

State-of-the-art of biomethane production and injection into grid in the European Union

Biogas can be produced through the following routes (EurObserver, 2006):

- from natural methanisation of urban waste in rubbish dumps;
- from urban biosolids and factory effluents inside the sewage purification plant itself;
- from treatment of household refuse in solid waste methanisation units;
- from treatment of agricultural waste (liquid manures and crop harvest waste) in small single farm-scale biogas units;
- from treatment of different types of waste at the same time (principally manure and liquid manure mixed with various other organic waste) in centralised (or collective) co-digestion units, principally developed in Denmark.

Some major European Union biogas data for 2004 and 2005 are presented in table 1. Concerning the primary energy production, rubbish dumps are the most exploited deposit at present, followed by sewage purification plants, and other types of deposits. Between 2004 and 2005 primary energy production shows a growth of 15.9%, mainly thanks to production of methanisation biogas from 540.5 to 854 ktoe (+58%, agricultural biogas in particular), and rubbish dump origin biogas (+12.8%).

The gross heat production, presented in table 1, might be underestimated as a significant part of the produced heat can hardly be monitored. The production of electricity in 2005 shows an increase of 1.9 TWh, compared to 2004. This is in particular thanks to electricity resulting from landfill gas and CHP biogas resulting from small agricultural units (mainly in Germany).

Table 1 *European Union biogas data for 2004 and 2005 (EurObserver, 2006)*

	2004	2005
<i>Primary production of biogas (ktoe)</i>		
Landfill gas	2,813.8	3,172.7
Sewage sludge gas	922.9	932.4
Other biogas	540.5	854.0
Total	4,277.2	4,959.1
<i>Gross heat production from biogas (ktoe)</i>		
Heat plants only	288.4	288.2
CHP plants	112.0	135.8
Total heat	400.4	424.0
<i>Electricity production from biogas (GWh)</i>		
Electricity only plants	6,756.8	7,364.1
CHP plants	6,032.5	7,296.2
Total electricity	12,789.3	14,660.4

Some special characteristics of a number of Member States with respect to biogas production are presented below (EurObserver, 2006):

- The growth of biogas in the United Kingdom (the leading EU biogas producer) is essentially due to marked increase in electrical production from rubbish dump biogas, thanks to the green certificate system (Renewable Obligation Certificate System) set up in the UK beginning 2002.
- In Germany the growth of biogas is mainly due to increase in electricity production from small agricultural methanisation units operating in combined heat and power production, thanks to the new renewable energy law adopted in 2004. The law established an especially attractive purchase price for small electricity production plants running on

biomass (including agricultural biogas). This incentive system has favoured rapid development and expansion of small agricultural installations from 850 in 1999 to 2700 in 2005.

- France with a very high biogas potential (based on agricultural waste, solid waste, food-processing industry sewage purification plants, rubbish dumps and urban sewage purification plants) is struggling to valorise its different production sectors. While thermal valorisation of biogas depends for a large part on local outlets being located nearby, electrical valorisation is still struggling to develop because of insufficient purchase prices. This situation should evolve, thanks to a new more advantageous purchase price expected in 2007.
- In Sweden biogas is used not only in heat and electricity production, but also as a fuel for transportation. Several hundreds of buses are running already on biogas, and more than 4500 cars are using a fuel composed of a mixture of petrol and biogas or natural gas, as well as a train operating in this way since 2005. Main biogas deposits in Sweden are sewage purification plants and rubbish dumps.
- The majority of Denmark's biogas production comes from its 20 co-digestion units and its 60 small agricultural methanisation units, with the remainder coming from rubbish dumps and biosolids treatment units. Biogas CHP production is very developed in Denmark, representing more than 99% of the country's biogas origin electrical production and more than 85% of its production of heat.

The amount of land fill gas is expected to decrease significantly over time, as a result of implementing the Landfill Directive (1999/31/EC). The targets of the Landfill Directive are formulated as follows (Article 5 of the Directive):

- Not later than 16 July 2006, biodegradable municipal waste going to landfills must be reduced to 75 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available.
- Not later than 16 July 2009, biodegradable municipal waste going to landfills must be reduced to 50 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available.
- Not later than 16 July 2016, biodegradable municipal waste going to landfills must be reduced to 35 % of the total amount (by weight) of biodegradable municipal waste produced in 1995 or the latest year before 1995 for which standardised Eurostat data is available.

Reduction of biodegradable rubbish that can be dumped in landfill sites would increase the volume of the organic matter that could be used as feed stock for the production of biogas by anaerobic digestion. The organic matter already landfilled will continue to produce methane by fermentation for many years.

According to an estimation, made in the European Commission White Paper (COM(97)599), the total energy content of landfill gas and digestible agricultural wastes in the EU exceeds 80 Mtoe (3.35 EJ). The White Paper estimates the contribution that could be made by biogas exploitation by 2010 at 15 Mtoe, on condition that effective measures are in fact adopted. Although the production and application of biogas shows a considerable growth in the last years, the growth rate is still too slow to achieve the White Paper biogas objective in 2010. The communication of the European Commission on "the share of renewable energy in the EU" concludes, that biogas development requires a coordinated policy in the field of energy, environment, and agriculture (COM(2004)366).

Within the EU-Altener Project "Regulation draft of biogas commercialisation in gas grid" (BIOCOMM, 2005) a survey has been carried out of the existing European normatives (direc-

tives and papers) influencing upgrading and use of biogas, as well as of the normatives on natural gas. 17 normatives influencing upgrading and use of biogas and 18 normatives on natural gas were considered, all of which published between 1975 and 2004. Comparison of the normatives showed that (BIOCOMM, 2005):

- Non of the considered directives or papers except the EU gas directive (2003/55/EC), mentioned biogas in the internal market of gas. Through the gas directive biogas just received equal treatment, but no priority as renewable energy at the international gas grid, comparable to the priority of renewable electricity at the electrical grid¹.
- The biofuels directive (2003/30/EC) mentioned biogas under definition of biofuels.
- Biogas was not discussed within the topic of security of supply.
- Biogas and gas from biomass was not perceived at all as fully grid connected renewable energy source which could replace a high percentage of natural gas in Europe.

The BIOCOMM study mentions the following non-existing normatives with respect to biogas:

- Priority for biogas energy: There is no parallel normative to the EU renewable electricity directive EC/2001/77², benefiting the CHP-sector, the heat sector and the fuel sector.
- Harmonisation of compatibility of upgraded biogas: Normatives on compatibility for biogas and gas from biomass with natural gas, with hygienic standards for gas from anaerobic digestion as a key issue, are missing in many Member States.
- Harmonisation of compatibility of gas transfer stations: Upgraded biogas needs to be measured before injection into the gas grid³. International directives need to be applied to small producers of about 50-1500 Nm³/h.
- RES-Heat: RES-Heat technologies have a substantial potential for growth, with a high potential share of the EU's gross energy consumption. Therefore, coherent targets and policies at EU level and in each Member State are important.
- Production of energy crops: Among others: 1) modification of the "set aside" norm for making it even more influential in the development of agricultural renewable energy⁴; 2) legislation concerning biological and technical characteristics of agricultural residues for energy production.
- Objectives and criteria for biofuels: Some recommendations have been made, among others, the following measures for biogas: 1) promotion of biogas as an alternative fuel to fossil fuel; 2) R&D programmes, developing biogas technologies linked to industry and domestic use; 3) increase the available information to the citizens about biogas.

The heating and cooling sector accounts for approximately 50% of overall EU final energy consumption. However, with renewables today accounting for less than 10% of the energy consumed for heating and cooling purposes, this potential is far from being exploited. While policies and practices vary widely across the EU, there is no coordinated approach, no coherent European market for the technologies, and no consistency of support mechanisms (COM(2006)848).

¹ Regarding biogas the following has been mentioned in the Gas directive:

- Member States should ensure that, taking into account the necessary quality requirements, biogas and gas from biomass or other types of gas are granted non-discriminatory access to the gas system, provided such access is permanently compatible with the relevant technical rules and safety standards. These rules and standards should ensure, that these gases can technically and safely be injected into, and transported through the natural gas system and should also address the chemical characteristics of these gases.
- The rules established by this Directive for natural gas, including liquified natural gas (LNG), shall also apply to biogas and gas from biomass or other types of gas in so far as such gases can technically and safely be injected into, and transported through the natural gas system.

² This directive sets specific regulations as well as specific RES-E indicative targets for each EU Member State.

³ Pressure, temperature and flow have to be regulated, backflow prevented, explosion protection be observed, data be exchanged between producer and grid operator (BIOCOMM, 2005).

⁴ For example: an increase in the compensatory payments, for example, seeds used for energy production (BIOCOMM, 2005).

The recent EU renewable energy road map (COM(2006)848) indicates, that “the absence of legally binding targets for renewable energies at EU level, the relative weak EU regulatory framework for the use of renewables in the transport sector, and the complete absence of a legal framework in the heating and cooling sector, means that progress to a large extent is the result of the efforts of a few committed Member States”. The road map emphasises that there has hardly been any progress since 1990s in the use of renewable energy sources for heating and cooling.

Figure 1 presents the contribution of renewable energy (electricity, transport and heat) in Mtoe during the period 1990-2004. Based on the Directive on renewable electricity (2001/77/EC), substantial progress has been made in the electricity sector, and the targets set will almost be made. Figure 1 shows the clear growth in electricity, the recent start of solid growth in biofuels, and slow growth rates for heating and cooling (COM(2006)848).

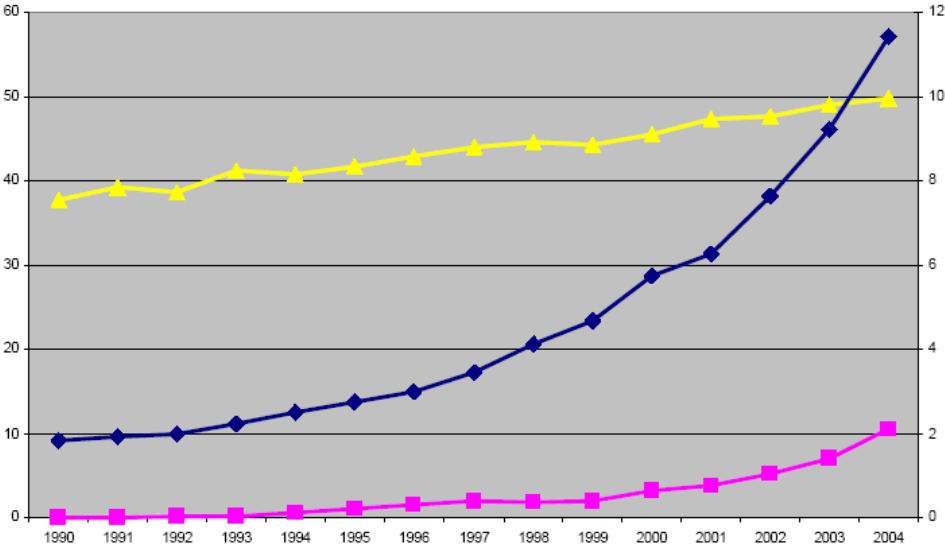


Figure 1 The contribution of renewable energy (Mtoe), electricity (blue, righthand scale, ex hydro), transport (purple, righthand scale) and heat (yellow), 1990-2004 (COM(2006)848)

The road map (COM(2006)848) sets out a long-term vision for renewable energy sources in the EU, and proposes a new legislative framework for the promotion and the use of renewable energy in the European Union. To meet the overall objective of a 20% contribution of renewable energy to the EU energy mix in 2020, the contribution from renewables in the heating and cooling sector could, according to the road map, more than double compared with the current share of 9% (COM(2006)848). Most of the growth could come from biomass and will involve more efficient household systems and highly efficient biomass-fired combined heat and power stations. The rest could come from geothermal and solar installations. As presented in figure 2, biomass with a contribution of 90 Mtoe could have a share of 75% of renewables to the heating and cooling sector in 2020.

Figure 3 presents the growth of renewable electricity and its projections by 2020. As can be seen, a contribution of 80 TWh electricity is expected to come from biogas in 2020.

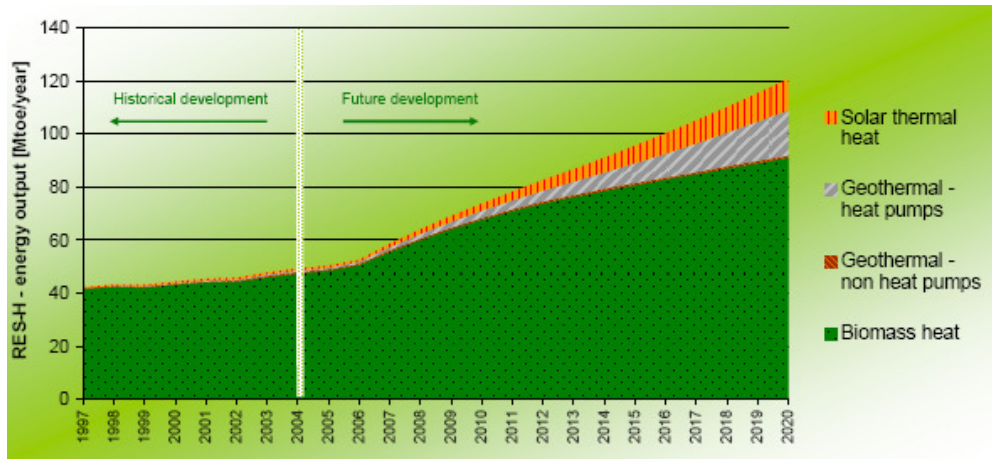


Figure 2 Renewable growth: heating and cooling projections by 2020 (COM(2006)848)

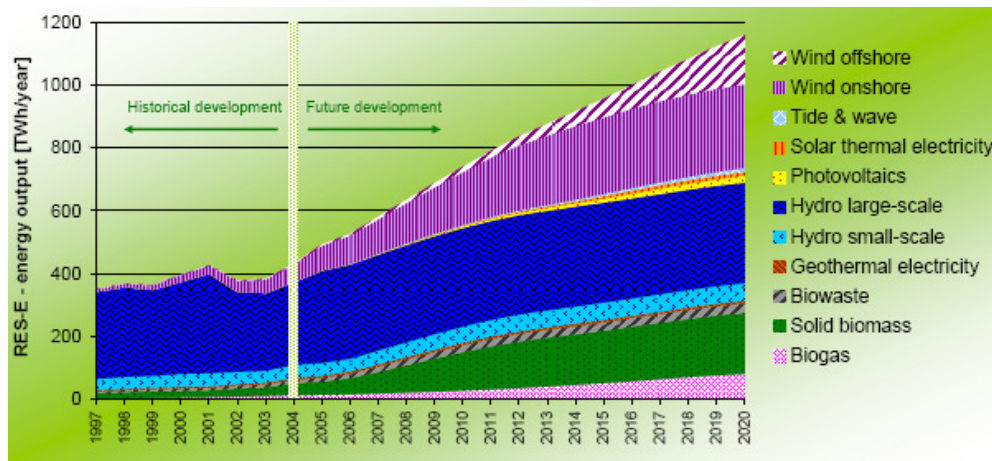


Figure 3 Renewable growth: electricity projections by 2020 (COM(2006)848)

In 2007 the Commission will propose new legislation including the necessary monitoring mechanisms for the post 2010 period, to address the barriers to growth in the use of renewable energies in the heating and cooling sector including, among others, administrative obstacles and lack of market information.

References

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