EBA
European Biogas Association

Digestate Factsheet:

the value of organic fertilisers for Europe's economy, society and environment

The products of anaerobic digestion

Anaerobic Digestion (AD) is a natural process driven by microorganisms which produce biogas and through upgrading, biomethane; two versatile renewable energy carriers that provide electricity, heat and fuel. It is often overlooked that biogas plants also create another product which is at least as valuable as renewable energy, because of its nutrient and organic matter content: digestate.

Organic fertilisers have the potential to transform Europe's agricultural sector forever, offering an attractive alternative to commonly used mineral fertilisers. This factsheet briefly outlines the benefits of digestate for the economy, society and our environment.

Digestate: a valuable organic fertiliser

Digestate has excellent fertilising properties, offering an alternative to agriculture, landscaping and horticulture. It is efficient and environmentally friendly. Organic fertilisers can compete with mineral fertilisers in several catagories.

Digestate is an excellent fertiliser containing all nutrients and micronutrients necessary for modern farming, including Nitrogen, Phosphate and Potassium.

Since no nutrients are lost during AD, farmers can close the nutrient cycle and reuse these vital minerals. Additionally, organic matter in digestate can build up the humus content in the soil; this is a benefit unique to organic fertilisers which is particularly crucial for arid and semi-arid lands with low carbon content

AD closes the loop by allowing Nutrient recycling.

- Phosphate's world reserves are declining at an alarming pace and depletion would be disastrous for further food production as it is an indispensable nutrient for plant growth. AD gives the possibility to recycle this valuable nutrient from organic waste streams;

- The percentage of readily available nitrogen is higher in digestate compared to the same organic material in its raw form, thereby increasing its fertilising value. In addition, organic fertilisers have a "softer" impact than mineral fertilisers which have high levels of available nitrogen, where the latter poses a higher risk of nitrogen leaching into water, while the former takes effect slowly providing nutrients steadily to plants for up to three years.

Digestate has proven to be a much safer fertiliser than nutrients from raw organic material.

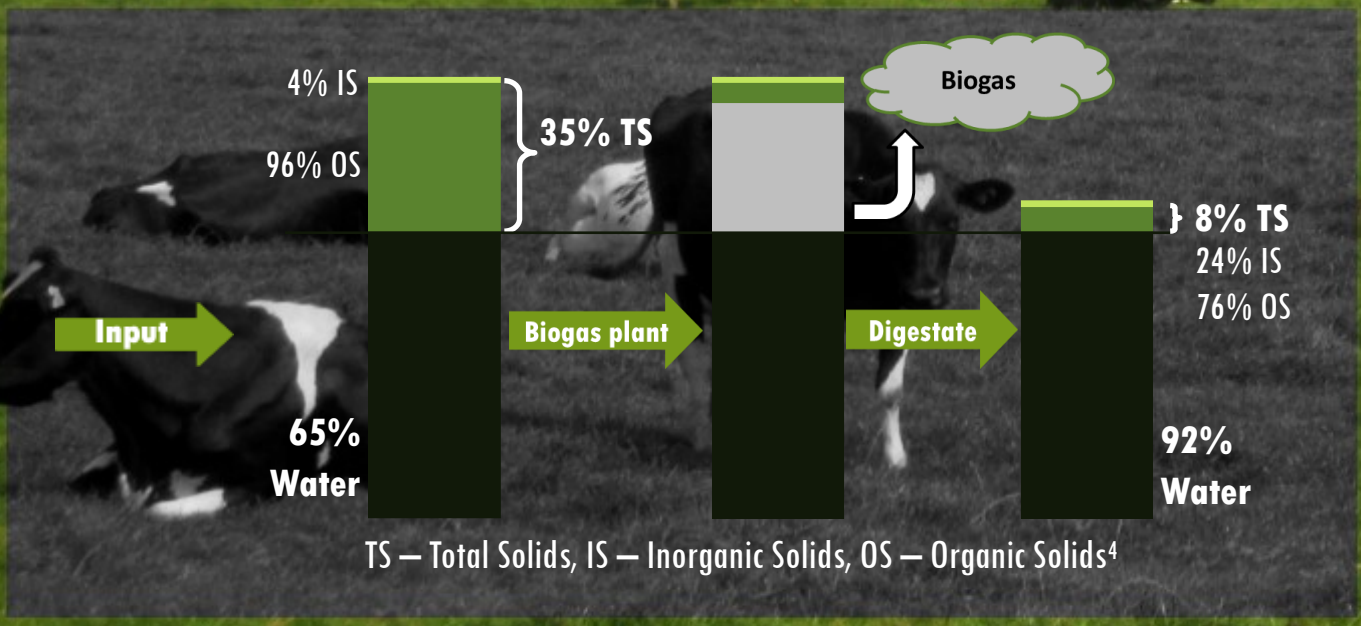
- Animal[1] and plant pathogens[2] are significantly reduced, and in most cases are eradicated, due to technical and thermal pretreatment of feedstock and the microbial conditions inside the digester;

- AD greatly reduces the spread of Invasive weeds, by neutralising seeds that may be present in the feedstock[3];

- The presence of unpleasant odours and dangerous gases is minimised by AD when compared with raw organic material.

- Due to its very good fertilising properties, digestate is much less likely to be disposed of inappropriately (such as landfilling and open storage) than raw organic waste. This significantly reduces the risk of water and soil pollution resulting from high concentrations of minerals in a reduced space.

1 tonne of artificial fertiliser replaced with digestate saves 1 tonne of oil, 108 tonnes of water and 7 tonnes of CO_2 emissions
Anaerobic Digestion and Bioresources Association



TS – Total Solids, IS – Inorganic Solids, OS – Organic Solids[4]

Digestate strongly reduces GHG emissions in the food, feed, beverage and agricultural sectors

Organic fertilisers in the form of digestate offer an excellent alternative compared with energy-intensive mineral fertilisers, as they release very low (or even neutral) GHG emission values throughout their full production cycle. This is due to the following:

Avoiding GHG emissions from open decomposition of organic matter. All organic materials can release powerful GHGs such as methane and nitrous oxide if they are left in contact with the atmosphere; this includes household waste in the form of sewage sludge and municipal biowaste, agricultural leftovers such manure and straw, as well as waste from food and beverage processing. Methane is 21 times stronger than carbon dioxide and nitrous oxide is 310 times more damaging than carbon dioxide[5]. Digesting organic materials avoids these unwanted emissions.

Replacing energy intensive mineral fertilisers. Modern food production is heavily dependent on industrially manufactured mineral fertilisers. The Haber-Bosch process fixes most of the nitrogen used in agriculture and accounts for 1-2% of the world's total energy consumption and 3-5% of the world's natural gas consumption[6]. In Europe, every ton of mineral fertiliser produced by this process emits an average of 9.7 tons of CO2 equivalent[7], which not only harms the environment but also perpetuates energy dependence from imported natural gas. By replacing mineral fertilisers with organic ones, digestate can drastically reduce emissions in Europe's energy-intensive agricultural sector.

Digestate's transport routes are usually shortened resulting in low GHG emissions. This is due to the decentralised nature of AD, which makes it viable across most rural regions in Europe. Additionally, farmers have an interest in minimising transport costs and enabling owners and co-owners of biogas plants to produce their own fertilisers at competitive costs.

Biogas and biomethane are low GHG renewable energy carriers which replace fossil energy. Energy (thermal and electric) as well as gaseous fuel coming from AD have very low carbon emissions when compared with their fossil fuel comparators. This is the case for all commercially used feedstock. Digesting waste captures powerful GHGs that would otherwise be released during decomposition; these avoided emissions often outweigh those which are released during biogas/biomethane production, transport and combustion. Manure is a good example of this as it can save up to 2,5 times the GHGs that it emits, making it carbon negative. Dedicated energy crops such as maize make GHG savings of over 50% compared with its fossil fuel comparator, while co-digesting crops with manure can reach higher reduction levels[8].

Digestate brings jobs and economic advantages to regions

AD is a state of the art technology, which employs highly skilled plant constructors, operators and related service providers. According to the latest estimates, there are over 65.000 jobs in the sector[9]. A large proportion of biogas plants are present in rural areas, offering excellent job opportunities in several of the most disadvantaged regions of Europe. Via processing, digestate can be adapted to provide multiple practical applications, offering great potential for further job creation in this field.

Saving money by using organic fertilisers

In most cases digestate is more competitive pricewise than mineral fertilisers and other organic fertilisers, what enables farmers to make significant savings in one of their biggest annual expenses. If they go a step further by building a digester to treat their farm's waste, they can produce fertilisers to use on their own land and even sell digestate when a farm has a surplus of nutrients. This may ensure an additional source of revenue for farmers and thereby consolidate their economic independence. Municipalities treating source separated waste and sewage water can create new local jobs, while at the same reducing their utility expenses or even bringing in new revenues from selling biogas, biomethane and organic fertilisers.

Italy produces up to 30 million tonnes of digestate annualy which equals to about €400 million fossil fertilisers savings
Italian Biogas Association

Challenges and solutions

Lack of a legal framework. Many European countries do not have appropriate (if any) legislation concerning digestate, resulting in legal barriers to the use of waste material, its conversion into products or its export abroad. To solve this issue across all member states, it is essential to revise the current EU Fertilisers Directive (which at the moment only includes mineral fertilisers), so as to grant equal legal stance to organic fertilisers. Moreover, despite the fact that AD is one of the most efficient ways of treating biowaste, in several member states it is still not recognised as a recycling process, nor is it explicitly acknowledged as recycling within the European waste hierarchy. Clearly defining both, digestate as a fertiliser and anaerobic digestion as a recycling process, within EU legislation would create a functioning market for organic fertilisers across Europe.

Clashes with existing legislation. The EU Nitrates Directive of 1991 is crucial for protecting Europe's environment, however, its unclear wording has led to several misinterpretations in national legislation. The Commission should provide clearer guidelines on when digested and co-digested manure can be used as a fertiliser in Nitrate Sensitive Zones, where it is taken into account that anaerobic digestion greatly decreases the risk of nitrogen leeching into water.

Lack of information. Most farmers are poorly informed (or even misinformed) about the benefits of digestate and other organic fertilisers, often making them hesitant about spreading them on their land. Public authorities should make a conscious effort to explain the advantages of digestate and the adequate management of local resources to build confidence on its use.

Glossary

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.

Biogas: the primary product of AD is a methane-rich renewable gas composed of 50 to 65% methane and 35 to 50% carbon dioxide.

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.

Digestate: remaining part of organic matter treated by AD, rich in nutrients and nitrogen, commonly used as an organic fertilizer in agriculture.

Mineral fertilisers: Fertilizer in which nutrients are in the form of inorganic salts obtained by extraction and/or by physical and/or chemical industrial processes.

Organic fertilisers: Fertilizer in which nutrients comes mainly from renewable carbonaceous materials from plant and/or animal origin.

References

[1] *Utilisation of digestate from biogas plants as biofertiliser,* IEA (2004)

[2] *Endbericht zum Forschungsprojekt 100296/2* , Leonhardt et al. (2010)

[3] *Nährstoffgehalt Gärrückständen,* Pötsch(2004)

[4] *Graph of Czech Biogas Association* (2015)

[5] *Greenhouse gas emission statistics,* Eurostat (2014)

[6] *Structure. Nitrogenase reveals its inner secrets,* Smith Barry E. (2002)

[7] *New technologies reduce emissions,* National Academy of Sciences US (2013)

[8] *Solid and gaseous bioenergy pathways Report (figure 9),* Joint Research centre (2014)

[9] *The state of renewable energies in Europe,* EuObserv'ER (2014)