GREEN GAS GRIDS

HUNGARIAN ROADMAP

FOR THE DEVELOPMENT OF THE BIOMETHANE SECTOR

September 2013

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1. INTRODUCTION

GreenGasGrids is a 3-year European project funded by the Intelligent Energy for Europe (IEE/10/235 SI2.591589) programme with the aim to boost the European biomethane market. The project will run until mid of 2014 and is co-ordinated by the German Energy Agency dena. The project's consortium consists of 13 European partners, including national energy agencies, scientific institutions as well as industry associations involved in biomethane, natural gas and renewable energy.

The purpose of the Hungarian Roadmap is, to identify the hurdles blocking the quick dispersion of biomethane production and distribution and to briefly describe the necessary tasks to be fulfilled for the development of the Hungarian biomethane sector.

2. HISTORY OF THE HUNGARIAN BIOGAS/BIOMETHANE SECTOR

The first Hungarian biogas plant was erected in 1950-1951 at the waste water treatment facility of the capital Budapest. During the next decades a few biogas plants were built next to large animal farms with the primary goal of local energy production and treatment of animal waste. The centralized big animal husbandries were mostly dissected as a result of the political changes in 1989-1990 and the Hungarian agriculture has been characterized by much smaller farms since then. Formation of larger agricultural units began from 2000 and the first large scale agricultural biogas plant was constructed in 2002 (Fig. 1).

Figure 1. The biogas plant in Nyirbátor, N-E Hungary

Currently about 40 biogas plants are in operation and about 20-25 landfill sites and waste water treatment facilities collect and utilize landfill gas or biogas, respectively. This comprises about 1% of the biogas potential of this country.

3. USEABLE FEEDSTOCKS

The main feedstocks for biogas production by applying anaerobic digestion (AD) can be grouped into three major categories: sewage sludge, agricultural wastes and by products, and solid organic waste in landfills. The utilization of kitchen and restaurant wastes for

biogas purposes is negligible currently in Hungary due to lack of incentives and stringent regulations for the digestate as fertilizer in agriculture.

3.1 WASTE WATER SLUDGE

In the majority of the large settlements (>5,000 inhabitants) the household waste water is treated and purified by biological methods. This, however, means aerobic treatment in most cases and only about 23-25 waste water treatment facility includes anaerobic degradation (AD) of the sludge in their technologies. The communal waste water is usually concentrated by gravity or mechanical means to 5-10% organic total solid (oTS) content prior to AD. Biogas generation is carried out at mesophilic temperature. Average decomposition of the organic material is 50-60% during the 20-30 days of residence. The methane content of biogas is 60-70%. Thermal, mechanical or chemical pretreatments are usually not applied in these technologies. The waste water treatment plants equipped with AD are listed in Table 1.

Location	AD fermenter (m^3)	Electricity. (kW)
Békéscsaba	2x2000	planned
Csepel	4x9000	4,000
Debrecen	2x4500 + 6000	659
Dél-Pest	4x2600+2000	1,450
Dunakeszi	2000+2x500	only heat
Észak-Pest	2x12000	3,000
Gödöllő	2x1500	only heat
Győr	2x3750	660
Hódmezővásárhely		
Kazincbarcika	2x1500	only heat
Kecskemét	2x1350	755
Komló	2x1500	only heat
Miskolc		1,4,000
Nyíregyháza	2x2000	185
Sátoraljaújhely	2x1500	
Sopron	2x2225	370
Szeged	2x4000	660

Székesfehérvár	2x3700 + 2x1500	only heat
Szentendre	2x800	only heat
Szombathely	2x2500	2x330
Vác	3x3000	only heat
Veszprém		254
Zalaegerszeg	2x1500	80

Table 1. Biogas producing waste water treatment plants in Hungary.

The total electricity production capacity is 12,567 kW.

Biogas is typically utilized locally in combined heat and power (CHP). Both electricity and heat are used within the waste water treatment facility, only few, large plants feed extra electricity in the grid. The AD of sewage sludge is an economically feasible investment at treatment plants of >10,000 m^3/day waste water capacity.

3.2. LANDFILL

Communal solid waste of about 4.6-5 million ton is generated in Hungary annually. Most of this material is deposited in landfill sites. In addition to small, rural locations there are 80 larger regional landfill sites in the country. 20 of them collects and utilizes landfill gas, their total electrical capacity is 12.7 MW. An additional 40-50 MW capacity is unused today. It is obligatory to burn landfill gas in torches where the gas is not utilized (XLIII./2000 Law on Waste Management). Source selected household waste collection is virtually non-existing in Hungary except for a few experimental projects. Approximately 30% of the collected solid household waste is biodegradable.

Landfill gas usually contains 40-45% methane and since methane is 22-23 times stronger green-house gas than carbon dioxide for sustainable environment it is mandatory at least to burn the methane.

The XLII./2000 law also regulates the degree of lowering of the biologically degradable content of the household waste. Relative to the 1996 value, the biodegradable fraction should be decreased to 35% by 2016. Therefore less biomass for AD is expected in landfilled solid household waste, but an increase in the source selected solid waste for biogas facilities can be calculated.

Landfill gas collection and utilization sites are listed in Table 2.

Location	Year	Electric capacity (kW)
Békéscsaba	2011	750
Bicske	2010	500 → 1,000
Debrecen	2007	600
Gyál	2010	499
Hódmezővásárhely	2007	185
Kecskemét	2009	875
Kétpó (Szolnok)	2011	875
Marcali	2011	375
Miskolc	2009	500
Nagykanizsa	2011	750
Pécs	2010	500 → 875
Pusztazámor	**2008**	**→ 1,100**
Salgótarján	2011	375 → 500
Szeged	2012	150 → 1,650
Székesfehérvár	> 2011	875
Tatabánya	2011	300 → 750
Veszprém	2009	875

Table 2. Landfill gas utilization sites in Hungary. The arrows indicate planned capacities.

Note that the at the largest landfill site of Hungary (Pusztazámor, highlighted in Table 2), the utilization of landfill gas is still in the planning stage, currently the vast amount of biogas is blown away in torches. Landfill gas is seldom used for heat production because the landfill sites are usually far from the settlements. Purification of the gas to biomethane quality is possible and in principle biomethane can be fed into the natural gas grid according to the Law on Natural Gas (XLII./2003). Unfortunately, no incentive and more importantly no unequivocal regulation support biomethane feed-in in Hungary. Consequently, electricity is generated from landfill gas where it is utilized. Currently, the total capacity of landfill power is 4 MW, the estimated capacity is >>100 MW.

3.3. AGRICULTURAL WASTE AND BY-PRODUCTS

No reliable data are available about the amount of food processing waste in Hungary. Only a small fraction of this biomass ends up in the biogas reactors. Our estimation indicated that at least 100,000 thousand m^3/yr material of this kind is formed, which equals to about 25 MW electric capacity if converted to biogas. Unfortunately, the majority of this biomass is discarded in landfills, which is less efficient treatment method for this waste stream. The lack if interest is primarily due to missing incentives and/or regulations promoting the more efficient utilization of biomass.

There are some 40 biogas plants operating with agricultural materials including animal waste and energy plant biomass. Their cumulative electric capacity is 20 MW. As a comparison one has to keep in mind that the total electricity production capacity of Hungary is 9,000 MW and the average utilization is 6,000-6,500 MW.

The main substrate for the agricultural biogas plants is animal manure. The number of animals raised in Hungary is dropping radically since 1990 probably due to the fragmentation of animal farms brought about by the changes in the political and economic structure.

The major sources are summarized in Table 3.

Source	Amount of manure (m^3)	Biogas potential (m^3)	Electricity content (GWh)	Biomethane potential (m^3)
Cattle	11 106 000	379 202 500	2 009	200 977 325
Pig	7 360 000	73 600 000	390	39 08 000
Poultry	772 000	50 180 000	265	26 595 400
Slaughter house	---	100 750 000	533	53 397 500
Total		**603 732 500**	**3 199**	**319 978 225**

Table 3. Biomass sources for biogas production from animal farms

The recent trend is the centralization of the animal farms and the disappearance of the small ones, which cannot keep up with the growing market competition. The novel large animal husbandries generally produce enough manure locally to fuel 500-1,000 kW biogas plants. The manure alone would be sufficient to supply substrate for at least 200 biogas plants of 600 kW capacity.

The cultivated land area of Hungary is 4,500 000 ha. In an average year about 16.9 million tons of grains (primarily wheat and corn) is produced. More than half of this quantity is exported as raw grain. If 15% the corresponding agricultural land was used to cultivate

energy plants the food and feed needs of the country would be unaffected, Hungary just would export about one third of the grains exported now. If the biomass gained this way is used for biomethane production and therefore the country would need less natural gas import, the saving would be equal to the income from grain export. In other words, if Hungary chose the production of higher value biomethane, the same income would be generated on smaller agricultural land area relative to the current practice of exporting the raw cereal grain. The numbers are collected in Table 4.

Source	Area (ha)	Utilization (%)	Biogas potential (x 10^3 m^3)	Methane content (%)	Biomethane potential (x 10^3 m^3)
Cultivated land	4 500 000	15	5 197 500	55	2 754 675
Pasture	1 010 000	20	404 000	54	214 120
Total			**5 601 500**		**2 968 795**

Table 4. Potential utilization of agricultural land for biomethane production.

The biomass as estimated above would supply substrate for 700 biogas plants, each with 2 MW capacity.

In total the domestic biogas potential adds up to 1,600-1,700 MW, which is about one quarter of the total electricity consumption of Hungary.

It should be emphasized that in addition to biogas the biogas facility produces digestate, which is an excellent replacement of the artificial fertilizers widely used in modern agriculture. Since fertilizer manufacturing is a highly energy intensive technology, considerable amount of additional saving on imported natural gas could be achieved. Although it is frequently considered as “icing on the cake”, the potential benefits are considerable.

4. LEGAL ASPECTS AND REGULATIONS

Implementation of EU biogas related regulations in Hungary is summarized in Table 5.

As indicated in Table 5, Hungary has adopted essentially all legislative measures prescribed or recommended by the EU. Unfortunately, the picture is less favorable when the domestic regulatory system is considered. The procedure is cumbersome, slow and very bureaucratic.

EU legislation	Hungarian response
White paper on Renewable Energy Sources (1997)	Implemented in connection with the adoption of 2009/28/EC directive.
Kyoto Protocol	By ratifying the Kyoto Protocol, Hungary committed to reducing its GHG emissions by 6%. As of 2008, the emissions were 34% lower than in the base year (average of 1985-87) as the result of the decline of traditional industrial activities.
EU Commission paper on Security of Energy Supply	Implemented in Hungary by the adoption of the National Energy Strategy for 2011-2030 on the 3rd of October 2011.
EU Directive 2001/77/EC	The Energy Policy Concept (adopted by the Hungarian Parliament in order to achieve the EU-level targets) has set the aim of increasing the share of renewable to 14.9-15.9%. The National Energy Efficiency Action Plan aims to improve energy efficiency by 1% annually between 2008 and 2016.
EU Directive 2003/30/EC	Implemented in the Renewable Energy Action Plan as 10% target for the year 2020 and reflected also in the National Energy Strategy for 2030.
EU Directive 2004/8/EC	Adopted through the National Energy Strategy for 2030.
EU Directive 96/61/EC	Adopted through the National Energy Strategy for 2030.
EU Directive 2003/87/EC	Adopted as part of 2009/29/EC directive.
EU Directive 91/676/EEC	Implemented as part of the national Water Management Plan adopted on 22nd December 2009
EC Animal by-products regulation	Directive 1069/2009/EC was implemented in the national legislation as applicable guideline for the collection and treatment of animal by-products.
General EU policies and targets for biogas	The National Energy Strategy specifies the targets for biogas as 5% of all energy sources by 2020.
Best Available Techniques (BREF 96/61/EC)	Adopted through the modification of the national Law on the Protection of the Environment on the 19th of June 2001.
BAT: Intensive Rearing of Pigs and Poultry (2003)	Implemented in connection with the national harmonization of 91/630/EC directive.
BAT: Slaughterhouse and Animal By-product Industries (2005)	Implemented through the ministerial decree 77/2006. (XI.3.) as part of the modification of the national law that regulates the

	operation of slaughterhouses.
Biomass Action Plan COM 2005/728.	Implemented through the National Energy Strategy for 2030.

Table 5. Implementation of EU legislative measures in Hungary

Depending on the local conditions the future biogas operator or investor should collect 20-24 permissions from various authorities before the construction of the biogas plant starts. The procedure is time consuming and usually lasts at least twice as long as the construction and start-up of the biogas plant itself. The regulatory rules of operation, electricity feed-in conditions and the use of digestate as fertilizer are likewise complicated and scare the potential biogas owner away from business. Recently, the global financial crisis made bank loan conditions strict.

5. RESEARCH AND TECHNOLOGY DEVELOPMENT

At Hungary in several institutions research activities are found on the field of biogas production. The key organizations are the following:

- University of Szeged
- University of Miskolc
- University of Szent István
- University of West-Hungary
- University Collage of Nyíregyháza

5.1. UNIVERSITY OF SZEGED

The team working at the Biotechnology Department, University of Szeged is one of the leading research establishments for bioenergy in Hungary. They have developed several patented innovations in the field of biogas and biohydrogen production from secondary substrates, organic waste and more than 200 publications in international scientific journals. The Szeged team took part in several domestic and international research and development projects and provides biotechnological service for domestic and foreign biogas plants. The team has wide experience in the biotechnological aspects of biowaste utilization, bioenergy generation and in fermentation, bioremediation technologies in general.

The team includes a large number of young scientists, some of them are working for their diploma work, others are PhD students or postdocs. The Department has established an

infrastructure that allows the training of the young experts at high international standards outstanding level. Custom designed AD reactors of 5 and 50 liter size, fully equipped and automated and analytical tools (GC, GC-MS, HPLC, PCR, Q-PCR, element analysis, DNA sequencing, anaerobic workplace, etc.) complement the facility. The laboratory has direct access to scale-up AD digesters of 50 m^3 size and collaborate with the 1 MWe biogas plant "Zoldforrás" outside Szeged.

5.2. UNIVERSITY OF MISKOLC

The Petroleum and Natural Gas Institute (KFGI, using the Hungarian abbreviation) of the University of Miskolc has been continuously involved in research aimed at the utilization of renewable energy sources, particularly biogas, since 2004, the results of which have been gradually introduced into undergraduate and postgraduate academic programmes. Realizing the research and development possibilities in combining renewable energy sources, particularly biogas, and natural gas, KFGI started three research projects related to the topic in 2004.

5.3. SZENT ISTVÁN UNIVERSITY

The biofermentation laboratory of the Szent István University is requested to be a field of effective bioethanol and biogas researches. Above the laboratory size, a plant size model of measuring system is in service for fermentation and distillation researches. A new unique measuring system with 1 m^3 capacity was installed in Gödöllő at the Institute of Ministry of Agriculture and Rural Development. The system is suitable for both biogas or bioethanol experiments.

5.4. UNIVERSITY OF WEST-HUNGARY

As a result of the teamwork of three Faculty of University of West Hungary and its' 16 industrial partners the Cooperation Research Center started its' activity in 1st January, 2005.

The activity of the University is related to the previously supported projects: there are three main fields of the activities (Environmental analyses, Waste handling and –recycling, Eco-energetic) based on the University human sources and experiences of its' industrial partners. The eco-energetic topic contains four main fields.

5.5. EXAMPLES OF RESEARCH ACTIVITIES

There are relatively few laboratories specialized in biogas technological development in Hungary. The research activity is guided by the needs of biogas plants. University of West Hungary studies the fermentability of sugar-beet slices, the by-product of the sugar refineries, the input biomass mixture is optimized and analytical measurements are performed. Szent István University of Gödöllő has built a bioreactor to model the biogas and bioethanol production at laboratory scale. Their primary interest is optimization of the concerted performance of the two technologies. A mobile anaerobic reactor was constructed at the College of Nyíregyháza for on-site determination of the best substrate composition. Laboratory scale continuously stirred and fed biogas reactors were designed and build (15 of 5 liters capacity and 4 of 50 liters capacity) at the University of Szeged. AS a result of some 30 years of research considerable experience has accumulated in Szeged concerning the biotechnology of anaerobic degradation and understanding of some aspects of the relationship among the microbes populating the AD reactor lead to several improvements and increase of efficacy of the AD process. The positive results generated industrial interest and a large scale plant (1 MWe) was built for the exploitation of the research results. The joint utilization of biogas and natural gas systems are studied at the institute of Oil and Natural Gas of University of Miskolc.

Most university laboratories offer technological services for biogas plants but only few companies make use of it. Foreign customers take advantage of the good quality but less expensive services.

6. IDENTIFICATION OF OBSTACLES AND BARRIERS

6.1. LEGAL ASPECTS

The requirements for setting up a biogas plant in Hungary cover several areas.. The major permits are listed below in bold; others are optional depending on the type and size of the plant:

- **planning permit (land use change)**
- **environmental authorisation (environmental impact assessment)**
- **digestate disposal permit**
- **building permit**
- **operational permit**
- **production permit**

- **operational permit**
- **production permit**
- **grid connection permit**
- waste management permit
- health & safety permits
- groundwater permit
- technical project plan
- storage permits
- fire & safety license
- geodetic license
- architectural heritage permission
- installation permit
- start-up license
- distribution permit
- usage permit
- green certificates
- water connection license
- safety report

The legal requirements are evaluated by the Authority for Environment Protection in line with Governmental Act: 314/2005. (XII.25.). If the AD plant treats >10.000 t/yr, an Environmental Impact Assessment should be prepared. If the treated organic waste exceeds 10 t/day a Unified Environment Use permit should be applied for.
Construction of special edifice is permitted by the Hungarian Trade Licensing Office, other buildings are approved by the Municipal Notary.
The Hungarian Energy Office is authorized to issue grid connection license. Below 500 kWh_{el} the biogas producer has notification responsibility, above this limit aggregated small plant permit is necessary.
MAVIR supervises the electricity grid operation. According to the Act LXXXVI/2007 on Electrical Energy, and the corresponding Governmental decree 273/2007 (X.19.), households or small enterprises can install small scale plants up to 50 kVA (45 kW) and connect them to the public low voltage grid. Governmental decree 389/2007. (XII.23.) regulates the mandatory feed-in and subsidy for electricity generated from waste or renewable sources or

by CHP. There is an amendment to this regulation (Governmental decree 60/2008. (III.26.)). Governmental decree 382/2007. (XII.23.) on authority licensing procedures for construction of electrical facilities should be followed when the grid connection is planned. Governmental decree 289/2007. (X.31.) regulates the state subsidy of residential piped gas and district heat consumption while Governmental decree 117/2007. (XII.29.) discusses financial and technical terms and conditions of connection to the public utility electrical network.
More details are available on the website of the Hungarian Energy Office: http://www.eh.gov.hu/engedelyezes-2/engedelyezesi-es-jovahagyasi-eljaras/villamos.html

Digestate from the agricultural biogas plants is commonly applied as liquid fertilizer on fields. Regulations regarding the categorization of the digestate are not harmonized among the regions in Hungary. Therefore different local authorities may handle the same requests differently. Digestate distribution by spraying require permit from the Agricultural Office, waste handling permit is issued by the Authority of Environment Protection A peculiarity is that animal manure can be applied directly on agricultural land if not treated in a wste treatment facility of any kind, including AD rectors. Digestate, however, is considered as waste after AD and is subject of waste disposal regulations, which are stricter than those of manure disposal. A costly and time consuming land protection examination has to be carried out in authorized laboratories twice every year before spraying the digestate.
Legal backgrounds include Governmental decree 50/2001. (IV.3.) on the agricultural use of wastewater and wastewater sludge; FVM decree 36/2006. (V.18.) on the permission, storage, use and distribution of yield enhancing materials; FVM decree 59/2008. on the detailed rules of the action program for the prevention of water against nitrate contamination caused by agricultural activities; FVM decree 90/2008. on the details about creating soil protection plan; KVVM decree 23/2003. (XII. 29.) on biowaste management and the technological requirements of composting and KÖM decree 16/2001. (VI.18.) about waste registry (FVM, KVVM, and KÖM are abbreviations of various ministries).

6.2. TECHNICAL

Mostly German and Austrian biogas technology providers are present on the Hungarian biogas market. Larger companies can withstand the long project preparation period (usually 2-3 years), the rapidly changing legal background, and strict regulatory conditions.
Domestic regulations deem biomethane producers as natural gas producers with respect to the relevant sections of Gas Law (known as GET). Although biomethane injection into the natural gas grid is allowed under law, none of the AD plants implemented such activity due

to the unsettled regulations and lack of feed-in subsidy. Hungarian standard, MSZ1648 contains the most important quality parameters for natural gas, the same should be applied when biomethan is to be fed into the natural gas grid.

The low pressure natural gas network operates under 10 bar pressure. Biomethane connection and feeding-into this part of the grid is limited particularly during summer months. The pressure in the transfer network is >10 bar. Biomethane could be fed into these sections, but the technical implementation is more expensive, the operational costs are higher than that of the low pressure distribution network.

Studies on the profitability of biomethane use in public transport pointed out one of the main barriers, i.e. none of the fuel distribution companies or natural gas providers assume responsibility for the development of the filling station network. Biofuel utilization of biomethane is therefore unlikely in Hungary in the immediate future.

6.3 ECONOMIC

The main economic barrier is the low and unsecure feed-in tariffs for green electricity relative to most EU countries and even non-EU member neighbouring Serbia.

The Hungarian scheme does not provide additional premiums or technology specific bonuses, but differentiates the subsidy depending on the season and daytime. The Hungarian Government decided to implement a new feed-in tariff system in 2010 and the old one was suspended. By 2013 the new subsidy system has not been developed, published and enforced. The status of uncertainty generates increasing reluctance among potential investors and operators of renewable energy production facilities. Those renewable energy producers who still receives subsidy for feeding-in green electricity receive this income depending on the time of the day when they supply energy to the grid. Peak, valley and deep-valley hours are defined for regular working days, valley and deep-valley sections are recognized for week-ends an holidays. Green electricity generating facilities of smaller than 20 MW capacity received in 2011 11 €/MWh in peak, 10 €/MWh in valley and 4 €/MWh in deep-valley periods, respectively. The subsidy system is not favourable for biogas plants where energy production is stable and balanced during the day. The problem can be solved by installing extra gas storage capacity, which increases investment costs.

Nearly 90% of Hungarian agricultural holdings have a size of less than 5 hectares and biogas production on a very small farm scale is economically not feasible.

The lack of investment money is also a strong barrier. Biogas plant return of investment is between 6 and 7 years with state support of initial construction and 8-9 years without. The

non-existing support for biomethane injection into the natural gas grid inhibits biomethane utilization.

6.4. SOCIAL

The environmental and social benefits of biogas are not adequately articulated in the media. The general population has limited knowledge about the renewable energies, most people develop indifferent attitude toward this topic. Biogas plants were built without confrontation and the acceptance of these facilities has been positive or neutral by the people living nearby.

„Green investments" including biogas plants generally receive positive responses although awareness and dissemination of the relevant information is needed. The interest expressed by the high number of participants at the GreenGasGrid 1st National Info Day and at similar conferences organized regularly by the Hungarian Biogas Association also indicates that information diffusion is an important task for the future.

7. IDENTIFICATION OF POSITIVE ASPECTS

7.1. LEGAL

For Hungary, where natural gas has the biggest share in the energy consumption mix (44%) and up to 80% of it is imported, substitution a fraction of natural gas by domestically produced biogas is particularly appealing. The Hungarian National Renewable Energy Strategy (RES) therefore places special emphasis on promoting biogas production and use. Although currently available technologies do not allow biogas to compete economically with natural gas there is an expressed intention to promote renewables including biogas. Biomethane is not fully in the decision makers' considerations yet, but the Hungarian Gas Vehicle Association, together with the Hungarian Biogas association is pressing the relevant issues strongly.

7.2. TECHNICAL

The strict system of installation and operational permits leaves room only for up-to-date and efficient biogas plants.

7.3. ECONOMIC

The average costs for biogas plant construction is 350 000 Euro / 100 kWh - including planning, permissions, technology.

Subsidy for biogas plant construction can be received from two major EU sources:

KEOP – Environment and Energy Operative Programme

As part of the action plan 2011-2013, KEOP-4.4.0 is available for proposals in renewable energy based electric, combined heat/electric and biomethane generation/production.

The maximum, non-refundable support is 70% - from 1 million to 1 000 million HUF.

Note: it is suspended; new supporting methods are under preparation.

ÚMVP – New Hungary Rural Development Programme

The total of 200 000 million HUF is available for proposals in rural development including farms.

Note: it is suspended; new supporting methods are under preparation.

7.4. SOCIAL

The average Hungarian citizen has little knowledge and low level of awareness about renewable energies. The Hungarian Biogas Association initiated a nationwide campain ”Biogas is the Green Ace”. Groups and school classes of 12-14 year old kids participated and learned about the benefits. The response was overwhelming, their relatives and even some of the teachers became acquainted with the basics and local media broadcasted programs on biogas. More programs of this kind are needed with media participation.

8. SUMMARY

Hungary depends on imported energy carriers. The most widely used fossil energy carrier in natural gas. The country produces vast amount of organic wastes and agricultural by-products relative to her size. There is a remarkably strong and successful research and development biogas related activity in Hungary. All these aspects are almost ideal for a strong biogas industry and various uses of this renewable energy carrier.

Unfortunately, this is not the case yet although progress from a practically non-existant biogas industry in 2000 to about 40 agricultural large scale plants together with the waste water sewage and landfill sites may be considered significant.

Rapid growth of biogas industry is hampered primarily by the implementation of straightforward and supportive legislation. There are too many and sometimes inconsistent regulations in effect, the regulatory measures change hastily and agencies supervising biogas industry are numerous and their actions are frequently uncoordinated. This scares away investors and set hurdles for biogas plant operators. The feed-in tariff system did not favour renewables and biogas earlier and it is idling for the past 3 years.

The result is that biogas industry in general and biomethane production in particular are in their infancy in Hungary. Important legislative measures, regulations, incentives are missing. The country has very well developed natural gas distribution grid. Technical standards for biomethane injection to the grid are to be developed.

The interest and the awareness level of the general public are low in renewables and biogas. This should be elevated in order to gain more widespread public support for the implementation of the relevant technologies.