

# The FLEDGED project

## DME production from biomass gasification with flexible sorption-enhanced processes

M.C. Romano<sup>1</sup>; C. Alonso<sup>2</sup>; Astolfi M.<sup>1</sup>; J. Boon<sup>3</sup>; E. Coda<sup>4</sup>; A. Dauriat<sup>5</sup>; G. Grasa<sup>6</sup>; G. Groppi<sup>1</sup>; G. Guandalini<sup>1</sup>; S. Hafner<sup>7</sup>; T. Hyppänen<sup>8</sup>; T. Jayabalan<sup>9</sup>; I. Martínez<sup>6</sup>; J. Mooijer<sup>10</sup>; R. Murillo<sup>6</sup>; J. Pacheco<sup>2</sup>; J. Palonen<sup>4</sup>; G. Rexwinkel<sup>10</sup>; J. Ritvanen<sup>8</sup>; S. Rojas<sup>11</sup>; R. Spörl<sup>7</sup>; J. Vente<sup>3</sup>



<sup>1</sup>Politecnico di Milano; <sup>2</sup>Ecohispanica; <sup>3</sup>ECN; <sup>4</sup>Foster Wheeler Energia Oy; <sup>5</sup>QUANTIS; <sup>6</sup>Instituto de Carboquímica (ICB-CSIC); <sup>7</sup>University of Stuttgart (IFK); <sup>8</sup>Lappeenranta University of Technology; <sup>9</sup>INERIS; <sup>10</sup>Frames Renewable Energy Solutions B.V.; <sup>11</sup>Instituto de Catálisis y Petroleoquímica (ICP-CSIC)



### FLEDGED AT GLANCE

#### OBJECTIVE

FLEDGED project aims to develop a highly intensified and flexible process for DME production from biomass and to validate it in industrially relevant environment (TRL 5).

#### WHY DME

DME is recognized by stakeholders as one of the most promising future biofuels, due to the easy adaptability of car engines and reduced life-cycle environmental impact.

#### APPROACH

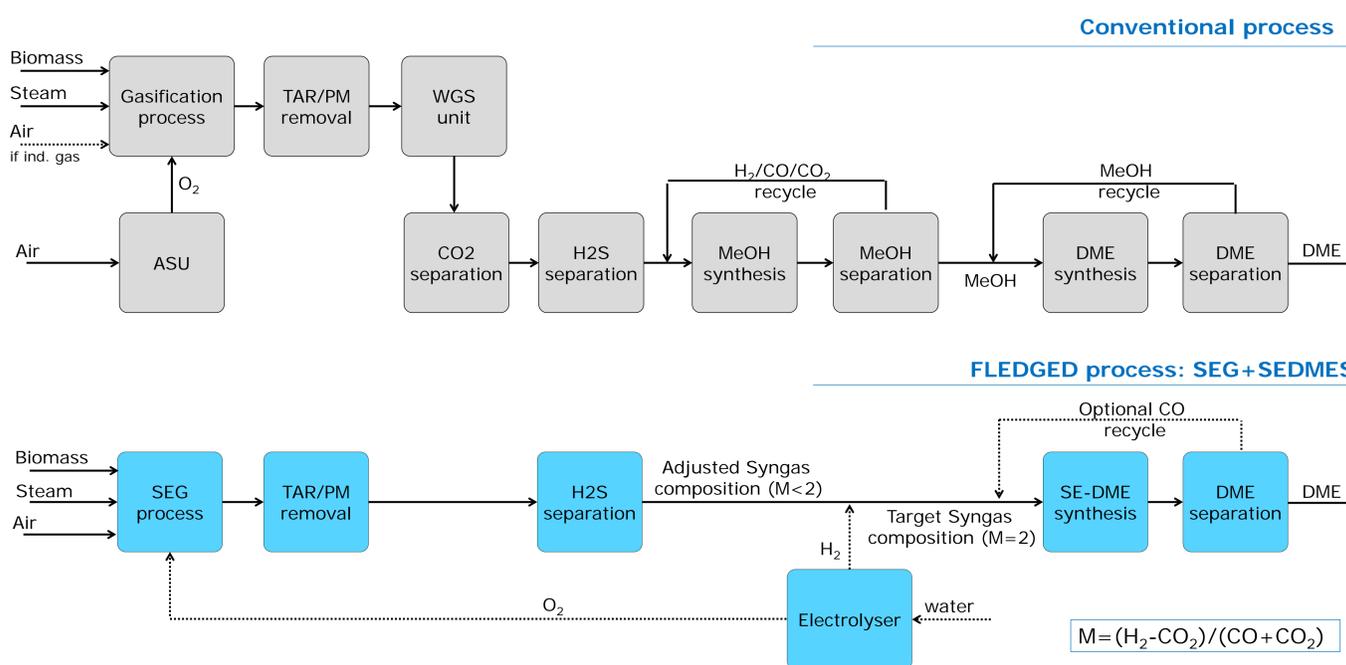
This project combines flexible sorption enhanced gasification (SEG) and sorption enhanced DME synthesis (SEDMES) technologies to produce DME from biomass, resulting in a highly intensified overall process.

#### OUTCOME

The outcome of the FLEDGED project will be a highly competitive concept for both small-medium scale plants serving regional markets and for large scale plants.

### FLEDGED CONCEPT

FLEDGED system is based on the flexible SEG process, where gasification parameters are adjusted to obtain a tailored product gas composition for the downstream SE-DME process. No ASU, no dedicated WGS reactor and no CO<sub>2</sub> separation units are needed, resulting in a compact and process-intensified plant.



### FLEXIBILITY

#### FUEL

Different types of 2<sup>nd</sup> generation biomass feedstocks can be processed by FLEDGED gasifier, ranging from woody to waste biomass.

#### RES INTEGRATION

By adjusting the process parameters of the SEG system, syngas composition can be modified to maintain the optimum M module for the DME synthesis when hydrogen from an electrolysis unit is fed to the plant. In this way, the FLEDGED process can support the electric grid in regions with increasing share of intermittent renewable energies through a Power-to-Liquid process, when surplus low cost electricity is available.

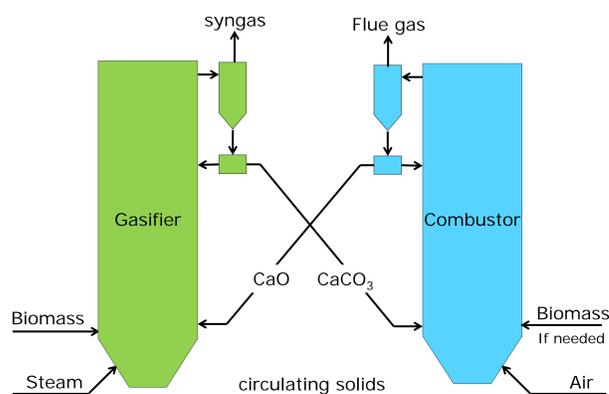
#### CCS

SEG process also allows an easy retrofitting into a CO<sub>2</sub> capture configuration by oxyfuel combustion in the SEG combustor. This allows for capture of biogenic carbon and therefore negative CO<sub>2</sub> emissions.

### FLEDGED KEY TECHNOLOGIES

#### FLEXIBLE SORPTION ENHANCED GASIFICATION

The flexible SEG process developed in FLEDGED is based on the indirect gasification concept. Calcium-based sorbent and other solids circulate between the gasifier and the combustor providing heat to the gasifier and absorbing the proper amount of CO<sub>2</sub> for the downstream process.

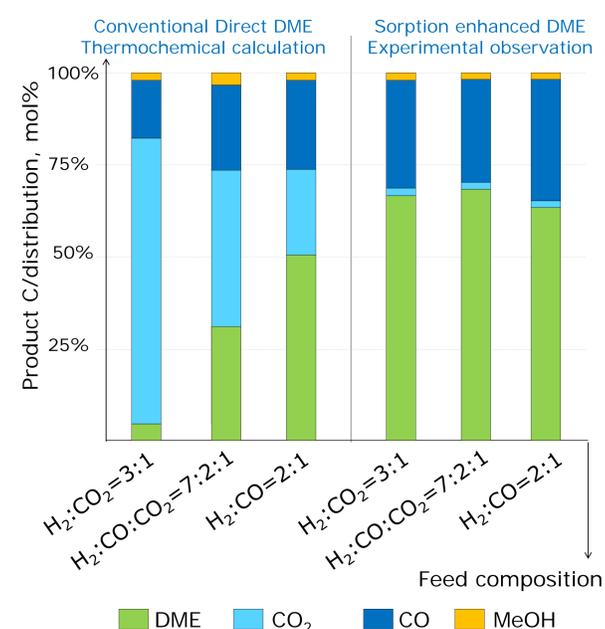


#### SORPTION ENHANCED DME SYNTHESIS

In the SE-DME process, in-situ water removal is achieved through a steam adsorbent added into the direct DME synthesis catalytic bed. In this way, thermodynamic limitation of conventional direct DME synthesis is overcome, increasing the single-pass DME yield, simplifying the downstream purification section and largely reducing or eliminating the recycle typically used in conventional processes.

Moreover, as observed in ECN lab tests, the product distribution is much less dependent on the CO/CO<sub>2</sub> ratio in the feed, as long as the module M is equal to 2. This makes SEDMES process highly suitable to be coupled with SEG system.

#### Conventional direct DME synthesis vs. SEDMES Experimental tests at ECN at 25 bar, 275 °C



#### FIND OUT MORE!

[www.fledged.eu](http://www.fledged.eu)

#### CONTACT US:

[info@fledged.eu](mailto:info@fledged.eu)

#### FOLLOW US!



@FledgedProject



Fledged H2020 Project

#### DOWNLOAD ME!



#### ACKNOWLEDGEMENTS

This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No 727600

