BUTTERFLY

rDME and SNG from feedstocks of biological and non-biological origin

18 October 2024
FUELPHORIA/BUTTERFLY/
POSEIDON Joint Webinar

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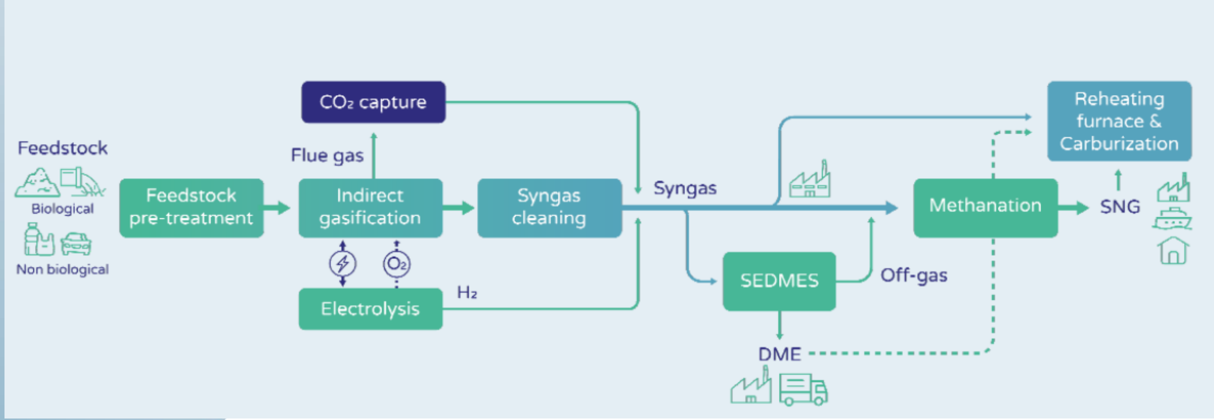
Funded by
the European Union

BUTTERFLY

Flexible and sustainable production of **renewable DME** (rDME) and **synthetic natural gas** (SNG) from **feedstocks** of biological and non-biological origin.

The project will **demonstrate at pilot level** a flexible, efficient and low-cost process to produce rDME and SNG by combining **indirect gasification** with **sorption-enhanced DME synthesis** followed by methanation.

The line-up



CO₂ capture
Feedstock
Biological
Non biological
Flue gas
Feedstock pre-treatment
Indirect gasification
Syngas cleaning
Syngas
Electrolysis
H₂
SEDMES
Off-gas
DME
Methanation
Reheating furnace & Carburization
SNG

Pilots and demo-plants

GAYA

Located in Saint-Fons, France, GAYA is an ENGIE cutting-edge semi-industrial R&D platform able to process biomass and waste residues.

GAYA will be used within the BUTTERFLY project in order to validate at demo-scale the gasification on broad types of feedstocks.

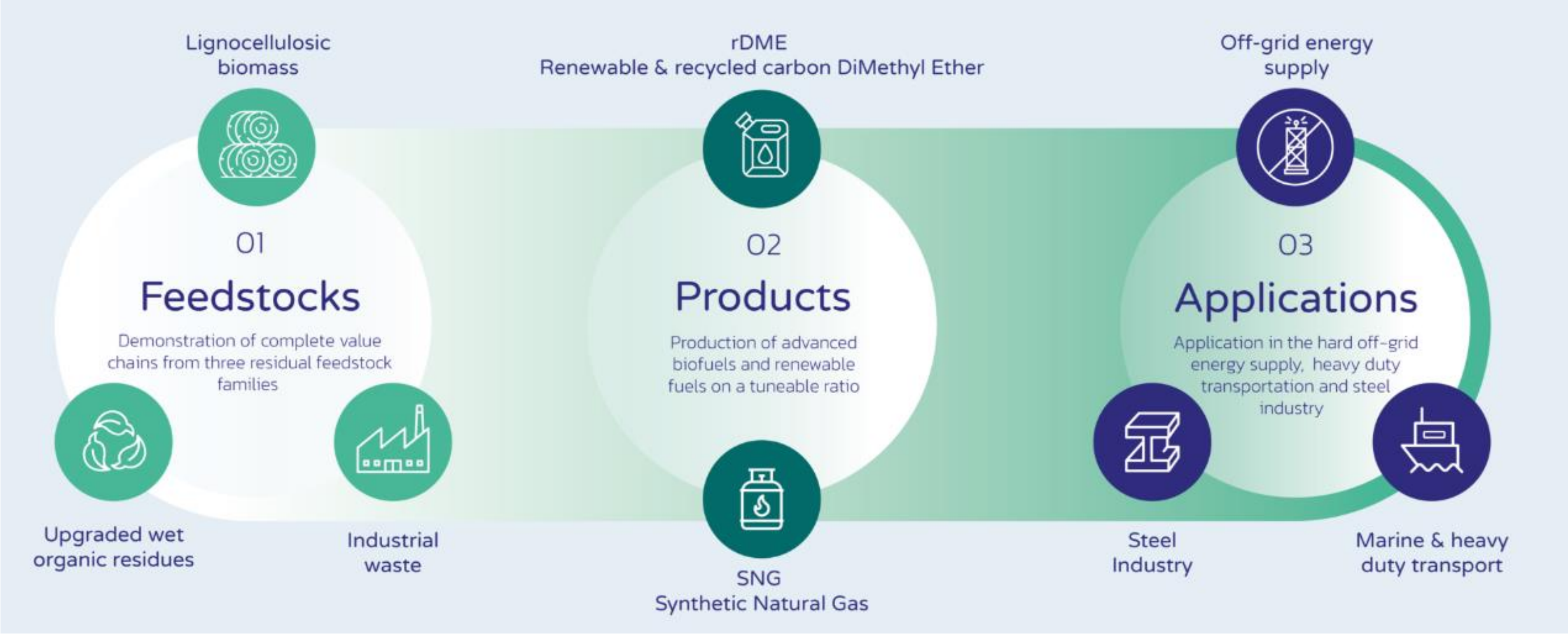
SEDMES

The dedicated SEDMES – Sorption-Enhanced rDME Synthesis unit, developed by TNO, comprises a dedicated 3 reactor column installation that ensures continuous production of rDME.

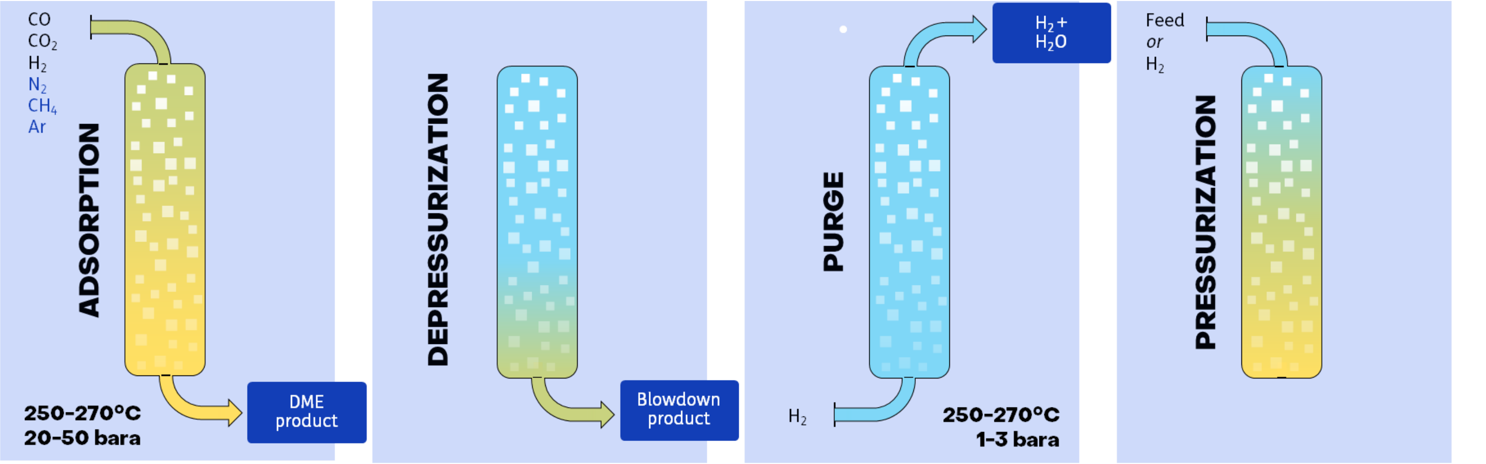
SEDMES technology coupled to GAYA gasification and methanation will demonstrate flexible rDME and SNG production at TRL6 and TRL 7.

TORWASH plant

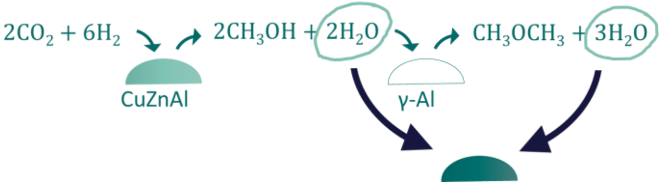
Levels of flexibility across the value chain



Sorption-enhanced dimethyl ether synthesis (SEDMES)



Functional materials:
CuO/ZnO (methanol synthesis catalyst); γ-Al_2O_3 (methanol dehydration catalyst); LTA-type zeolite (water sorbent)



Variable carbon efficiency

Reaction	DME synthesis	Methane synthesis
CO conversion	$CO + 2H_2 \rightleftarrows \frac{1}{2} CH_3OCH_3 + \frac{1}{2} H_2O$	$CO + 3H_2 \rightarrow CH_4 + H_2O$
CO_2 conversion	$2CO_2 + 6H_2 \rightleftarrows CH_3OCH_3 + 3H_2O$	$CO_2 + 4H_2 \rightarrow CH_4 + 2H_2O$

$$M = \frac{[H_2] - [CO_2]}{[CO] + [CO_2]}$$

$M = 2$

$M = 3$

H_2 availability/market demand

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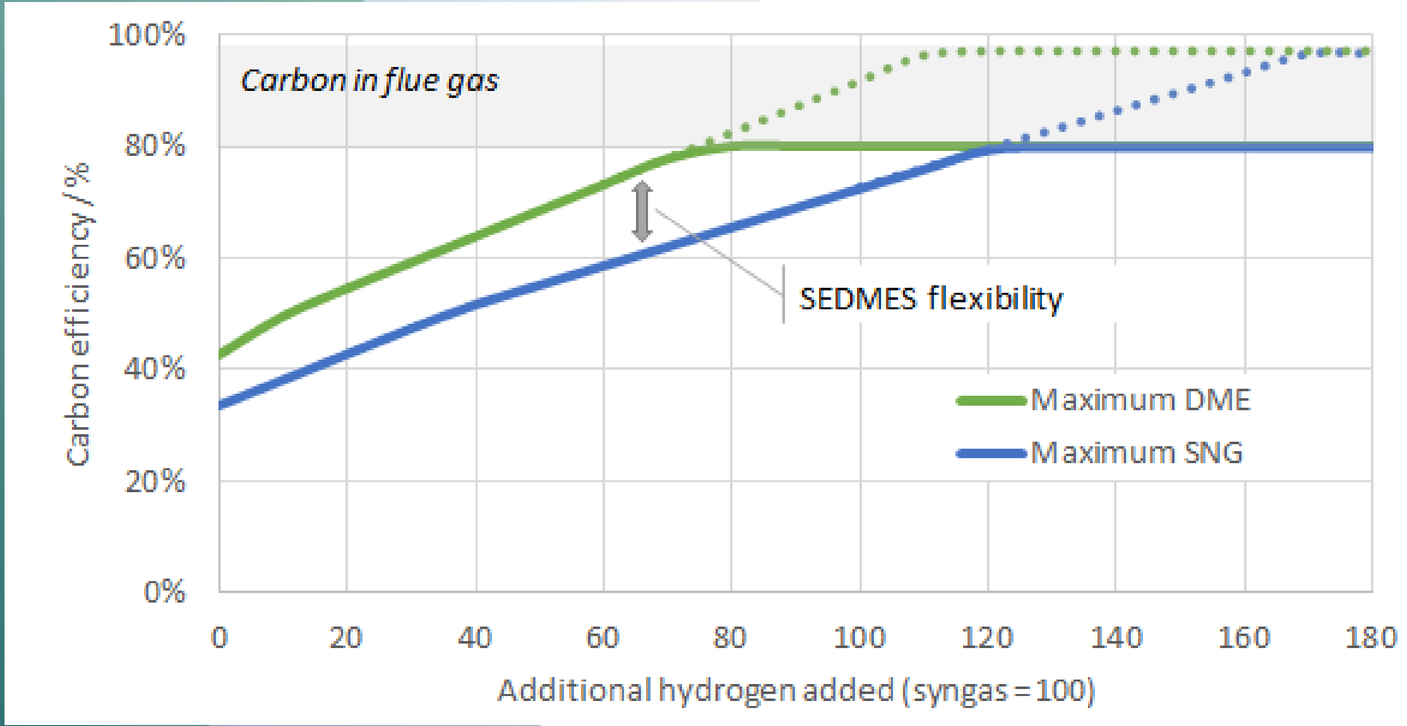
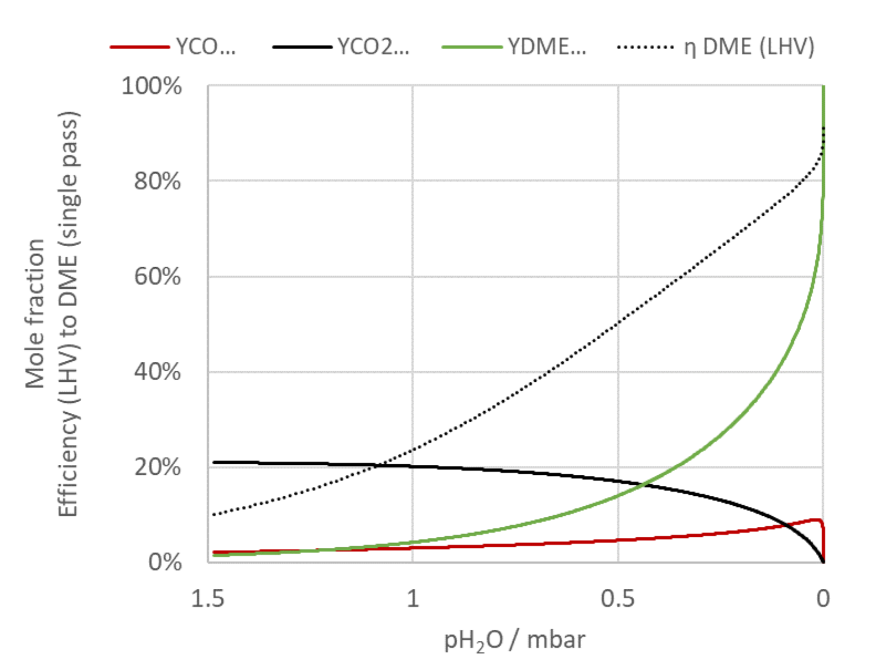
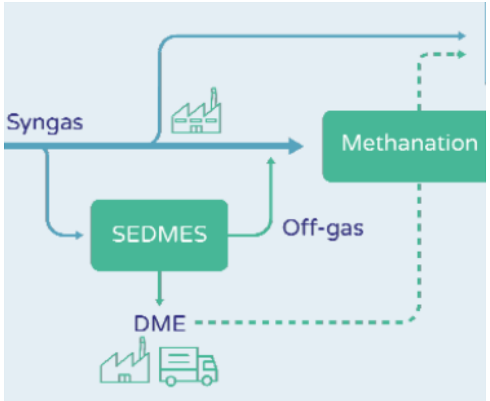
Variable carbon efficiency



DME yield



- Deep water removal allows high DME yield
- Fine-tune the regeneration: achieve desired conversion level



WP2: De-risk the large-scale demonstration

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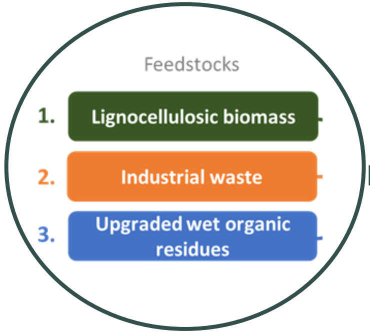
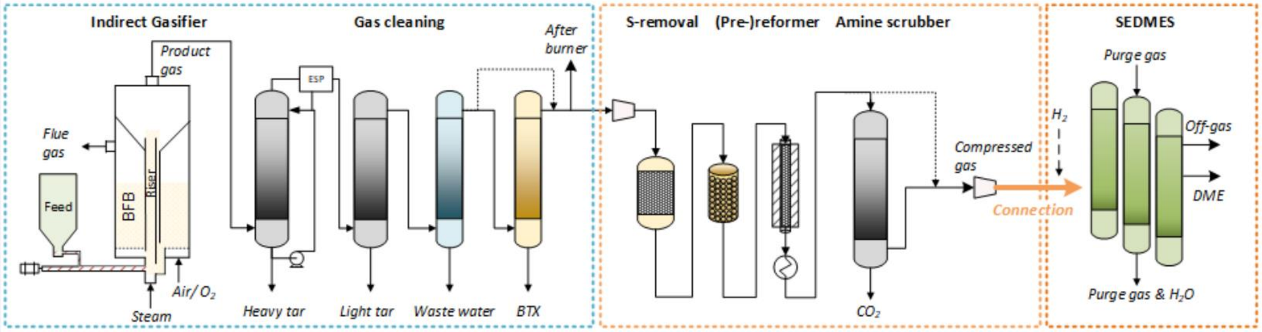
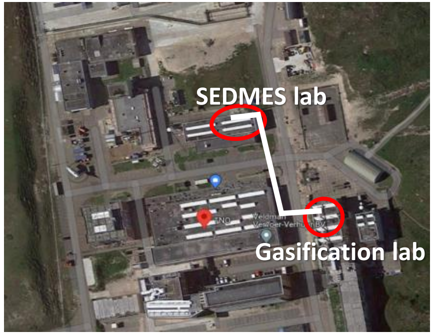




Important feedstocks

- **Agricultural residues**
- **ASR/SRF** provided by **Celsa**
- **Black pellets** provided by **Torwash**

Connection between gasification and SEDMES labs →



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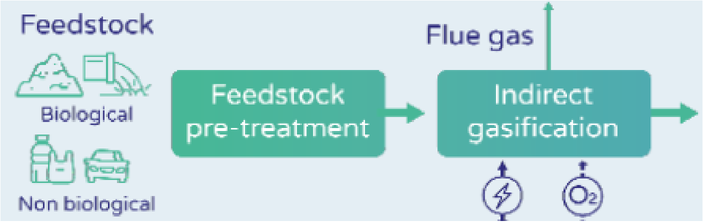
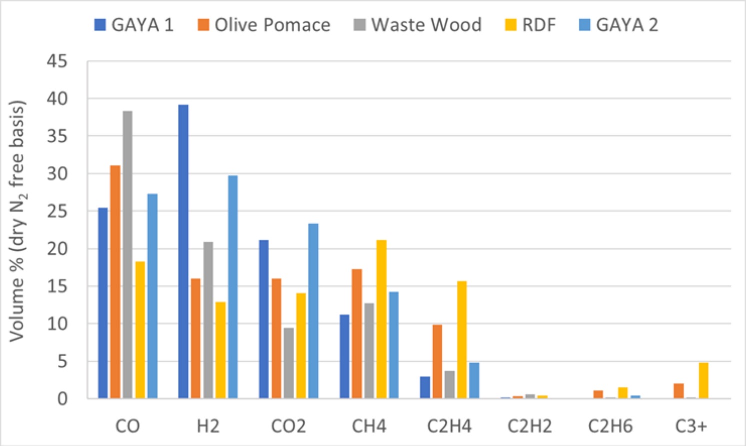


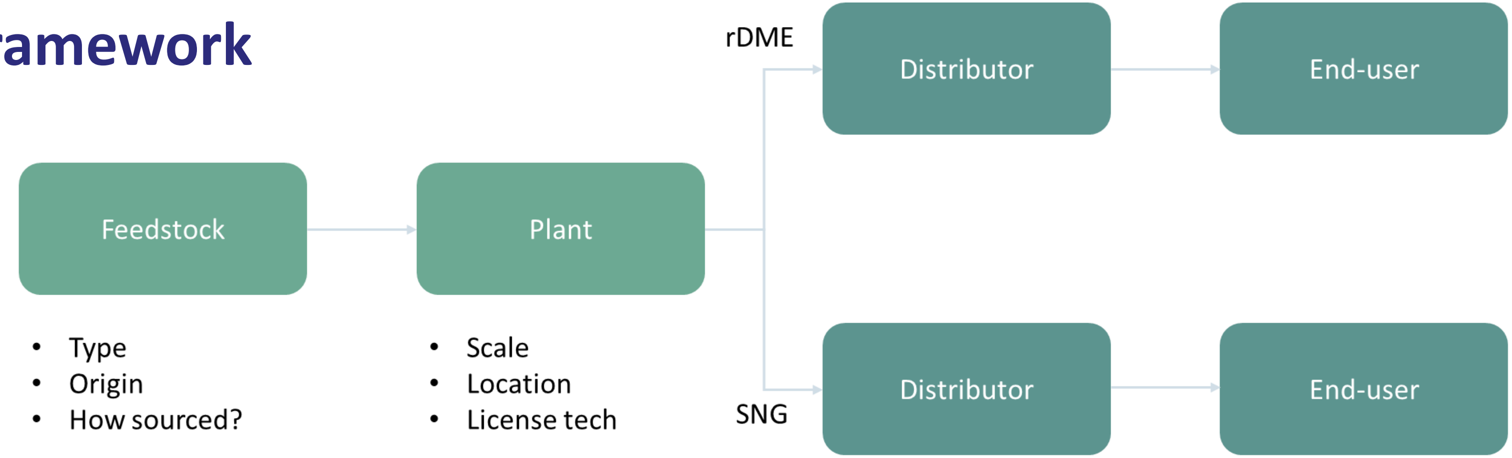


Feedstocks to be tested next

- Waste Wood
- Cereal Straw
- Flax (linen)
- Black Pellets

WP5: Market identification and technology exploitation

Framework



Feedstock:
- Type
- Origin
- How sourced?

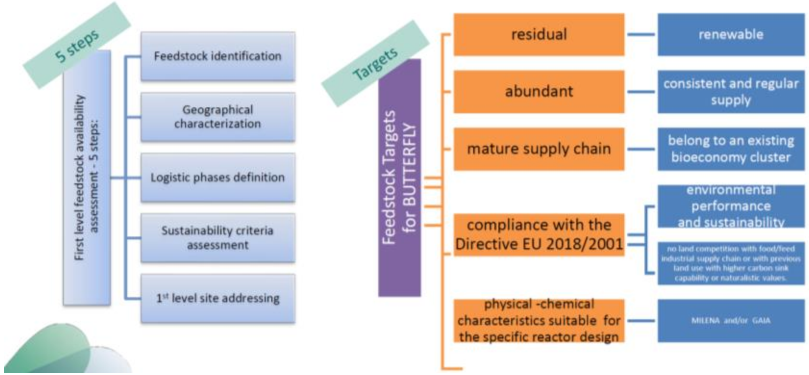
Plant:
- Scale
- Location
- License tech

Distributor:
- How?
- How far?

End-user:
- Sector
- Quality of product
- Annual consumption
- Infrastructure changes

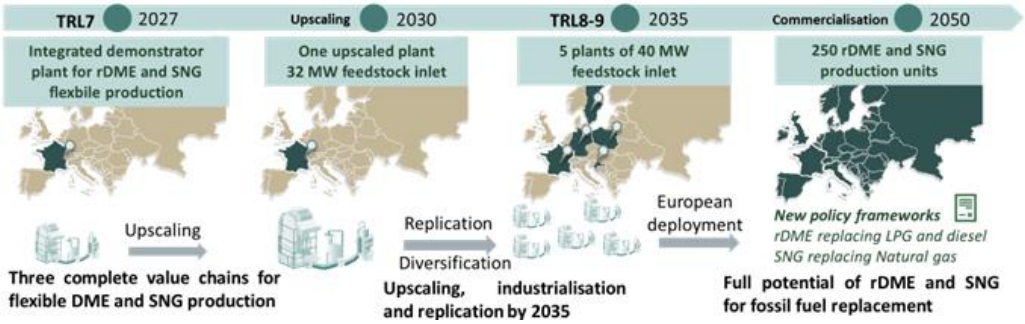
WP4: Assess the optimization and digitalization of the value chains developed in BUTTERFLY

1st level availability assessment



- Diversity in feedstock origin
- Total thermal energy of feedstock
- LPG and SNG consumption volumes
- Available and required infrastructure
- Access to renewable energy sources (optional)
- Regulations of EU and of the member states
- Access to industrial data from BUTTERFLY partners – relevence for the business case task
- Meets sustainability targets
- Meets costs targets

Targeting Europe-wide deployment



Thank you!

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Funded by the European Union

Funded by the European Union. Views and opinions expressed are those of the author(s) only and do not necessarily reflect those of the European Commission. Neither the European Commission nor the granting authority can be held responsible for them. This project has received funding from the European Union's Horizon Europe Research and Innovation Programme under Grant Agreement No. 101118241.