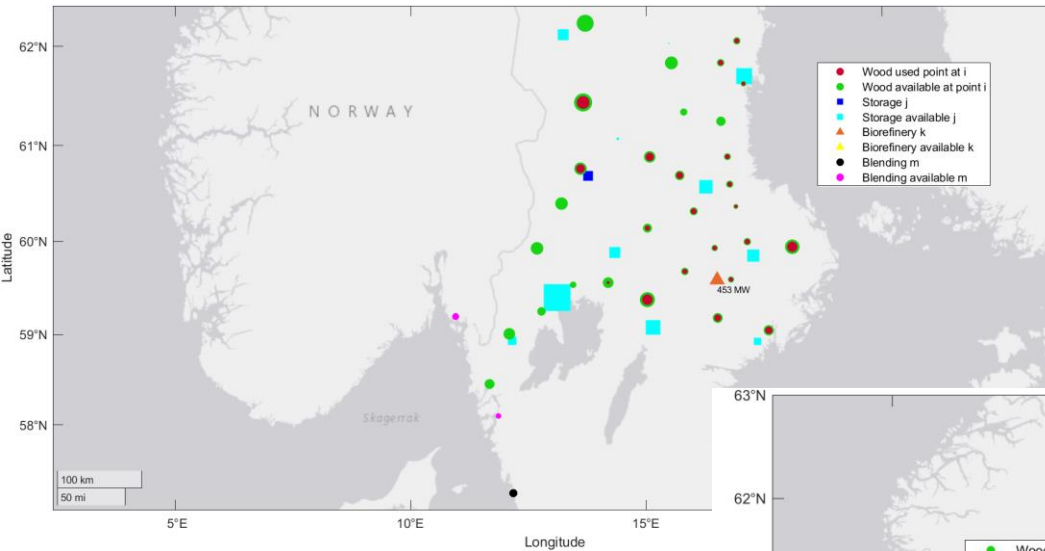


## Puglia





- Woodchips (Sweden) – 2100 kton/y





## Get in touch with us

Website: [www.converge-h2020.eu](http://www.converge-h2020.eu)

Researchgate: **CONVERGE: CarbON Valorisation in Energy-efficient Green fuels**

Linkedin: **showcase/converge-horizon2020**



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