



FLEXIBLE DIMETHYL ETHER PRODUCTION FROM BIOMASS GASIFICATION WITH SORPTION ENHANCED PROCESSES

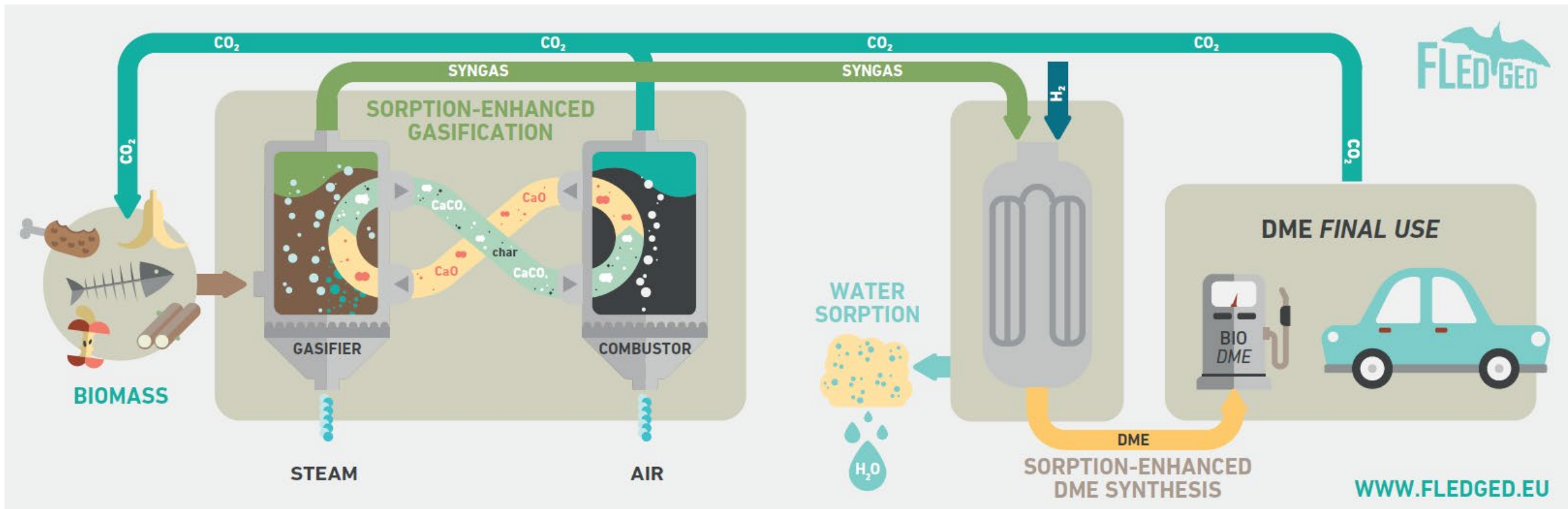
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POLITECNICO DI MILANO, DEPARTMENT OF ENERGY

FLEDGED FINAL WORKSHOP, 27-29/10/2020

The FLEDGED project

The **FLEDGED** project has delivered two technologies *validated in industrially relevant environment (TRL5)* for the production of **Bio-Dimethyl Ether (DME) from biomass gasification**:

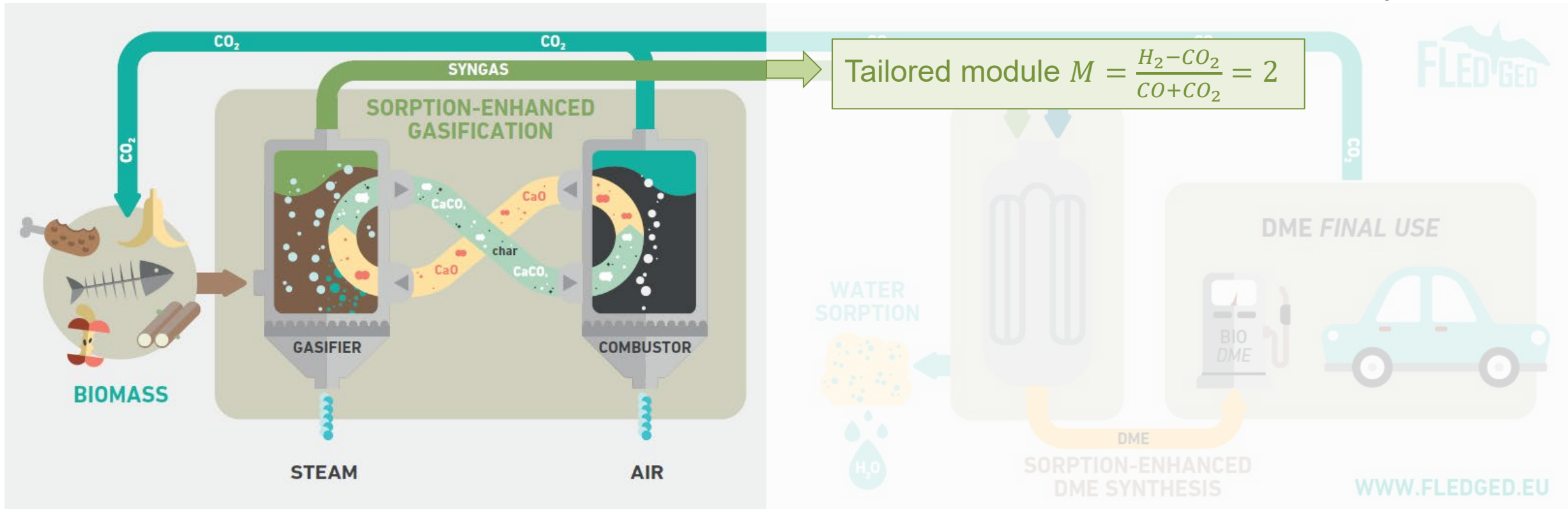
- Process intensification
- Process flexibility



Sorption Enhanced Gasification (SEG)

In **Sorption-Enhanced Gasifier**, CaO-rich sorbent circulates between a gasifier-carbonator and a combustor-calciner to produce:

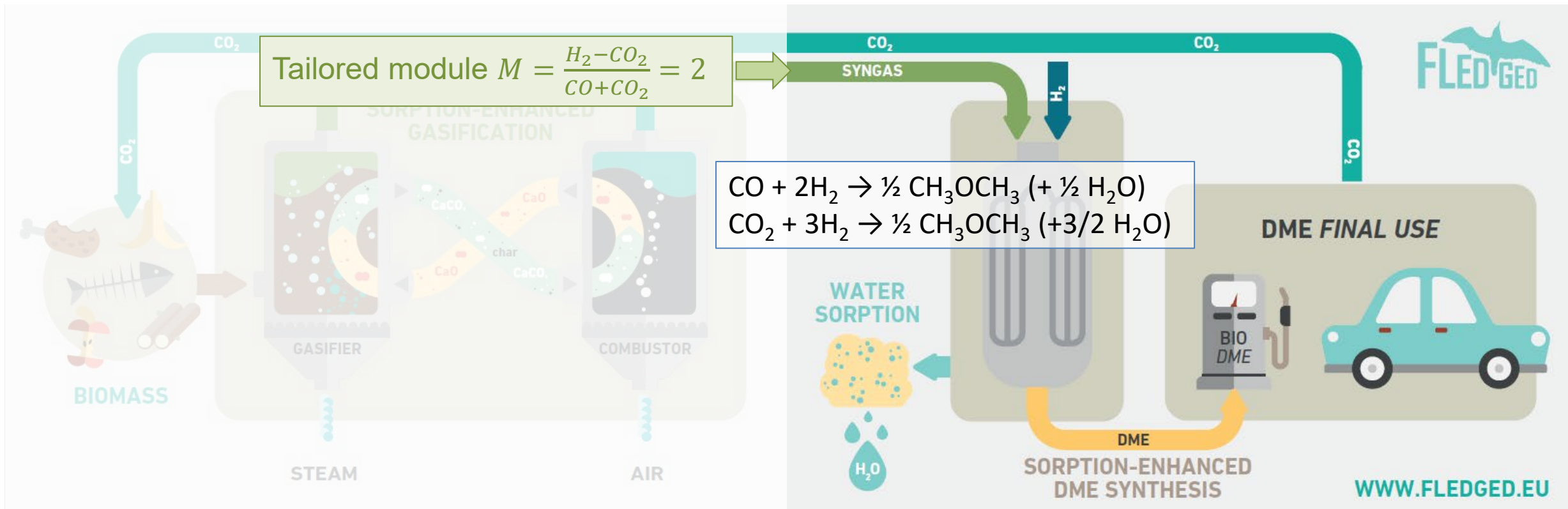
- a **N₂-free syngas** with **no need of air separation unit** (*indirect gasification*)
- a syngas with **tailored module “M”** thanks to **in-situ CO₂ separation** by reaction: $\text{CaO} + \text{CO}_2 \rightarrow \text{CaCO}_3$



Sorption Enhanced DME Synthesis (SEDMES)

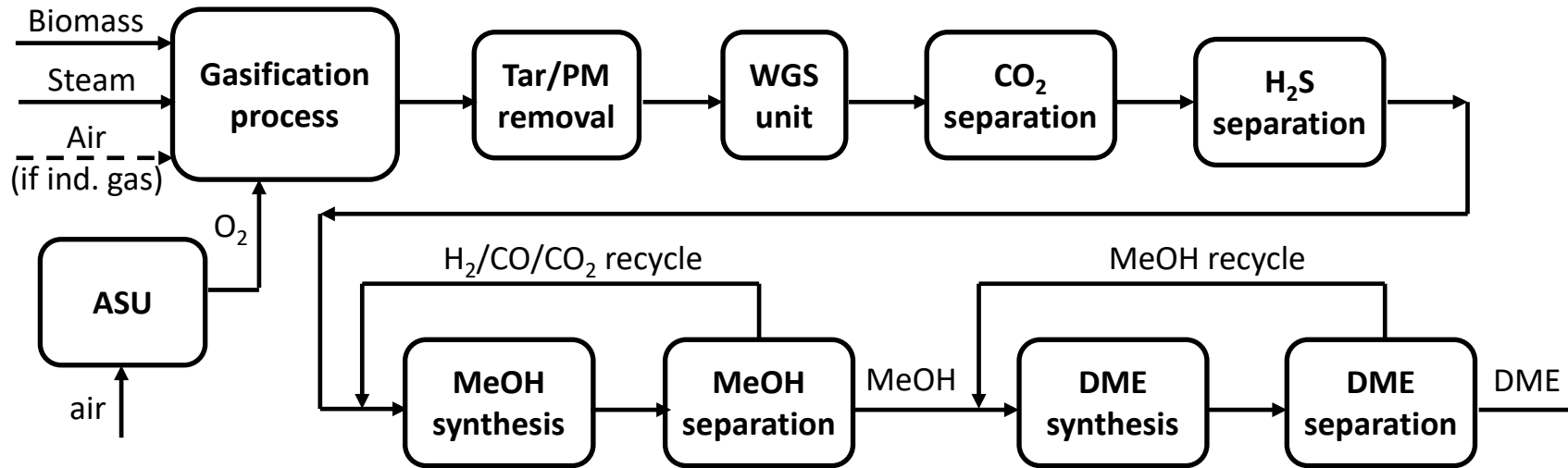
Sorption-Enhanced DME Synthesis is a direct DME synthesis process using sorbent for **in-situ water sorption**:

- **high per-pass DME yield**, thanks to the reduced thermodynamic limitation of methanol dehydration reaction
- **insensitivity on the CO/CO₂ ratio in the feed** (if module M ≈ 2)

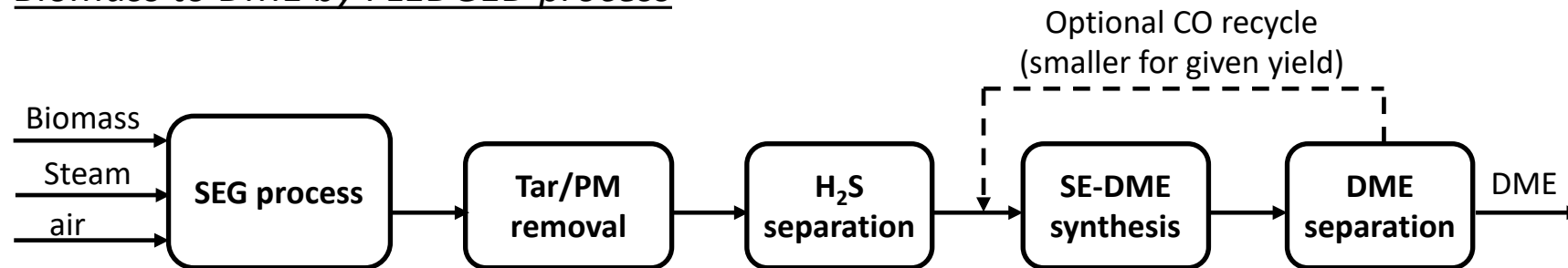


Process intensification

Biomass to DME with conventional process

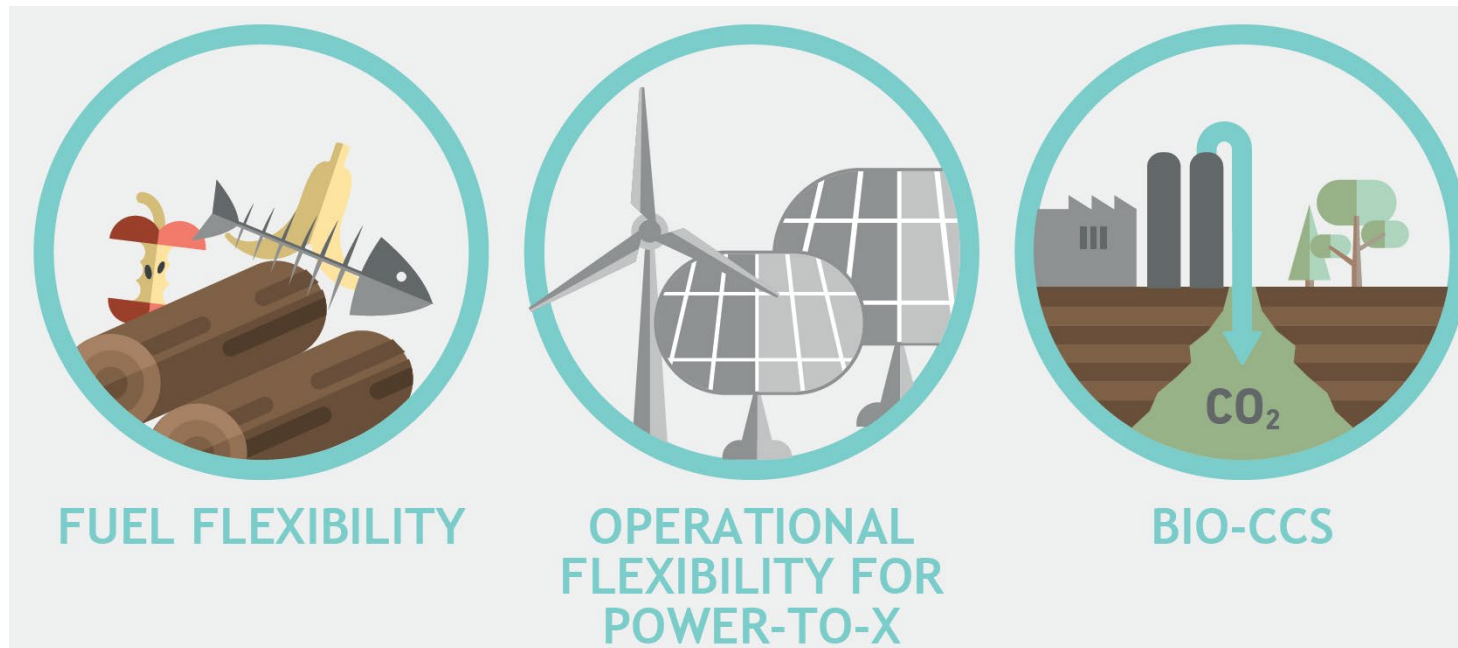


Biomass to DME by FLEDGED process



Process flexibility

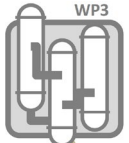
- **Fuel flexibility:** SEG exploits the fuel flexibility typical of fluidized beds and has been tested with woody biomass, agricultural waste, municipal solid waste as feedstocks.
- **Operational flexibility:** by changing the solids circulation in the SEG unit, CO₂ separation can be reduced, allowing the integration with intermittent H₂ from electrolysis for energy storage via power-to-DME
- **Bio-CCS:** with an O₂-blown SEG combustor, concentrated CO₂ stream is produced, suitable for geologic storage, delivering a negative emission system



The FLEDGED project



Components development and experimental screening at TRL4



SEG and SEDMES validation at TRL5



Process modelling and integration study



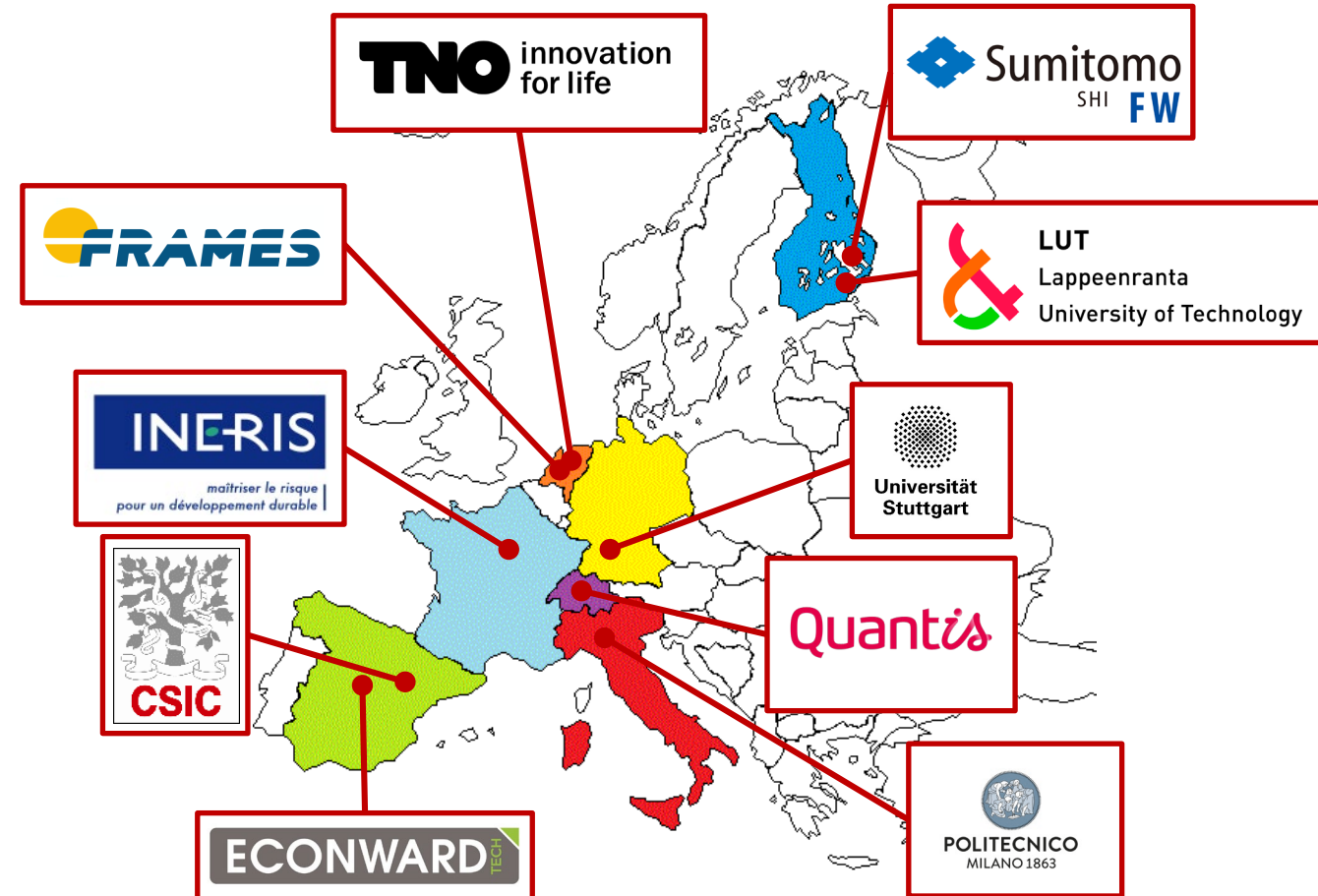
Scale-up and economic analysis



Risk and sustainability analysis



Exploitation





Final Workshop

**“FLEDGED Project: flexible Sorption Enhanced
processes for biomass to DME conversion”**

27-28-29 October 2020, 16:00-18:00



Registration on: www.fledged.eu/finalwebinar/



Workshop agenda

27th October 2020

Process integration, waste-to-fuel, risk and sustainability analysis

16:00	Overview of the FLEDGED project	Matteo C. Romano, <i>Project coordinator</i> Giulio Guandalini, <i>Dissemination manager</i> (Politecnico di Milano)
16:10	DME – Solution for Transport Applications of Today and Tomorrow	Werner Willems, <i>Technical Expert</i> (Ford)
16:30	Integrated process techno-economic evaluation and flexible Power-to-DME operation mode	Alessandro Poluzzi, <i>Research Scientist</i> (Politecnico di Milano)
16:45	Risk assessment of biomass to DME industrial plants	Thangavelu Jayabalan, <i>R&D Engineer - Process safety</i> (INERIS)
16:55	Environmental life cycle assessment of DME produced from biomass	Filippo Sessa, <i>Sustainability Specialist</i> (Quantis)
17:05	Socio-economic analysis of biomass based DME production and use	Simone Schucht, <i>Environmental Economist</i> (INERIS)
17:15	An example of circular economy: municipal waste collection, recycling process and DME synthesis integration	Rubén García Cano, <i>R&D Process Engineer</i> Julio César Aparicio Gaya, <i>Innovation Manager</i> (Econward)
17:30	Open discussion & round table	



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ECONWARD
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Workshop agenda

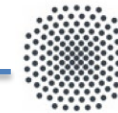
28th October 2020

Sorption Enhanced Gasification

16:00	Overview of the FLEDGED project	Matteo C. Romano, <i>Project coordinator</i> Giulio Guandalini, <i>Dissemination manager</i> (Politecnico di Milano)
16:10	Experimental activities in 30 kWth Bubbling Fluidized Bed gasifier at ICB-CSIC	Isabel Martínez, <i>Research fellow</i> (CSIC-ICB)
16:30	Pilot scale experimental campaigns in dual circulating fluidized beds	Selina Hafner, <i>Research Scientist</i> (University of Stuttgart)
16:50	Three-dimensional simulation of sorbent enhanced gasification	Kari Myöhänen, <i>Adjunct Professor</i> (Lappeenranta University of Technology)
17:10	Large scale gasification unit for biomass-to-fuels: feasibility and economic analysis	Juha Palonen (Sumitomo SHI FW)
17:30	Open discussion & round table	



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Universität Stuttgart



LUT
Lappeenranta
University of Technology



Sumitomo
SHI **FW**



Workshop agenda

29th October 2020

Sorption Enhanced DME Synthesis

16:00	Overview of the FLEDGED project	Matteo C. Romano, <i>Project coordinator</i> Giulio Guandalini, <i>Dissemination manager</i> (Politecnico di Milano)
16:10	Renewable DME: Commercialization in North America	Elliot Hicks (Oberon Fuels)
16:30	Sorption-Enhanced cyclic process development and testing at industrially relevant scale	Jasper van Kampen, <i>Research Scientist</i> (TNO)
16:50	Catalyst/Sorbent mixtures development for Sorption Enhanced operation	Sergio Rojas (CSIC-ICP)
17:10	Modelling and design of fixed bed reactors for sorption enhanced dimethyl ether synthesis	Simone Guffanti, <i>Postdoc Researcher</i> (Politecnico di Milano)
17:25	Large scale DME synthesis plant from wooden biomass: feasibility and economic analysis	Glenn Rexwinkel, <i>R&D Engineer</i> (FRAMES)
17:40	Open discussion & round table	



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Fledged H2020 Project



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