dena
German Energy Agency

biogaspartner

Biomethane: The energy system's all-rounder.

Contents.

The efficient use of biomass is essential.

Biomass is a finite but widely available resource. It is vital for human and animal food production and is characterised by numerous industrial applications in sectors such as paper, wood, and furniture manufacturing. In addition to such material applications, biomass also plays an important role in the future realisation of a sustainable energy system, and is of particular importance to the provision of heat, electricity and fuel in the context of Germany's energy transition.

The substantial impact of biomass on our daily lives combined with the finite nature of the resource has made efficiency maximisation of paramount importance.

One of the most auspicious applications of biomass is the generation of biogas. By the end of 2015, there will be roughly 9,000 plants in which biogas is created through the fermentation of biomass. There is currently technology available on the market which allows biogas to be upgraded to the quality of natural gas – so-called "biomethane" or "bio natural gas" – and to be injected into the grid. This process allows for the replacement of conventional natural gas in many areas, thus making an important contribution to climate protection. Currently, more than 185 plants feed biomethane into the natural gas grid. Other projects are currently being planned or constructed. For a more detailed overview visit www.biogaspartner.com.

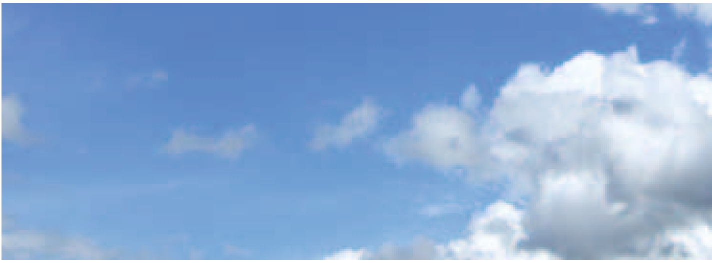
This brochure provides you with important facts about biogas injection. Allow yourself to be convinced of the virtues of biomethane, the energy system's all-rounder.

Biomethane protects our climate.

Biomethane extracted from biomass can replace fossil-based natural gas. In this way, it can reduce the emissions from greenhouse gases, and thus achieve an important contribution to a sustainable and environmentally-friendly energy economy.

CO_2 emissions resulting from the burning of fossil-based energy sources are known to be a primary cause of global warming. Natural energy sources such as biomethane release only as much CO_2 as is absorbed from the atmosphere by plants as they mature. Thereby, the ideal circumstances of climate-neutral energy consumption become conceivable.

The utilisation of agricultural waste by biogas generation can make a further contribution to climate protection. The fermentation of liquid manure and the subsequent output in the field reduces the potential of global warming. This positive consequence is unique to biogas production. It is for this reason that biogas and biomethane can be seen as having a more positive influence on the global climate balance than other forms of biomass currently in use.

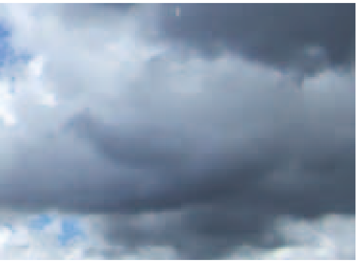


Biomethane stabilises the energy system.

The supply of biogas and biomethane can be maintained all year round. Slurry, manure, and organic waste resulting from food-processing continues to accumulate. Similarly, harvested biomass is stored in silos designed large enough to maintain the necessary supply of energy from biogas throughout the year.

Thus, the production of biogas and biomethane makes an important contribution to a stable and reliable energy supply. The regularity of supply has the ability to balance the fluctuating electricity production originating from alternative renewable energy sources such as wind and photovoltaic.

This advantage is increased by the ability to inject the gas directly into the existing natural gas grid and to use it independently of its production location. Thus, biomethane plays an important role in the context of Germany's energy transition.



Biomethane reduces import dependency.

Some 97 per cent of Germany's oil and over 85 per cent of the country's natural gas is imported. A large proportion of these imports originates in countries whose future political stability remains incalculable. In light of such deterministic geopolitics, the strategic relevance of a secure energy supply has increased in Germany and the EU.

Biomethane is created from indigenous, renewable resources and organic waste products. Legitimate prognoses project a sufficient amount of resources for biomethane to supply ten per cent of Germany's current demand for natural gas by 2030. These calculations take Germany's overall energy goals for the future into consideration. This would allow the country to import less natural gas, and to significantly increase energy security.

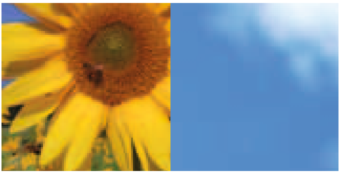
The well established and closely linked European natural gas grid provides good opportunities for the cross-border trading and marketing of biomethane and through this, to lower import dependency in the European network and reach the biomethane targets of many European countries.

Biomethane stimulates regional development.

The production of biogas from regional resources creates jobs, especially in agriculture, supply logistics, engineering, plant construction, and maintenance.

This allows local farmers to profit in particular from resulting developments in related “non-food” sectors of local economic development. These sectors provide increased planning security and create an opportunity for alternative sources of revenue.

As plant operators or partial plant owners, the commercialisation and injection of biogas allows farmers to become direct beneficiaries of overall regional economic prosperity. Technology-related occupations in Germany are created, not only to satisfy domestic demand for German biogas technology and German expertise, but also in the German export market.



Biomethane is eco-friendly.

A variety of organic materials can be used in biogas plants exclusively, or in combination with others, without substantial technical alternation to the facility. Typically, crops commonly used for the generation of energy are processed together with biogenic waste, thus providing site-specific adaptability of the energy mixture used.

The cultivation of energy crops is generally associated with the formation of monoculture. However, due to the diversity of resources that can be used for the production of biogas this is no longer a necessary concern. Moreover, farmers tend to be interested in cultivating a large variety of plants in order to ensure the fertility of their cropland.

Existing research projects in this area focus primarily on the implementation and accelerated cultivation of various energy crops. Furthermore, new cultivation methods are being field tested, and thereby adapted to local conditions.

The production of biomethane necessitates a comprehensive understanding of the preservation of biodiversity contextualised within a multifaceted landscape. The cultivation of fuel crops for the production of biogas is capable of being integrated into existing agro-ecosystems, and provides opportunities for the responsible use of natural resources.

Biomethane secures patterns of material flow at the local level.

The generation of biogas creates a simple and ecological means of harnessing the solar energy preserved within plants, and thereby locally sustains the circulation of nutrients.

The anaerobic digestion of biomass generates biogas, which can be converted into energy. A digestate is created as a by-product comprised of all non-digestible substances and all mineral deposits contained within the biomass. In addition to basic nutriment composites found in plants, such as nitrogen, phosphorus and calcium, unused trace elements are also measurable.

Biogas plants are always located in close proximity to areas where biomass is cultivated. This circumvents the need for energy-intensive transportation of energy crops to the plant location, and minimises the cost of redistributing the by-product throughout surrounding cropland. The by-product can be used as a commercial fertiliser, thus reducing the costs associated with the regular purchase of manufactured fertiliser. The use of all biogas by-products ensures the optimisation of the value-added chain of this resource.

Biomethane comes from natural processes.

The technical procedure for creating biogas reflects a natural process. Naturally-occurring bacteria break down the biomass in the fermenter, similar to the way nutrients are digested in the stomach of a cow. As the bacteria separate the natural fibres of the biomass, biogas emerges as long molecular strands of hydrocarbon. These strands are comprised of roughly 55 per cent methane with the remaining percentage represented largely by carbon dioxide, as well as minimal amounts of trace gases such as ammonium and hydrogen sulphide.

Unlike in the case of the cow's stomach, technical processes capture the biogas generated, which prevents it from entering the atmosphere.

The energy source in biogas is methane. Once biogas is sufficiently processed to the quality and purity of natural gas it can be injected directly into the natural gas grid. The release of carbon dioxide resulting from the subsequent burning of biomethane is counterbalanced by the retrieval of carbon dioxide from the atmosphere during energy crop cultivation, thus neutralising atmospheric effects of the process as a whole.

Biomethane uses existing infrastructure.

Once they have been processed, no difference exists between the practical applications of biogas and biomethane and their fossil-based counterparts. That is, biomethane can be injected into the existing natural gas infrastructure and can also be used by conventional technical devices.

This means that many appliances used within the residential industrial or transport sectors can be powered by environmentally-friendly biomethane without having to invest substantial amounts of additional resources into the conversion of existing system technology. Thus, the financial burden placed upon the political economy by the integration of biogas and biomethane is minimal.

Biomethane demonstrates a versatility of application.

Biomethane is more flexible in its application than any other renewable source of energy. Its ability to be injected directly into the existing natural gas grid facilitates energy-efficient and cost-effective transport. This allows gas grid operators to enable consumers to make an easy transition to a renewable source of gas.

The diverse, flexible spectrum of applications in the areas of electricity generation, heat provision, and mobility creates a broad base of potential customers. Biomethane can be used to generate electricity and heating from within smaller decentralised, or large centrally-located combined heat and power plants. It can be used by heating systems with a highly efficient fuel value, and employed as a regenerative power source in gas-powered vehicles. The utilisation of biomethane as a source of energy is a crucial step toward a sustainable energy supply.

A further, younger sales path for biomethane can be found in the material use of biomethane, especially in the chemical industry. 3 per cent of the German natural gas consumption is reused for the material use for the production of synthesis gas, which again is the basis for numerous basic chemicals and chemical products. The substitution of natural gas with biomethane reduces the use of fossil materials and supports the intended change from a fossil to a bio-based industry.

Biomethane supports efficient combined heat and power systems.

Of the estimated 9,000 biogas plants in operation in Germany by the end of 2015, only a small proportion efficiently utilised the energy content of their biogas. In the majority of cases, biogas was only used for electricity production. The production of heat, which represents some two thirds of biogas energy output, remained unused due to a lack of viable heat-related applications in the site area.

The upgrading and injection of biogas into the natural gas grid allows biomethane to be brought to other areas, in which the heat generated can be used alongside the electricity generated. The heat generated from biomethane can be used for all forms of household, commercial, and industrial applications. These so-called combined heat and power systems are, from the perspective of climate protection, the most efficient applications of biogas and biomethane.

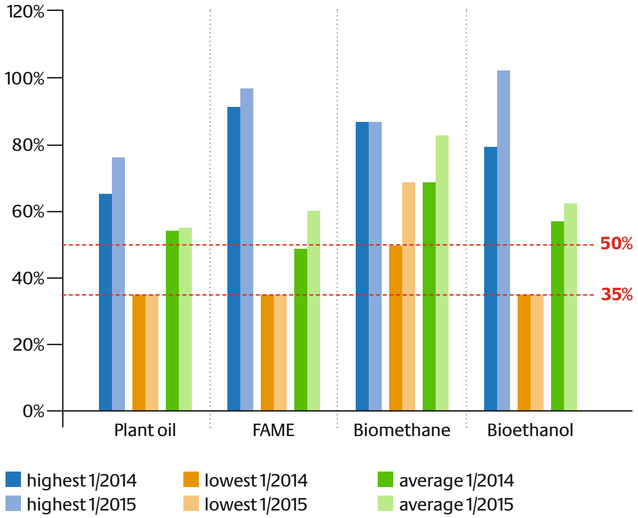
The conversion of biogas to biomethane only makes sense in cases where the plant is of a minimum size. New and existing small-scale biogas plants provide the option of transporting generated biogas, via a micro-gas grid, to a larger, more centralised location where the biogas can be processed and fed into the central grid.

Biomethane is an environmentally friendly and inexpensive biofuel.

In its upgraded form, biomethane has the same fuel characteristics as natural gas. Therefore it can be technically and harmlessly used as a pure fuel, as well as in different mix ratios.

Greenhouse gas avoidance of biofuels

from certificates of sustainability in Nabisy* public database



**Avoidance towards fossil reference value (83,8g CO2 eq/MJ) and without consideration of application (type and member country)*

In comparison to other biofuels the greenhouse gas balance of biomethane is outstanding. With the application of biomethane in the transport sector up to 90 per cent greenhouse gas emissions will be saved. Additionally, with natural gas/biomethane mobility, air emissions like nitric oxide and carbon monoxide, as well as noise emissions, are much lower than petrol and diesel vehicles. Despite the climate-saving advantages of biomethane it is sold for the same price as natural gas at petrol stations. In comparison to petrol, it is currently around 50 per cent more favourable.

Biomethane brings partners together.

In addition to fully-developed technical conceptualisations, the success of biogas injection projects heavily depends upon the development of a practical business model. Having affiliates in the related fields of agriculture, plant construction, and areas of business, such as finance and energy economics, provides an opportunity for the consolidation of expertise and capital for purposes of project realisation. This consolidation facilitates a synergistic relationship among professional actors throughout the added-value chain. These actors represent the key to further optimisation and exploitation of potential for efficiency. The participating affiliates profit from a lasting return on their investment.

The early integration of external actors such as local administrators, residents, and environmental organisations can help subjugate conflicts of interest, establish common goals, and develop comprehensive solutions. Central to this process is the exploitation of all merits of the injection of biogas in order to ensure a lasting contribution to the development of a sustainable energy system.

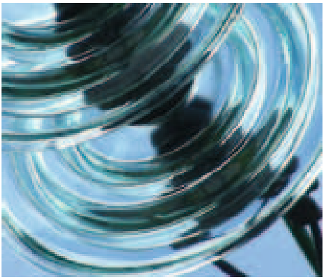
Biomethane is the smart option for the future.

In addition to current methods of biomethane generation based on anaerobic biomass digestion, other ways of biomethane production are subject to extensive research.

The acronym SNG stands for "Synthetic Natural Gas". Beside the conventional resources like coal or lignite, SNG can be obtained from biomass (bio-SNG). In contrast to biogas production from anaerobic digestion, the biomass in this case is metabolised with thermo-chemical processes. After the gasification of organic materials, the gas is converted into synthetic gas, methanised and eventually processed into its final form, in which it can also be directly injected into the natural gas grid. In contrast to anaerobic digestion, bio-SNG primarily employs wood and other solid forms of biomass such as miscanthus or straw.

Yet another interesting option is the "power to gas" concept. This turns renewable power from wind or photovoltaic plants into gas. Hydrogen is produced from excess power with the help of water electrolysis. The hydrogen can then in part be directly injected into the natural gas grid or can be further converted into synthetic gas. In case of a higher power demand, the gas thus stored in the natural gas grid can again be converted into electricity. Or it can be used for heat generation or as fuel. Hydrogen can also be used for industrial purposes. Thus, "power to gas" links both our power and gas infrastructure.

The parallel use of these methods for biomethane productions presents an interesting option for the future. The combination allows all possible raw organic and waste materials as well as wind and solar power to be efficiently converted into a natural gas substitute which can be used in the gas grid. The current generation of biomethane based on anaerobic digestion therefore, the first step toward developing a comprehensive strategy for climate friendly, renewable gas injection. This strategy will allow renewable methane to play a central role in a sustainable energy system.



The “biogaspartner” project.

The Deutsche Energie-Agentur (dena) – the German Energy Agency – has worked together with its business affiliates to develop the “biogaspartner” project. The scope of the project involves the bringing together of market actors from across the value chain for biogas injection. The dena’s role is to act as a neutral moderator, responsible for creating a platform for the acquisition and filtration of information concerning biomethane. This includes the national and international dissemination of information to relevant actors. The project’s market-oriented approach aligns with the market actors’ goal of establishing biogas injection into the natural gas grid as a component of the future energy mix. For more information visit www.biogaspartner.com.

www.biogaspartner.com
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The project is supported by the following partners:

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- BMF HAASE Energietechnik
- bmp greengas GmbH
- BORSIG Membrane Technology GmbH
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- DBFZ gGmbH
- DLG e. V.
- DVGW e. V.
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The platform for biogas grid injection:
www.biogaspartner.com

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