

Bio-economy pilot

Case for joint-demonstration "Gas fermentation from gaseous waste streams/gasified biomass "

Leader: Flanders; Co-Leaders: Nordrhein Westphalia, Emilia Romagna, Baden-Württemberg, Lombardy

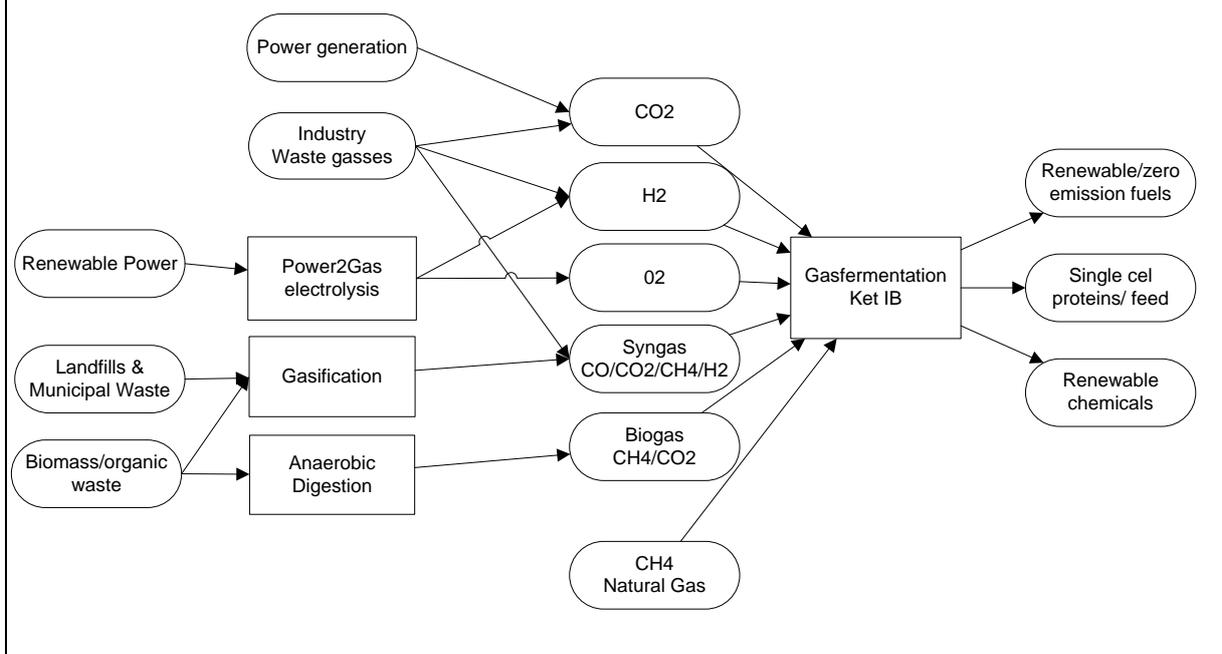
Concept Note

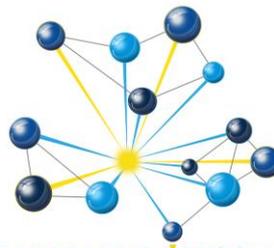
- Description of the application(s) envisaged, with detailed description of the specific application

This concept addresses the circular economy by piloting and demonstrating innovative first-of-its-kind and large-scale recycling value chains :

- It focuses on gaseous industrial emissions (CO , CO_2 , CO_2 and CH_4) as feedstock on the one hand, and gases obtained by gasifying municipal and/or industrial solid waste (MSW, ISW) on the other hand.
- Gas fermentation technology is used to produce chemicals and energy carriers (ethanol, acetate, butanol, isobutanol, ethylacetate, and others).
- Peaks of renewable energy production can be stored in the form of chemicals through a power-to-gas or power-to-chemicals approach.

The scheme below gives an overview of the different value chains and steps/stakeholders involved :





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- Assessment of the “distance-to-market” (TRL 5, 6, 7 or 8) and of the business potential for the own companies.

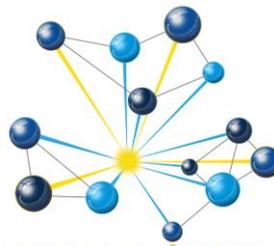
- Knowledge and expertise on gas fermentation is steadily growing. Important players as Lanzatech, Coskata, Ineos Bio, Calysta Energy all have built large scale pilot or production fermentors. Arcelor Mittal, world’s leading steel and mining company has announced plans to invest 87 million EUR to construct Europe’s first-ever commercial scale production facility in Ghent to produce bioethanol from waste gases released during the steelmaking process.
- Gasification of coal is a mature technology. More and more pilot and demonstration plants are being built for biomass or MSW gasification.
- Although big industries from steel, waste management and chemical sectors are driving stakeholders in this targeted circular value chains, the crucial technology providers in gasification and gas fermentation are SME’s. In addition, circular economy production units will - in many cases - be medium-scale and regional-based, thus providing business opportunities especially for SME’s in the different regions.
- In this concept **new value chains** are created: steel mills or waste managers will become the feedstock suppliers of the chemical industry, with technology providers as the enablers. The opportunity consists of creating value out of waste. This will generate more income for the steel mills and waste managers, support innovative SMEs as technology platform companies, and provide the chemical industry with cheaper feedstock, thus giving the European industry a competitive edge, thus supporting job-creation in Europe.

- Description of the key assets of the regions participating

Europe harbors all the required players to exploit this new technology at its full potential: the region covering the Netherlands, Flanders and North Rhine-Westphalia in Germany for instance is one of the largest chemical industry cluster in the world, and accounts for a substantial amount of greenhouse gas emissions. Implementing this technology to convert the waste gasses into chemical products would give the chemical industry in the region (i) feedstock security, (ii) sustainable chemistry, (iii) competitive technology that will anchor this chemical cluster in the region.

Specific key assets:

- The presence of steel mills, e.g. **Arcelor-Mittal** (AM) in the port of Ghent (Flanders) and **ThyssenKrupp** in Duisburg (NRW), producing vast amounts of off-gases.
- The presence of companies active in waste management, such as **SITA (GDF Suez group)**, **Remondis**, **Organic Waste Systems...**
- Technology providers to produce fermentation grade syngas from waste: **Advanced Plasma Power** (UK), **Concord Blue** (DE), and **Ecoloop** (DE) .
- Big chemical industries such as **Evonik**, **Calysta**, **Lanxess**, **BAYER** and **BASF**, willing to sign off-take agreements for gas fermentation chemicals in order to gain feedstock flexibility, use regional carbon sources and get access to new fermentative production systems providing microbial pathways to cost-efficient drop-ins as well innovative chemicals.



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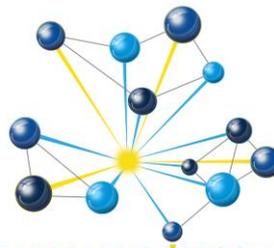
- The presence of an **open innovation pilot**, the Bio Base Europe Pilot Plant, that is accessible to research groups and companies and has gained quite some expertise already in syngas fermentation.

- **What is the added value of joint demonstration activities here?**

- Combining different expertise that is spread over the regions, e.g. gasification technology from NRW combined with syngas fermentation in Flanders
- Guarantee the appropriate critical mass in up- and down-stream value steps to be able to deliver innovative solutions
- Speeding up implementation of this value chain by learning from other regions
- Reinforce clusters and technology centres through exchange of knowledge, concepts and ideas and increase cooperation among clusters and technology centers
- Exchange best practices and identify opportunities for collaboration between the clusters and technology centres
- Identify additional potential strategic partners active in the domain of syngas offering complementary competences and added value.
- Identify value chain linkages and business opportunities for cross-border and cross sectoral collaboration, especially between SME's, to maximize the innovation uptake and productivity increases in this field.

- **Description of a first set of common demonstration activities.**

- Conducting **value chain analyses/studies** among SME members and other relevant stakeholders to identify and map complementary R&D results, innovation competences and needs, skills and smart specialisations areas, support structures, industrial infrastructures, etc. This could be done according to the different parts of the value chains and in this way possible matches and interests for collaboration can be identified.
- **Identification of potential strategic partners** active in the domain of syngas or that could offer additional complementary competences and added value to set up a gas-based value chain in a certain region.
- Prepare investment plans and funding dossiers for **pilot and demo** facilities and projects in order to bring the technology of (syn)gas production and fermentation closer to commercialization. Europe currently does neither have a pilot facility able to fine-tune and scale-up these promising new technologies to industrial scale nor is a demonstration plant available yet. Investments and



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operations of gas fermentation equipment is substantially more expensive than regular fermentation equipment. This high price is simply unaffordable for small companies, and poses a major challenge for large companies, hampering scale-up trials of promising technologies tremendously.

- **Possible implementations:**

- an open innovation, multipurpose gas fermentation pilot plant.
- a pilot and demonstration plant on gasifying MSW and ISW and transforming the resulting synthesis gas into chemicals.

- **Who would be interested to join the case?**

All actors with expertise in one or more parts of the value chain (from feedstock supply and treatment to downstream processing and use of gas fermentation outputs) are invited to connect to this case.