Biogas and small scale biomass heat in the Renewable Energy Action Plans

1. Introduction

This paper aims at helping Member States to finalise their national Renewable Energy Action Plans (REAP)[1].

Bioenergy will play a key role in achieving the mandatory EU target of 20% renewable energy in 2020, set by the renewable energy directive. Bioenergy currently covers more than 7% of the final energy demand in Europe and technological advancements in recent years have allowed for bioenergy to contribute to all energy sectors, being heat (both low and high temperature), electricity and transportation (bioethanol, biodiesel, biomethane, advanced biofuels from lignocellulose, etc.).

This position paper focuses on two bioenergy technologies – small scale heating (up to 100 kW) and the all-rounder biogas, which were both addressed in the AEBIOM conference dedicated to biomass in the REAPs during the sustainable energy week on 25 March in Brussels. See AEBIOM website for minutes and presentations.

2. Biogas

2.1. Why biogas

The biogas sector has seen a rapid development in recent years and continues to grow. This versatile technology allows the use of untapped raw materials, especially waste streams like manure or food waste, and opens up a wide range of applications providing energy in the heat, electricity and transport markets. Biogas can be used on site or upgraded to biomethane (natural gas quality) and used in the natural gas grid or as vehicle fuel.

Biogas advantages

- Versatile energy carrier with very favourable emissions profile
- Combined production of electricity and heat (or cold)
- Injection into the natural gas grid and storage function
- Alternative vehicle fuel which can be counted double when using waste material for the biogas production

[1] Relevant documents including the template for the REAP are available online at http://ec.europa.eu/energy/renewables/transparency_platform/transparency_platform_en.htm)

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

- Sustainable raw material for chemicals
- Great potential for use of various waste streams
- Full biomass nutrients recovery and soil improvement
- An appropriate technology to exploit energy potential from wet organic waste
- Decreased dependency on natural gas imports to Europe

2.2. Biogas target for 2020

This section refers to tables 10, 11 and 12 of the template, where the contribution of biogas to the gross final energy consumption has to be stated. In table 7 and 7a as well the contribution of raw materials for biogas production should be mentioned and a coherency/comprehensiveness is needed.

Primary production of biogas reached 7,5 Mtoe in 2008. A contribution by each member state is given by Eurobserver (annex 1). Based on the newest study of the German Biomass Research Centre, the European Biogas Association and AEBIOM the European potential for 2020 is estimated as high as 48 Mtoe (around 10% of the natural gas consumed in Europe), more than half of which is within the EU 27.

Calculation as in annex 2 and 3 give the primary biogas production, not (necessarily) the gross final energy consumption. The "value" of biogas within the REAP depends on its use, as the targets are counted in gross final energy (electricity production, transport fuels, fuels for heating). Therefore the conversion path from primary to final energy is decisive. The table below gives an overview.

Depending on the biogas route one toe biogas will count up to 4 times more to the final energy statistics. It should be noted however that the calculation methodology should not hide the importance of all energy sectors, and double counting of biogas from waste in the transport sector brings "virtual energy" in the statistics.

Table : Biogas value in the REAP

Primary energy	Conversion path	Final energy counted for the 2020 target
1 toe biogas or biomethane	Power	0,4 – 0,5 toe
	Combined heat and power	0,8 - 0,9 toe
	Heating (via natural gas grid, residential and industrial processes)	1,0 toe
	Transport fuel (energy crops)	1,0 toe
	Transport fuel (waste stream)	2,0 toe[2]

[2] see template paragraph 3.2

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

2.3. Measures to implement biogas

This section refers to table 5 of the template for REAP.

Experience has shown that the development of biogas markets requires sound and adopted strategies with regard to targeted markets, capacities and concepts. Besides the political will, sufficient, reliable and long-lasting support mechanisms are needed which allows investment security for typically 10 to 20 years. Schemes are key requirements to boost biogas markets, but also deep know-how and awareness of workload and risks on site of project implementation.

So far many European countries (most notably Germany) have introduced guaranteed feed-in tariffs for electricity for durations of 10 to 20 years. Support measures for heating (heat distributed via district heating or gas delivered to the households/enterprises via the gas grid) and transport require a different approach. The following measures should be taken into account in the REAP (Table 5 of the template):

Type of measure	why	comment
Feed-in-tariff for electricity, guaranteed grid access and other measures to stimulate the market	Long term planning security for biogas developers is crucial. It also possible to e.g. adapt feed-in tariffs to steer the development towards small or large scale plants, certain feedstock or efficiency requirement	Like other RES, biogas has long pay back periods and needs therefore security of income that warranties the bankability. Electricity from renewable sources needs free access to the grid
Access to gas grid (template paragraph 4.2.8)	In order to fully utilize the versatility of biomethane, it can be injected into the natural gas grid and used independent from the place of production	Easy access to the existing gas grid is crucial for the further development of biomethane injection, a priority access similar to the electricity regulations is required
Support for biomethane injection	Level playing field for electricity – generation (feed-in tariff) and biomethane use for injection into the gas grid or as transport fuel	Biogas might be used for electricity only if no similar support exists for biomethane injection;
Simpler and unified technical standards for biomethane	Biomethane for use as vehicle fuel or for grid-injection has to meet different criteria regarding methane content (80% to 97%), CO2 (<2% to <6%), oxygen, calorific value etc.	Too ambitious standards (sometimes higher than for natural gas) hinder the biomethane injection;
Local biogas grids for heating or transportation	Local biogas grids can transport the biogas through a separate	Existing buildings heated by natural gas are difficult to

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

	biogas or biomethane grid to the consumer (for heating purposes or gas filling station for transportation)	refurbish with alternative heating systems (e.g. solid biomass boiler); Renewable energy use in buildings is especially addressed in the template (table 6)
Expansion of district heating networks	Use the heat from biogas CHP which increases the efficiency and final energy accountable for the REAP	DH grids are very capital intensive and need public funding
Facilitate permissions for new biogas plants	Efforts should focus on communication and coordination between relevant administrative bodies for permits	Getting permits for new biogas plants is a long lasting process in all member states. Regulations are too numerous and the public misperception is the rule (misunderstanding about odors, transport, waste handling, pollution)

3. Small scale heating (SSH)

In 2007 around 6 Million dwellings (out of around 340 Mio. in the EU[3]) were equipped with solid fuel boilers and sales of solid fuel boilers were about 234.000[4]

The definition of small scale appliances can be done along the following lines:

- Maximum power output of 50 kW – this is along the lines of the LOT15-study (Solid fuel boilers) commissioned by the European Commission in the framework of the Energy Using Products-Directive.
- Usage for residential heating mainly
- Appliances are grid-independent in terms of power supply (manually stoked ovens) or dependent on electricity (automatic boilers)
- Utilization can be distinguished between primary heating for hot water and heat production and secondary heating to improve overall heating-system performance (e.g. also in passive houses)

3.1. Why small scale heat

While this form of bioenergy is well established, a new generation of pellet-, wood chip- and wood log boilers or stoves have made a big leap forward regarding energy efficiency, user friendliness and particle emission.

[3] Source: BRG Consult study on European Heating market
[4] Obernberger, 2009

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

Advantages of SSH :

- Very large market potential (40% of final energy consumption)
- Mostly use of local cheap fuels (wood logs) in addition to positive socio-economic effects of using local biomass[5]
- Possibility for automatisation with pellets and wood chips
- Room to increase efficiency (heating more households with the same amount of biomass)
- Offer possibility for individual actions/investments in favour of renewables
- Offer alternative solutions to avoid the future energy poor (those that will have much difficulties in the future to buy energy)
- Greenhouse gas mitigation (most cost efficient bioenergy path for greenhouse gas mitigation with only 6-9 €/to CO2 avoided based on the costs of federal support programmes)

3.2. Targets

This section refers to tables 11 of the template, where the contribution of solid biomass to the gross final energy consumption has to be stated.
In table 7 and 7a as well the contribution of biomass should be mentioned, including for small scale heat sector.

Biomass used by households and services is given by Eurostat (annex 3). It represents 35 Mtoe, out of 78 final energy consumption, or 45%. It is therefore essential to address this sector. An increase of 100% or more for this sector will be necessary to reach the targets. For pellet boilers and stoves a high growth rate can be expected in most countries.

The targets for 2020 can be ambitious in this sector as well because :

- Prices of oil and natural gas will probably continue their volatile price behaviour and member states should offer alternative for the consumers, keeping in mind that heat generation is by far the most important energy consumption in existing houses.
- Pellets offer more standardisation possibilities both for the fuel and for the appliances, increasing the reliability of installations. Automatisation of appliances, both stoves and boilers, are bringing a huge breakthrough and open the market to news consumers that are not linked anymore to multiple manual load every day.
- Progresses have been made in emissions of stoves and boilers regarding particulates, CO and other emissions, making biomass appliances more environmental friendly.

[5] „Socio-economic drivers in implementing bioenergy projects“; Domac, J. et. al. 2005: Biomass&Bioenergy, volume 28, issue 2, pages 95-266

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

3.3. Measures

This section refers to table 5 of the template for REAP.

Type of measure	Why	Comments
Investment support	Because investment cost for biomass boilers are significantly higher than fossil appliances.	Support should be foreseen with a medium term approach, paying attention to the available budgets of the member states.
Tax advantages or general CO_2 tax	Same reason. A general CO_2 tax will benefit all renewable energy sources.	Tax advantage is generally more stable than investment subsidy. CO_2 taxes, most notably in Sweden, have proven to be very effective.
Standardisation	It improves the reliability of the fuel / appliances	EU standards are under development (pre-standards EN 14961 will be translated soon in national law)
Communication	Information to consumers is essential. It should be objective and concrete to influence their choice of the best fitted energy system.	Information campaigns can include technologies and combi-systems (e.g. solar thermal and biomass), how to heat, maintenance and other benefits
Qualification / training	Many installers are newcomers for renewables and there is a high risk of technical problems in their learning process, leading to bad examples and bad image of bioenergy in the media.	The project Qualicert can be helpful for member states to evaluate their needs and possible measures.

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

Annex 1 : Primary production of biogas in EU in ktoe (Eurobserver, state of RES, 2009)

	2007				2008*			
	Landfill gas	Sewage sludge gas[1]	Other biogas[2]	Total	Landfill gas	Sewage sludge gas[1]	Other biogas[2]	Total
Germany	346,3	386,9	2925,9	3659,1	343,9	394,1	2937,8	3675,8
UK	1393,1	191,3	0,0	1584,4	1416,9	220,2	0,0	1637,1
France	338,5	51,8	28,6	418,9	379,3	44,2	28,5	452,0
Italy	314,7	2,1	71,1	387,9	324,7	4,2	81,1	410,0
Austria	4,8	5,8	206,3	216,9	4,8	4,8	222,8	232,4
Netherlands	48,4	47,7	79,9	176,5	44,4	48,9	132,5	225,7
Spain	116,1	49,1	27,3	192,4	157,0	19,7	26,6	203,2
Poland	21,0	43,0	0,6	64,7	34,2	95,0	2,6	131,7
Sweden	24,9	52,5	19,1	96,5	23,0	57,3	22,8	103,0
Denmark	7,2	20,7	65,6	93,5	6,4	20,2	67,2	93,8
Czech Rep.	31,0	31,1	14,1	76,2	29,4	33,7	27,0	90,0
Belgium	48,9	4,1	26,4	79,5	46,7	7,5	33,4	87,6
Finland	27,6	12,3	1,8	41,7	30,7	11,9	2,4	45,0
Ireland	23,9	7,9	1,7	33,5	25,9	8,1	1,4	35,4
Greece	29,6	5,4	0,3	35,3	28,3	5,9	0,2	34,4
Portugal	0,0	0,0	15,8	15,8	0,0	0,0	23,0	23,0
Slovenia	7,6	0,6	3,8	11,9	8,2	3,1	2,7	14,1
Hungary	2,1	1,3	3,4	6,7	2,4	1,7	7,0	11,1
Luxembourg	0,0	0,0	9,1	9,1	0,0	0,0	10,9	10,9
Slovakia	0,2	6,8	0,5	7,5	0,2	9,5	0,6	10,3
Latvia	5,4	2,2	0,0	7,5	6,6	2,2	0,0	8,8
Lithuania	0,0	1,6	0,8	2,5	0,4	1,7	0,9	3,0
Estonia	2,8	1,4	0,0	4,2	2,0	0,9	0,0	2,8
Romania	0,0	0,0	1,3	1,3	0,0	0,0	0,6	0,6
Cyprus	0,0	0,0	0,2	0,2	0,0	0,0	0,2	0,2
Total EU	2794,5	925,3	3503,5	7223,5	2915,3	994,7	3632,1	7542,1

***** Estimation. Estimate. — 1- Urbaine et industrielle. Urban and industrial.— 2- Decentralised agricultural plants, municipal solid waste methanisation plants, centralised CHP (Combined Heat and Power) plants.
Source EurObserv'ER 2009

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

Annex 2 : Biogas potential (source : AEBIOM Biogas Roadmap, www.aebiom.org)

Origin(according to template for National Renewable Energy Action Plans)	Potential Billion m³ Biomethane	2020		
		Assumed percentage of use until 2020	Primary energy Billion m³ Biomethane	Primary energy Mtoe
Agriculture	**58,9**	**62%**	**36,4**	**31,3**
Agricultural crops directly provided for energy generation (5% of arable land; calculation in annex)	27,2	100%	27,2	23,4
Agricultural by-products / processed residues	31,7	28%	9,2	7,9
straw	10,0	5%	0,5	0,4
Manure	20,5	35%	7,2	6,0
rest (landscape management)	1,2	40%	0,5	0,4
Waste	**19,0**	**50%**	**9,5**	**8,2**
Biodegradable fraction of municipal solid waste including biowaste (biodegradable garden and park waste, food and kitchen waste from households, restaurants, caterers and retail premises, and comparable waste from food processing plants) and landfill gas	10,0	40%	4,0	3,4
Biodegradable fraction of industrial waste (including paper, cardboard, pallets)	3,0	50%	1,5	1,3
Sewage sludge	6,0	66%	4,0	3,4
Total	**77,9**	**59%**	**45,9**	**39,5**

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

Annex 3 : Calculation of Biogas potential from energy crops and manure for 2020 (FAOSTAT 2009, AEBIOM calculations)

Country	Arable land	Biogas potential from crops*	Total manure	Biogas potential from manure**	Total biogas potential
		5% land; yield 15t/ha	Cattle and pigs	35% manure used	**5% land & 35% manure**
unit	1000 ha	Mtoe	Mt	Mtoe	**Mtoe**
Austria	1382	0,30	34,0	0,13	**0,43**
Belgium	840	0,18	48,6	0,19	**0,37**
Bulgaria	3086	0,66	10,7	0,04	**0,71**
Cyprus	115	0,02	1,7	0,01	**0,03**
Czech Republic	3032	0,65	24,6	0,10	**0,75**
Denmark	2306	0,50	47,2	0,18	**0,68**
Estonia	598	0,13	4,1	0,02	**0,14**
Finland	2253	0,49	15,7	0,06	**0,55**
France	18433	3,97	299,1	1,16	**5,13**
Germany	11877	2,56	225,8	0,88	**3,43**
Greece	2548	0,55	10,5	0,04	**0,59**
Hungary	4592	0,99	17,2	0,07	**1,06**
Ireland	1060	0,23	97,2	0,38	**0,61**
Italy	7171	1,55	102,9	0,40	**1,94**
Latvia	1188	0,26	6,1	0,02	**0,28**
Lithuania	1835	0,40	13,9	0,05	**0,45**
Luxembourg	61	0,01	2,9	0,01	**0,02**
Malta	8	0,00	0,4	0,00	**0,00**
Netherlands	1059	0,23	73,7	0,29	**0,51**
Poland	12502	2,69	113,4	0,44	**3,13**
Portugal	1083	0,23	24,0	0,09	**0,33**
Romania	8553	1,84	53,8	0,21	**2,05**
Slovakia	1377	0,30	9,2	0,04	**0,33**
Slovenia	177	0,04	7,4	0,03	**0,07**
Spain	12700	2,74	138,6	0,54	**3,27**
Sweden	2643	0,57	25,0	0,10	**0,67**
United Kingdom	6085	1,31	149,3	0,58	**1,89**
EU 27	**108564**	**23,39**	**1556,9**	**6,04**	**29,43**

***see calculation example in the annex**
Approximately 5 Mio ha land in Europe

****Assumed methane content in biogas 65%; assumed yield of 20 m^3 biogas per ton of manure**

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77

Annex 4 Bioenergy balance in Europe in 2007 (in ktoe). Source : Eurostat

	Gross inland consumption of bioenergy	Final use by households/ services	Derived heat	Final energy consumption of bioenergy
EU27	98.383	34.994	7.714	77.953
Austria	4.630	1.892	552	3.912
Belgium	1.711	218	4	1.016
Bulgaria	678	624	-	677
Cyprus	13	9	-	12
Czech Republic	1.988	1.194	80	1.812
Denmark	22.102	4.968	1.130	14.120
Estonia	2.915	1.057	949	2.469
Finland	592	404	79	571
France	5.394	2.173	-	4.459
Germany	7.279	1.163	1.249	6.609
Greece	13.394	7.949	226	11.838
Hungary	1.126	772	-	1.108
Ireland	1.304	627	29	935
Italy	236	30	-	214
Latvia	4.463	1.592	230	2.712
Lithuania	765	440	135	722
Luxembourg	100	16	5	66
Malta	1.173	884	103	1.113
Netherlands			-	-
Poland	2.696	294	130	1.347
Portugal	4.732	2.871	113	4.400
Romania	3.149	1.163	-	2.883
Slovakia	3.360	2.863	18	3.277
Slovenia	9.819	957	2.630	8.864
Spain	454	326	8	438
Sweden	598	44	43	542
United Kingdom	3.710	464	-	1.835

AEBIOM - European Biomass Association, info(a)aebiom.org, Phone: +32 24 00 10 22
EBA - European Biogas Association, Stolpp(a)european-biogas.eu, Phone: +49 81 61 98 46 77