Biogas and biomethane – the products of sustainable use of renewable resources

Anaerobic Digestion (AD) makes the best use of organic materials by producing biogas for the generation of renewable heat, electricity, fuel and fertilizer while closing the nutrients cycle and reducing greenhouse gas emissions.

Thermal gasification is a complementary technology to anaerobic digestion and greatly amplifies the potential of renewable energy in the form of heat, electricity and vehicle fuel.

EBA's strategic vision - EU biogas and biomethane production

2020 – Biogas is a versatile energy source and the EBA goal is that the fuel will contribute at least 1.5% of the EU's primary energy mix corresponding to about 5% of the EU's natural gas consumption (in energy equivalent terms).

2030 – EBA believes that there is a realistic overall potential for biogas production from anaerobic digestion of at least 30 billion m^3/year. Thermal biomass gasification is developing rapidly and, with the right support, is capable of contributing substantial volumes of syngas and biomethane. Taken together, a conservative estimate for the total production of biomethane is 50 billion m^3 per year. With the right policies in place, by 2030, the industry could produce renewable energy equivalent to approximately 10% of EU's current natural gas consumption, for use for electricity generation, heating/cooling and as a transportation fuel.

Definitions:

- **Anaerobic Digestion (AD):** is a biological process in which microorganisms break down biodegradable material in the absence of oxygen creating two important products: biogas and digestate.
- **Thermal gasification (Gasification):** is a physico-chemical oxygen depleted process in which the carbon containing components of the biomass break down to syngas instead of being completely combusted
- **Feedstock:** AD can process almost any biogenic material including solid and liquid manure; energy crops; catch crops; agricultural waste and residues; industrial food and beverage waste; and sewage sludge and the organic fraction of municipal solid waste. Gasification can theoretically process any carbon containing material and is a complementary technology to Anaerobic Digestion (AD), since it can treat high-solids feedstock with low anaerobic biodegradability; these include lignocellulosic feedstocks such as wood chips, and non-recyclable waste fractions of biomass origin currently landfilled or incinerated for energy recovery.
- **Biogas:** the primary product of AD is a methane-rich renewable gas composed of 50 to 65% methane and 35 to 50% carbon dioxide.

- **Digestate:** remaining part of organic matter treated by AD, rich in nutrients and nitrogen, commonly used as an organic fertilizer in agriculture.
- **Syngas:** The primary product of gasification is a mixture of carbon monoxide and hydrogen, with traces of methane and carbon dioxide. It may be used directly for electricity generation, or further transformed to increase its share of methane.
- **Ashes:** All non-nitrogen nutrients contained in the resulting ash, which are recycled to the producing lands, e.g. forests. To maximize the recycling of nitrogen, all feedstock high in nitrogen should always be treated through AD.
- **Biomethanation:** Besides methane formed spontaneously during gasification, syngas can be transformed into methane through two catalyst aided reactions: the water-shift reaction (hydrogen and carbon dioxide formed from carbon monoxide and water) and the Sabatier reaction (methane formed from carbon dioxide and hydrogen).
- **Biomethane:** when carbon dioxide and trace gases in biogas are removed, a methane rich renewable natural gas substitute is left in the form of biomethane. Biomethane can be injected into the gas grid, used as a vehicle fuel or used for combined heat and electricity generation.

Gasification's and AD's contribution to key EU policy areas:

- **European climate targets**: High-rate dedicated anaerobic digesters using organic wastes as feedstock reduce the need for the landfilling of organic materials thereby cutting greenhouse gas emissions, avoiding groundwater pollution and helping to replace mineral fertilisers. Anaerobic Digestion cuts methane emissions from landfill and slurry pits while reducing the use of fossil fuels, commercial fertilisers and chemical inputs. Large scale production of biomethane from biomass gasification will also significantly increase the availability of renewable alternatives to fossil fuels.
- **European energy security:** biomethane from gasification and AD is a locally generated, decentralised, flexible and storable energy supply, balancing the intermittent production of other renewable energy sources and improving energy security. Large scale thermal biomass gasification makes it feasible to create truly renewable natural gas fuelled balancing power schemes for the future. Gasification and AD are the most cost-effective and energy efficient ways to produce green gas for grid injection. Biogas and syngas powered CHP plants, with over 40% power efficiency and over 85% total efficiency, are among the most energy efficient ways to cogenerate heat and power. High-solids lignocellulosic waste fractions can be transformed into higher value energy carriers such as automotive fuels or electricity, depending on the needs of the market. Fully implemented, AD and gasification combined have the potential to make all gas in the European natural gas transport system renewable.
- **Food security and resource efficiency:** AD is the technology which currently delivers the most benefit from organic wastes and crops, extracting energy whilst recycling the nutrients and organic matter. Crops grown for biogas production can be integrated into food crop rotations, thus improving the overall productivity of farming and providing preceding crop value and soil quality improvements. Gasification utilizes feedstocks high in solids and lignocellulose and therefore does not compete with AD for waste food feedstocks. It has the potential to make the valorification of high-solids waste fractions more versatile and flexible, when adding the choice of fuel generation and injection of biomethane into the natural gas transport system.

- **Improved air quality:** biomethane used as a transport fuel reduces particulate matter (PM10) and NO_x emissions by over 95% and 25% respectively, when compared to diesel engines with catalytic converters.
- **Bioeconomy:** The Biogas industry generates thousands of green jobs, invigorates the European countryside and reduces energy and agricultural bills through the local production of bioenergy and bio-fertiliser. Short-rotation forestry on fallow lands in agriculture expands the options for the European farmer, and represents an opportunity to complete the nutrient cycle for bio-fertilisers from waste streams that may not be suitable for food production, such as wastewater treatment plant sludge. Biomethane production from biomass gasification will invigorate the European market, by increasing the versatility and value of the European waste streams. It represents a great opportunity for industries based on forest resources, by adding a new market outlet for wood chips, and making it possible for the paper and pulp industry to add automotive fuels to its product line. It may also create a new export market since many of the leading technology suppliers are European.
- **Bioenergy:** Anaerobic Digestion facilitates the sustainable use of feedstocks by enabling the use of crops which support biodiversity and deliver high ecological standards.
- **Prevention of contamination:** in many EU Member States manure is spread on fields without any treatment to control pathogens, potentially causing biological contamination. Treatment through AD at higher (> 50°C) or at mesophilic temperatures greatly reduces the number of plant and animal pathogens within a feedstock. AD carries the benefit of also destroying most weeds.

The EBA is lobbying for recognition of:

- **The socio-economic benefits** that different renewable energy sources provide, including job generation, reducing greenhouse gas emissions and improving nutrient recycling, so that national support schemes for these energy sources are improved and expanded.
- **The valuable role biogas from AD and syngas and biomethane from biomass gasification** can play in balancing the intermittency of other renewable energies.
- **The unique advantages of biogas from AD and syngas and biomethane from biomass gasification** to be fully taken into account: these are the only sources of energy that can use both, the electricity and gas grids; flexibly up-scaled providing peak energy; or used for power, heat and transport purposes, whilst also making a significant contribution towards a reduction in greenhouse gas emissions.
- **The contribution of AD and gasification to GHG savings** through the replacement of oil and coal as fuels (the potential reduction of CO_2 when compared to coal is 750 kg/MWh_{el}) and indirectly through avoided methane emissions from untreated manure and other organic wastes when stabilised digestate is used as a fertilizer.
- **The complementary nature of gasification and biogas technologies**, enabling the full use of the various domestic waste streams and creating new opportunities for agriculture in terms of choice of crops and full utilization of European fallow lands whilst minimizing iLUC (indirect Land Use Change) effects and maximizing domestically sourced renewable energy streams.
- **Anaerobic digestion as the best technology for getting the most value from organic wastes and crops**, through extracting the energy and recycling the nutrients and organic matter. AD as an essential part of all future biorefinery pathways.
- **The value of syngas as a large-scale provider of renewable balancing power**, thus facilitating a greater proportion of intermittent renewables such as wind and solar power.

- **The value of digestate as a valuable biofertiliser** and its potential to replace artificial fertilisers and improve soil quality, humus content and productivity.
- **The potential of gasification to boost the forestry based industries**, creating new possibilities for upgrading waste streams into products.
- **The potential of biogas industry to revitalise the European countryside** and generate hundreds of thousands of jobs.

And the following specific EU policy framework:

- The EU to develop a coherent strategy setting out the **best uses of biogas, syngas and biomethane from AD and biomass gasification**, with a stable EU-wide legal framework allowing Member States to tap into its full potential by incentivising the best regional uses of these renewable energy carriers. Recognition of this contribution to the EU and Member States' climate and energy targets to be stated clearly in all relevant official publications.
- **Europe's waste management policies** to include a ban on sending organic wastes to landfill and to prioritise their treatment in AD and biomass gasification. Make the use of syngas for combined heat and power generation a priority route for the valorification of incinerable organic waste fractions high in solids, and support the future addition of automotive fuel production through biomethanation.
- All EU Member States to introduce **mandatory source separation** and collection of food waste for households and businesses to increase the rate of nutrient recycling through AD.
- In cooperation with the natural gas industry, **biomethane to be available at all gas refuelling stations** across Europe either in pure form or blended by 2030.
- The development of **sustainability criteria** for biogas/biomethane which take into account all the benefits of the technology. The carbon value of biomethane to be recognised and taken into account in all modelling work and impact assessments. The introduction of a consistent sustainability scheme that applies across all uses of biomethane.
- The EU shall develop specific **targets** (which are independent of those for natural gas) for biomethane injection to grid and its use as a transport fuel.
- **R&D** to support the development of the industry and to contribute to increased efficiency and innovative substrate use, thus improving the performance of the technology in Europe. Encourage industry to develop into global export markets which will deliver cash flow back to the EU economy.
- The EU shall introduce a regulation making it possible to use **bio-fertilisers** from waste streams unsuitable to food based farming, allowing them to be diverted to forestry and other dedicated energy crop based farming.
- The EU shall introduce a regulation establishing **end-of-waste criteria** for digestate and include digestate among the fertilisers addressed by the revised Fertiliser Regulation. Logically, digestate will be exempted from REACH in the same way as biogas and compost.
- All energy sources must be treated equally in Europe. Nationally tailored **support schemes** will be maintained and endorsed by the EU's Guidelines on environmental and energy State Aid.

And EU trade policies:

- The establishment of a European **market for biomethane, digestate and ashes**, to facilitate cross-border trading of these three valuable products.