

Development of sustainable heat markets for biogas plants in Europe

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Updated report on national policy enforcement for heat use from biogas in Austria, Croatia, Czech Republic, Denmark, Germany, Italy, Latvia and Romania

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1 Introduction

The EU member states have set the targets for biogas development until 2020 in their National Renewable Energy Action plans. However, the focus in biogas production lies on the electricity production and use of heat from biogas CHP plants is often not considered. This inefficiency in energy use creates a bottleneck in current biogas production, causing macroeconomic and microeconomic losses.

Economic and ecological optimisation of the biogas plants is the main driver for heat utilisation concepts. A broad variety of heat utilisation concepts exist and can be successfully applied in many biogas plants depending on their location and the location of the potential heat customers. Examples for heat concepts include the use of heat for heating and cooling, drying or for additional electricity production. Even though there are many good practise examples of heat utilisation from biogas plants, there is a lack of broad implementation of heat utilisation concepts in many countries.

The initial report was elaborated in the framework of the BiogasHeat project and contains the identification of main bottlenecks as well as solutions to tackle these bottlenecks in 8 European countries (Austria, Croatia, Czech Republic, Denmark, Germany, Italy, Latvia and Romania). It was updated in April 2015 to show developments in policy enforcement in the various project countries.

2 Heat utilisation in Austria

In the year 2011 about 520 GWh electric power from biogas were fed into the Austrian power grid. By this time 288 biogas plants were operating (having a contract with OeMAG) with a maximum capacity of 80 MW (<http://www.oem-ag.at/de>). According to calculations done by e7 and ARGE Kompost & Biogas the heat use potential accounted for approximately 530 GWh_{th} in 2011. According to the Federal Ministry for Agriculture possible biogas potential until 2020 is about 21 PJ or 6,000 GWh final energy. Despite the comprehensive Austrian regulatory framework the majority of biogas plant operators face financial difficulties. Therefore, various forms of heat use are essential in order to increase revenues from combined heat and power production.

In the early 1990's, only a few biogas plants were operating. In 2002 the Green Electricity Bill (Ökostromgesetz - ÖSG) was passed. This led to an investment boom in the biogas market. In 2006 the ÖSG 2002 was amended, which nearly resulted in an investment stop due to the cut of feed-in tariffs and contract periods. The ÖSG 2006 was amended in 2009. Among other changes, a minimum efficiency ("Brennstoffnutzungsgrad" according to ÖSVÖ 2012, § 2 Abs. 1) of 60% for biogas facilities was introduced in order to enhance CHP-capacities. Only sites achieving this threshold are allowed to apply for the state regulated and annually adopted electric power feed-in tariffs. However, in 2012 the new ÖSG was implemented. Until 2020 the development of additional 1,300 GWh (200 MW installed electric capacity) from biomass and biogas is aimed if enough substrates are verifiable.

Currently, feed-in tariffs for electric power range between 12.93 Cent/kWh (capacity > 750 kW) and 19.5 Cent/kWh (capacity < 250 kW). According to ÖSET-VO (2012), by expiry of the contract period tariffs are cut down (towards 9.95 Cent/kWh). Furthermore, Austria guarantees a CHP-bonus of 2 Cent/kWh for electricity produced in efficient CHP unit if the efficiency factor is at least 0.6 (according to "KWK-Gesetz", § 8 Abs. 2). Also extra money for operating costs (max, 4 Cent/kWh) was granted in order to reduce cost pressure (substrate costs and operating costs).

On behalf of the Austrian Federal Government the company Kommunalkredit Public Consulting (<http://www.umweltfoerderung.at>) grants subsidies for various investments (environmental support) for heat. Private persons, municipalities and companies are allowed to apply for the Umweltförderung Inland (UFI). The following subsidies are of interest for biogas plant operators: connection to district heating grid; production of biogenous fuel; energy efficiency advisory on farms.

Heat utilisation potential from biogas plants is high. Therefore the focus should be given to combined heat and power production in existing biogas plants. For existing biogas plants the business model of district heating is very well developed. Distances to district heating networks increase. Further potential lies with various forms of drying. Also the construction of local biogas grids can be seen as a chance in future. Existing investment subsidies in heat use should be maintained, however, more funds in research (technique and heat use models) and innovation (demonstration projects; market launch initiatives) should be available. Also funds for training are needed. With respect to feed-in tariffs Austria strongly focused on power production. Thus follow-up policies represent the main bottleneck in the biogas market. Proper tariffs lead to planning reliability and enhance further investments.

Also the advancement of the CHP-bonus could be considered. CHP-bonus could increase in line with rising efficiency. This would deliver an additional incentive to implement a strong heat use concept. Economic proven heat use concepts could be gathered in order to come up with a positive list. In addition, further research and communication efforts should be done. Also the role of banks is fundamental as they provide urgently needed liquidity. However, banks are very reluctant nowadays. A strong commitment from banks and politics together is crucial to revitalise the Austrian biogas market. Nevertheless, injection of biomethane into the natural gas grid is a further potential business model of biogas which should be developed.

Legislative developments until the end of the project

The current legal basis sets the Green Electricity Bill from the year 2012 (Ökostromgesetz 2012), as well as the enactment on green feed-in tariffs from the year 2012 (Ökostrom-Einspeisetarifverordnung 2012) and the CHP-Bill from the year 2008 (KWKG-Gesetz 2008). Since then, there were no changes according to the legal framework conditions with respect to

1. green feed-in tariffs,
2. CHP-bonus and
3. other premiums.

For this reason a sectoral update can be found with respect to

1. Extension of run-times of green feed-in tariffs

After reconciliation with DG COMP there were several follow-up meetings with the ministry. The Austrian Biogas Association (ARGE Kompost & Biogas) strives towards a formulation of competitive implementation variants. The package of measures is not known yet as the package is subject to legal consideration currently. (Source: ARGE Kompost & Biogas, Mitgliederinfo 2014 07)

2. Follow-up tariffs

The Green Electricity Bill 2012 provides an annual contingent of 10 Mio. EUR for solid biomass and biogas (thereof 3 Mio. EUR are committed to solid biomass < 500 kW_{el}). It can be assumed that every biogas plant operator wonders about their economic situation in future. When and to which conditions the biogas-specific measures according to the governmental program will come into action is not known. The application for follow-up tariffs according to § 17 Ökostromgesetz 2012 should be also considered. (Source: ARGE Kompost & Biogas, Mitgliederinfo 2014 06)

3 Heat utilisation in Croatia

Croatian legal framework that describes utilisation of energy from biogas is not sufficiently elaborated to allow maximal utilisation of biogas primary energy. Biogas is expressed at some 40 legal documents that could be arranged in three main categories: energy, agriculture and environmental protection. Within energy policy, biogas is described as one of RES while in other policies, biogas is positioned as a tool for achieving some specific goal of agriculture policy (e.g. a rural development measure) and environmental policy (e.g. a GHG emissions saving tool, agriculture pollution prevention measure).

One of the most important bottlenecks for Croatian biogas market development in general is lack of knowledge within responsible bodies on biogas versatile properties. Currently, biogas production has two mutually exclusive incentives: feed-in tariff for RES-E from biogas (set of laws from energy, since 2007) and 50% grant in investment for building and/or reconstruction of a biogas plant (set of laws from agriculture). Law on RES-H is pending since 2008.

In the Energy Sector Development Strategy, biogas potential is under-estimated as it is based on manure monodigestion of 20% total livestock units. Final version of NREAP is missing which should precise what desirable forms of biogas useful energy are, including biogas heat.

Croatian biogas market is an emerging market with nine operating plants (8.135 MW) and 45 pending projects (~70 MW). All biogas produced is aimed at CHP engines as RES-E feed-in tariff is the only incentive for energy from biogas. Most of the existing plants (66%) include heat utilisation in the on-farm production process (heating the greenhouses, poultry houses, or pig stables). This fact leads to the wrong impression that biogas heat utilisation concept is well developed in Croatia. The reality could be not further from the truth as very few of 45 pending projects have investigated heat utilisation and heat utilisation options are rather limited. Since mid. 2012, the new feed-in tariff mandates minimal overall efficiency of 50% for a biogas plant to be eligible for incentive purchasing price of electricity. So far, only one biogas plant has met the condition.

Given the Croatian biogas market state-of-the-art and biogas features in general, the identified bottlenecks with the emphasis on heat energy in the legal framework are:

- Lack of knowledge in different useful energy forms that biogas could provide among decision-, policy-, strategy- and legal framework-makers
- Lack of communication among legal bodies and authorities which ends up with lack of coordination in benefiting from side-effects of biogas production (GHG savings emission tool; rural development measure; soil, water and air pollution prevention tool)
- Inertia among national energy companies in accepting more convenient and environmentally friendlier fuels beyond conventional fossil sources
- Lack of incentives for utilisation of RES-H in general, including biogas
- Lack of knowledge among investors/developers of biogas projects on possibilities of heat energy from biogas CHPs
- Investment in biogas plant is not feasible to most of Croatian farmers and most of investors in biogas plants originate from non-agriculture sector
- Heat utilisation asks for an additional investment
- Lack of transparency in the existing legislation related to the RES-E feed-in tariff regulations where it is not clearly specified how to implement mandated >50% of overall CHP efficiency
- Missing implementation parts in legal framework that describes district heating that would facilitate local governments to decide upon development of local heating grids (3rd phase of District Heating Development Strategy of Republic of Croatia)
- Underutilised power of business community in communicating practical experiences gained while implementing a biogas projects to the responsible bodies.

Suggestions for better utilisation of heat energy from biogas and corresponding effects are listed below:

- Deliver the Law on RES-H incentives together with corresponding implementation acts and measures or other equivalent legal document that will define RES-H utilisation (Renewable Energy Action Plan, Law on RES etc.)
- Finalise 3rd phase of District Heating Development Strategy of Republic of Croatia which will enable development of district heating sector
- Providing incentive scheme that will guide small biogas plants towards CHP and large biogas plants towards biomethane production in order to maximise energy yield from biogas.

Legislative developments until the end of the project

Since the first Report on “National policy enforcement for heat use from biogas” in 2013, several crucial changes occurred in Croatian framework that affect directly or indirectly biogas heat use.

On 1st July 2013, Croatia became the 28th EU member state which changed the background of legal and regulatory aspects: pre-accession funds become accession funds, National Renewable Energy Plan has been adopted...In legislative part, several big changes happen that determine policy and rules for development of renewable energy market, heat market, rural development and, consequently, biogas heat use.

Law on Renewable Energy Sources (RES) has been pending for adoption for about two years and its current form is unknown. Its intention is to define not only all RES but also all useful energy from RES. A presentation from Croatian Energy Market Regulator (HROTE) announced that current feed-in system will be changed to market premiums. There are speculations that public discussion will be sometimes between end March – early April 2015 but this has not an official confirmation.

A Heat Market Law adopted in mid-2013 introduced significant innovations in the District Heating sector in terms of planning, organisation and functioning. The main goals of the new act are to create conditions for the safe and reliable delivery of heat, market development, the protection of end-customers, heat price competitiveness, efficient production and use of heat, and to minimise negative impacts on the environment and sustainable development, in line with EU rules. The impact of this act on the biogas sector is difficult to foresee due to its complexity. The potential for implementation of biogas heat unquestionably exists, but how it will take off remains to be seen in the years to come.

Croatia became eligible for using the European Agricultural Fund for Rural Development – EAFRD which is a positive change in biogas heat use. Namely, although the Rural Development Program for Croatia 2014 – 2020 is still in a form of draft, there are direct and indirect options to facilitate biogas heat use. Direct measures are investments in on-farm biogas production and use. Indirect measures are even more appealing as they support use of heat from biogas cogeneration plants where heat represents „waste“. Those measures are investments in either building or equipment or infrastructure that are related to heating of agricultural facilities plus investments in agricultural processes that require heat: drying, greenhouses, mushrooming... In addition, there are measures that co-finance manure and digestate management.

Due to pending Law on RES, little effort has been made in removing the most important barrier that was highlighted two years ago: insufficient description of total efficiency of a biogas cogeneration plant (mandatory heat use). Proposed measures that refer to Positive list from German EEG (2012) were positively accepted by regulators but system support remained absent. It is expected that pending Law on RES will continue in support of high-efficient cogenerations and mandate heat use from cogeneration plants on biogas but the form of this mandate remains uncertain.

Biogas heat use among 13 operational biogas cogeneration plants is high but the planned heat use among 65 pending projects in the Registry of RES and Cogeneration is as little as 3% or mere 3 MW, in comparison to 64 MW electricity. Description of heat use from biogas plants in the pending Law on RES remains unknown.

From the originally proposed measures, a positive development has been made, although it remains to be partial. All originally proposed measures to improve heat use from biogas in Croatia remain actual.

However, this document highlights three vital prerequisites:

- Creation of stable investment framework for biogas production
- Explicit and overall legal description with corresponding implementation acts
- Establishment of on-field control institution such as verifier described in EEG (2012) that would support work of HERA (Croatian Energy Regulatory Agency), prevent eventual misuse and provide first-hand experience on barriers/failures of existing legislation with proposals how to remove them.

Continuing on the highlights vital prerequisites, EIHP proposes three priorities for future biogas heat use:

1. Setting the Public Discussion on Law on RES as soon as possible with sufficient time to provide quality remarks on the content with the aim of both efficient and optimal use of energy from biogas
2. Cooperation creation and its maintenance among ministries, involved institutions and business community
3. Establishing of control institution – energy verifier.

4 Heat utilisation in the Czech Republic

About 300 agricultural biogas plants have been installed in the Czech Republic in the last 10 years with a total installed electric capacity close to 200 MW. The Act on the support of electricity from RES was adopted in 2005 with the objective to reach the target for the share of RES-E in 2010, without regard on cost optimisation and with no requirements on energy efficiency. Thanks to relatively high feed-in tariffs for electricity and thanks to investment subsidies most of the biogas plants were designed only for the production of power, whereas the available heat is wasted into atmosphere.

In May 2012 a new Act on the supported sources was adopted which introduced a number of changes enabling a more flexible control of future development of individual RES branches and meeting the countries RES goal for 2020 in the least cost way. For biogas plants the law introduced new requirements on sustainability (at least 30% of biogas should be produced from substrates other than from arable land and permanent pastures) and on energy efficiency (at least 50% of energy in substrates should be utilised). These positive features will be come into force after 24 months from the adoption of the law, which is mid. 2014.

The actual tariffs are determined by the Energy Regulatory Office (ERO). For new sources put in operation in 2012 ERO introduced a requirement (as a precondition needed for granting the most favourable tariff) requesting that the plant should supply useful heat corresponding to at least 10% of net electricity produced. The tariff for new plants put in operation in 2013 (according to the draft Decision published by end of October 2012) takes a different approach. New tariffs are significantly lower and the difference (compared to current prices) is partially compensated by a special CHP bonus. The new secondary legislation describing in detail the determination of CHP electricity entitled to the support is also in preparation. The draft version of this legislation however does not specify clearly what types of heat use will be regarded as suitable for the biogas plants.

The following clarifications should be added to the legislation:

- The Decree on CHP should comprise the definitions of “useful heat” and “economically justifiable demand” in the way these terms have been specified in the EU Directive on Energy Efficiency
- The suitable types of heat use for biogas plants should be defined by means of a positive and a negative list. As an example may be used the German law on RES (EEG 2012) with the following exceptions:
 - a. Drying of digestate might be considered in the positive list only in a limited extent and only for the production of solid biofuels. Production of dried digestate as fertiliser on the other hand is not a reasonable option
 - b. Input heat for additional power production by technologies such as ORC is not considered as eligible heat use corresponding to CHP – it is in fact just an improvement of the overall electric efficiency of the plant
- Create incentives for modifications of existing projects

The following legislative measures could help converting existing projects towards higher energy efficiency:

- Granting CHP bonus also to existing projects. This would be a simple and effective measure, but the ERO opposes saying that existing projects benefit already enough from existing high electricity tariff and in some cases from investment subsidies
- Granting the continuation of the existing feed-in tariff if the CHP unit is moved to a new location, closer to heat demand. Current legislation would regard this case as a new installation, leading to a significantly lower tariff. This option looks promising, but the technical details have to be clarified (such as how to treat a possible extension of the total capacity, if an additional small CHP unit to cover the self-consumption of the biogas plant has been added).

The new requirements for granting operational support for electricity from biogas plants are heading in the right direction so as to stop wasting the heat produced. However, actual detailed rules specifying which types of heat will be eligible have to be clarified. Also creating incentives for existing plants is very important.

Legislative developments until the end of the project

The Czech RE legislation went through significant changes in the course of the BiogasHeat project duration.

A new Act "On public support of supported energy sources" (No. 165/2012) has set correct requirements for new biogas plants (regarding energy efficiency and substrate types) as a precondition for operational subsidy for RE-electricity, however after one year this support has been stopped by an amendment adopted in late 2013. New biogas plants put in operation since 2014 can receive only CHP bonuses if they provide useful heat; this support is however insufficient for economic feasibility and so no new biogas plants have been built after 2013. New heat supply projects from existing plants have to be based just on market prices – the capital costs have to be covered by revenues from heat sales, which have to compete with existing mainly fossil fuels of these potential customers.

A certain improvement of conditions for implementation of heat supply project should bring new operational programmes funded by EU, which will start later in 2015. The following three programmes can be mentioned:

- Rural development programme (organised by ministry of agriculture),
- Environmental programme (by ministry of environment) and
- Programme Enterprise and Innovations for Competitiveness (by ministry of industry and trade).

These programmes will provide investment subsidies for projects utilising waste and for energy efficient sources and thanks to this, potential investors could offer heat from biogas plants at competitive prices.

BiogasHeat project during its course actively participated in the formation and adjustment of Czech legislation in favour of utilisation of heat from biogas plants and also showed a number of concrete examples of such solutions.

5 Heat utilisation in Denmark

In general there is a good utilisation of heat from Danish biogas plants. This is due to a number of climatic, technical and fiscal factors. There is a strong tradition in Denmark for district heating, even in rather small villages, and these district heating grids are well suited for distribution of heat from biogas plants.

On the centralised biogas plants (CBP) the heat production (apart from the process heat) is distributed in district heating grids, and almost no heat is lost.

On farm biogas plants (FBP) the heat production is used for heating the house and stables in pig farms. In the summertime however, there is often a heat surplus which is cooled in emergency coolers in order to maintain the electricity production.

The legislation for the establishing and operation of biogas plants in Denmark is well developed. This also goes for the utilisation of heat from the plants. Furthermore there is a strong desire among Danish politicians to promote biogas, which is reflected in the "Energy Agreement" signed by most parties in the Danish Parliament in March 2012.

There are however challenges and potential for even better utilisation of the heat:

- On FBPs, especially cattle farms, there is a heat surplus in the summer period, which should be utilised
- There is often strong local resistance against having a new CBP near a village; as a consequence new plants may be located far away from villages with district heating grids
- Utilisation of heat for industrial purposes is often not economically attractive because of the Danish energy taxation system.

To improve the utilisation of heat from Danish biogas plants, the following measures are proposed:

- New biogas plants near villages not having a district heating grid yet
- Substitute natural gas with biogas on existing CHP plants
- Selling heat to existing (larger) district heating grids
- Gas transmission pipes from FGPs to CHP plants in villages
- Selling heat from FGPs to neighbor houses, especially institutions with larger heat consumption could be interesting
- Utilisation of surplus heat from FGPs for process heating, for example grain drying, volume reduction of slurry etc.
- Upgrading and injection of biogas into the natural gas grid; the biogas could then be "taken out" at another point on the grid for cogeneration or other purposes (this concept is known from the wind energy sector in Denmark, where electricity from wind turbines is fed into the grid and "taken out" at another point as wind electricity, even though it is of course mixed up with conventional electricity).

Legislative developments until the end of the project

Through the Energy Agreement in 2012 (parliament decision) a "Biogas Task Force" was established. Its work up to December 2013 was published by the Danish Energy Agency in 2014. Mainly its conclusions from January 2013 are applicable but the Biogas Task Force has some concerns regarding the role of biogas in future energy supply.

The Biogas Task Force assesses in December 2013 that "it is likely that biogas production with current conditions will be more than doubled from 4.3 PJ to about 10 PJ by 2020". This assessment is based on the approval by the Energy Agreement of increased support for the use of biogas for electricity production and upgrading, and the effects of plant grant pool under the Rural Development Programme. The Biogas Task Force, however, notes that only a limited amount of projects (1,5PJ) are in the planning phase by end of 2013 and that the assessment must therefore be regarded as uncertain.

6 Heat utilisation in Germany

There are around 7,500 operating agricultural biogas plants in Germany. Most of the biogas plants produce electricity and inject it into the grid, whereas produced heat from the CHP is often wasted. Even though there are good practice examples on the successful heat utilisation from biogas plants, a broader implementation of heat utilisation concepts is still missing.

The introduction of the so-called 'CHP bonus' in the amendment of the Renewable Energy Act (EEG) in 2004 resulted in a significant increase of heat utilisation of biogas plants. In addition to the basic feed-in tariff, the law had foreseen the additional payment of 2 €/kWh if the waste heat of the CHP plant was also used. With the increase of the CHP bonus in the new version of the EEG in 2009, the incentive to expand the use of the waste heat was further strengthened. With the amendment of the EEG in 2012, the CHP bonus of the old feed-in tariff system of 2009 is replaced by an obligation to use the heat of biogas plants. As of 1 January 2012, biogas operators of newly installed biogas plants are required to use at least 25% waste heat during the first year of operation and at least 60% heat in the following years from the CHP plant. 25% thereof counts for heating of the digester. Instead of complying with this heat use obligation, a biogas plant operator can also choose alternatively to use at least 60% manure in a biogas plant. In this case, no minimum heat use must be ensured.

Many biogas plants are placed in the areas where heat utilisation concepts cannot be implemented as potential heat consumers are too far. 60% heat utilisation obligation will change this situation as site selection and heat utilisation concepts will be taken into account already in the planning phase. However the new obligation creates bottlenecks as well. In case a biogas plant operator loses his heat consumers, the feed-in tariff is not paid anymore. EEG 2012 foresees no measures how to tackle such situations and reduce the risk for biogas plant operators.

Development of district heating networks is essential for heat utilisation from biogas plants. There are two state support programmes for the development of heating networks:

- BAFA (Bundesamt für Wirtschaft- und Ausfuhrkontrolle)
- KfW (Kreditanstalt für Wiederaufbau)

However, the weakness of such support programs is that the requirements are changing quite often and the budget is limited.

In general, heating market still lacks legislative improvements. For example, heat utilisation concepts have to be considered only in new biogas plants, whereas older biogas plants are not obliged to utilise their heat. Also older biogas plants have a potential for optimisation and could consider heat utilisation concepts.

Legislative developments until the end of the project

The most recent amendment of the EEG came into effect on 01.08.2014. Therein the promotion of renewable energies has been changed in significant parts. Some of the amendments are extensive, for example in the case of the obligatory direct selling, the wide restriction of financial incentives for biomass plants, the introduction of invitations to tender for ground mounted solar (PV) plants, or the adjustment of the special compensation for large-scale electricity consumers ("industry discount").

The objective of the EEG 2014 is to steadily and cost efficiently increase the share of RES in gross electricity consumption. The amendment of the Renewable Energy Sources Act is based on the following guiding principles:

- Better integration of RES into the grid: RES plants shall increasingly take over tasks so far provided by conventional energy generators.
- Integration of RES plants in the market: In principle, the direct selling of generated energy to energy providers should be the basis for the financial support scheme set out by the amended EEG 2014.
- The financial incentives shall be concentrated more strongly on the less expensive technologies, i. e. on onshore wind power and solar energy (PV).
- The costs for the financial incentives are intended to be reasonably distributed among all stakeholders.

In order to provide for a foreseeable expansion of power generation from RES, expansion targets for individual RES are stipulated by the amended regulatory framework. These targets are:

- Onshore wind energy: 2.500 MW (net) annually
- Offshore wind energy: 6,500 or 7,700 MW to the end of 2020, thereafter 800 MW annually
- PV: 2,500 MW (gross) annually
- Biomass (including biogas): 100 MW (gross) annually
- For the other RES, no expansion targets are prescribed.

The new provision for the promotion of biomass, biogas and bio-methane is the most widely revised of all energy types. While the existing complexity of the promotion requirements has been reduced by the recent amendments, the financial support has also been considerably restricted.

7 Heat utilisation in Italy

Italy is the second country in Europe for the production of Biogas but still is unable to release all its potential regarding heat use, as it has not received full acknowledgement as a primary source for energy efficiency. Italy in the last decade have been going through a massive development of energy awareness: it started with the liberalisation of electrical energy in 1999 and saw the turning point with the beginning of the new era of energy policies with the EU Climate-Energy Package of 2008, implemented with the Green Certificates, incentives for renewable energy production and later on with the different feed-in-tariffs and White Certificates, the subsidies for energy efficiency. The production of electricity is the main activity considered for incentives so far: the recovery of heat was considered since 2005 with the white certificates, but the use of heat combined with power in biogas plants was never really taken into consideration by market operators.

Positively, the Legislative Decree No. 28 of 3 March 2011 introduced measures to simplify and streamline the administrative procedures for the implementation of renewable energy plants, both for the production of electricity and for the production of thermal energy. According to the Decree, the construction and operations of renewable electric energy production plants is subject to the Unique Authorisation released by the Regional Authority: this simplification has effectively facilitated the start-up of plants. Nevertheless, the biogas market driver is still the production of electric power. Still, in order to enjoy the incentives for the production of electricity and heat, it's necessary to refer to two different laws.

The Decree of the Economic Development Ministry of July 6th 2012, which regulates the incentives for the production of electric energy from renewable sources other than photovoltaic, displays quite a good policy for investing in biogas, but still sets new barriers and the real bottlenecks for the investment in new plants.

For the positive side, besides the feed-in-tariff for the production of electricity (for plants using by-products: 236 €/MWh below 300 kW; 206€ for 300-600 kW and 178 for 600 to 1000 kW; incentives are lower for plants using agricultural products), the decree recognises a price for cogeneration. This price is 10 €/MWh in the case biogas is produced using by-products, and is of 40 €/MWh if the heat is used for district heating. The problem is that for the bonus, high-efficiency cogeneration is required (PES>0) and the heat used for the fermenter is not considered as "useful heat" and thus cannot be accounted.

Special premium tariffs are applied for using advanced technology: in the case of high-efficiency cogeneration plants, with nitrogen recovery system from the treated substances with the aim of producing fertilisers compliant with the law, the award for cogeneration increased by 30 €/MWh (removing at least 60% of the total nitrogen entering the plant); the production of fertiliser must be done without fossil energy contributions. For plants up to 600 kW, a price of 20 €/MWh is set for the case that the plant operates in cogeneration and a recovery of 30 % of nitrogen by producing fertilizer is realised.

The decree regulates that the maximum electric power to be subsidised by the feed-in tariff for power production, is equal to 5.8 billion euros per year. Thus, the annual quotas of total national power set, within which it is granted access to the incentive mechanisms are – for biogas, biomass, landfill biogas, bioliquids - 170 MW for 2013, 160 for 2014, 160 for 2015. As it can be seen below, such amounts were not all used and part of the power set is still available

for 2016. In order to control the total amount of subsidies, the decree orders that plants must access to a public register if the nominal power is more than 100 kW and below 5 MW. In order to participate to the tender for accessing the register, participants must have the authorisation for the construction and exercise of the plant. The criteria used for the ranking of priority access to the quota within the registers, are: plants should be owned by individuals or groups of farmers, fuelled by biomass and biogas matrix composed of agricultural products and by-products, or either organic waste, with a power peak not exceeding 600 kW. Incentives are guaranteed at a basic rate plus some bonus for high-efficiency cogeneration,

nitrogen recovery (biogas), reduced greenhouse gas emissions and atmospheric emissions (biomass); smaller plants are facilitated rather than large plants. The plant must start the ordinary exercise within 22 months after the incentive tariff is agreed by the authority.

Above the threshold of 5 MW the incentive is foreseen only for 2013, and depends on the participation to public auctions. The quota for 2013 is 120 MW for 2014 and 2015 quotas are not yet available. Concerning the operators, the competition is based on a lowest bid auction in percentage reduction from the starting price, which corresponds to the basic feed-in-tariff in force for the last echelon of power at the date of entry into operation of the plant. The first auction (January 2013) saw only one applicant for biomass, with a request for 13 MW to be subsidised against the 120 MW available in total, meaning that the auctions frightened the operators with low tariffs and too much bureaucracy.

For the record, the result was much better: 220 MW requested against 170 to be subsidised: too bad that these numbers with time have deflated: in contrast to the systems that access to incentives by auction, in fact, the records do not require a surety to guarantee enrolment and is widespread practice to make the request only as a precautionary measure, without the certainty that the project will be then realised.

The registers foresee in total the allocation for the production of electricity from biomass and biogas a quantity of installed power which is a little less than 500 MW. The experience so far has shown that the amount of power actually realised is much lower that assigned in response to records.

Developments until the end of the project

The situation at 31 December 2014 is such the cost allocated for incentives through the registers is equal to 310 millions:

- 173.6 million for biomass
- 136.6 million for biogas

The result, however, is that the plants registered and actually operating are only about 14 %, using 44.4 million euro in total (of which 32 to biogas) and with a corresponding power estimated around 25 MW.

There currently are no reliable forecasts about the final results of the processes of construction of the plants (it might be thought that about 50% of them is not finalised).

The amount of power not implemented, which could be around 250 MWe, and the related commitment of spending at least 150 million euros for the incentives could be reloaded and used for the biogas sector by 2020.

Elements to be considered for the future are:

- The bonus for CHP and heat use should be more easily accessible
- The Guidelines of the European Commission regarding competition (for plants larger than 500 kWe auction mechanisms are to be used for the assignment of the feed-in-tariffs).
- The production of biogas has a high added value in terms of system compensations thanks to its programmability and ability to create a contact between the electrical system and the gas system
- Combined biogas / biomethane production
- Need to make the incentive system more usable (eg. a single register annually is a stiff mechanism)

8 Heat utilisation in Latvia

There are around 40 biogas plants operating now in Latvia. Most of the plants are qualified for receiving the electricity feed-in tariff. Feed-in tariff in Latvia is given for the electricity that is generated from renewable energy sources (Cabinet Regulation No.262) and for the electricity generated in high efficiency CHP plants (Cabinet Regulation No.221). Biogas plant operators could choose under which regulation to apply. Most of the plants are operating under regulation No.262 where efficient heat use was not required. Plants that are operating under Regulation No.221 are subject of heat use efficiency requirements. The drawback of the Regulation No.221 is that the efficient heat use is defined as obligation to sell heat to the end user. Heat used for the self-consumption (e.g. for heating the digesters) is not considered as a part of efficient heat use. Moreover, so far there were no real control mechanisms in place for checking the conformity of existing biogas plants in regard to fulfilling the heat use efficiency criteria.

Measures that should be taken to provide solutions for increased heat utilisation from biogas plants should be targeted to three groups of biogas plants:

- Biogas plants that receive the feed-in tariff for electricity under Cabinet Regulation No.221
- Biogas plants that receive the feed-in tariff for electricity under Cabinet Regulation No.262 and other existing biogas plants
- Future biogas plants.

For the first group the definition of efficient heat use should be revised and control mechanisms for checking the real heat use efficiency at the plant should be implemented.

The second group of biogas plants that were constructed without being obliged to use heat efficiently has already come to the point where efficient heat use is necessary for the overall economical feasibility of the biogas plant. Biogas policy makers should help these biogas plant operators by minimising current bottlenecks in terms of:

- Introduction of changes in existing district heating legislation to allow district heating system operators benefit from using heat generated from biogas or to give advantage for biogas as fuel over the natural gas
- Developing alternative uses of biogas besides CHP – to provide real opportunities for injection of upgraded biogas into the natural gas grid, and to establish the framework conditions for biomethane use in transport.

Future biogas plants should be obliged to use heat efficiently.

Developments until the end of the project

By the end of the project the situation was still that there would be a problem in 2017 when licences for many CHP plants expire (after 10 years) and plant operators had to decide whether to make new investment or close their plants. The Ministry of Economics of Latvia was asked consider this gap in future RES capacities in terms of realistic possibility to reach the 2020 bioenergy target.

Current amendments to the relevant legislative acts, require the more efficient use of heat in order to receive financial support. However, this proved to be problematic for biogas plants operating on manure as the digesters require a high share of this heat.

Various actors proposed additional concepts on how to ensure the proper use of resources and support schemes. Examples are cutting support for biogas installations in remote areas where heat utilisation is not feasible and looking into alternative support concepts. These could be either efficiency related demands such as upgrading of biogas for transport or environmental considerations such as waste treatment.

Additionally, agricultural questions could play a role, e.g. the use of un-cultivated land.

9 Heat utilisation in Romania

Renewable energy policies are favourable for biogas sector development in Romania, providing also at the legislative level a number of advantages, both for electricity generation and for combined heat and power. Even though the emphasis is put on the high efficiency cogeneration (one additional Green Certificate (GC) for high efficiency cogeneration, within the GC support system, or high efficiency cogeneration bonuses, through the alternative support scheme), there are a number of legal inconsistencies that prolong or even block the implementation of biogas projects and therefore integrated concepts related to it, with multiple and more efficient use of biogas energy potential.

There is no specific legislation dedicated to biogas neither at national laws, ordinances and government decisions level, nor at other normative acts or rules on implementing the existing laws, with concrete detailing on biogas.

The National Renewable Energy Action Plan (NREAP) only mentions the biogas, but there are no definite specifications regarding concrete actions and it doesn't stipulate anything for the produced heat in biogas cogeneration. It takes into account only other RES.

Also under current legislation as a hindrance to the development of heat recovery and use systems from biogas plants is a demarcation between biogas, on the one hand and landfill gas and sewage sludge fermentation gas, on the other hand. This is seen in terms of granted GC number (2 versus 1), although they represent the same type of renewable energy.

Biogas market in Romania is still underdeveloped. In order to ensure increased use of heat from biogas plants, support initiatives are necessary to improve the current situation.

At the legislative level it is important to make the following improvements:

- No longer make distinction between the three types of renewable gases (biogas, landfill gas and sludge fermentation gas)
- Provide more incentives and facilities for biogas energy projects and for efficient use of its energy potential, including for waste heat recovery
- To simplify permitting, financing, accreditation and qualification procedures for energy producers from RES. Unification at regulatory, methodological and administrative structures is important.
- To create new legislative initiatives and re-establishment of new support schemes. Provide access to funds for an effective heat use and support the rehabilitation and increasing confidence in district heating systems. This also includes the promotion of development of heating sector and of renewable heating and cooling concepts, including biogas.

At the energy policy level it is important:

- To review and specify the policies for heat as well as ways to use it for the consumers. In addition, the contribution of biogas should be incorporated into the national energy policy. Biogas should be also considered to achieve the national targets
- To update the measures provided for strategies and action plans on energy for the thermal energy sector development, integrating specific measures on biogas cogeneration use
- To stimulate initiatives for promoting new conceptual acquisitions and reinforce the information actions on sharing experience and training among potential investors, operators as well as among politicians and managers.

Developments until the end of the project

The legislative framework was completed in principal with the following normative acts:

- OUG 57/2013 refers to the changes in the system of support mechanisms for the energy produced from renewable energy. Most important aspect is the temporary canceling of the green certificates issuing in the period from 1st July 2013 to 31 March 2017. The measure is not affecting the green certificates for the energy from biogas.
- OUG 994/2013 brings supplementary details on the green certificates scheme for the facilities for which ANRE has issued authorizations, as follows:
 - o 0.7 green certificates/ 1 MWh for hydroelectric facilities with installed capacity smaller than 10 MW;
 - o 0.5 green certificates until 2017 and 0.25 green certificates starting from 2018, for each 1 MWh produced from eolian facilities;
 - o 3 green certificates/MWh for photovoltaic sources.
- Law number 23/2014 is harmonizing the governmental decisions with the framework of the renewable energy law number 220/2008

None of those law changes is affecting the biogas support scheme. To date, the new facilities for biogas production are receiving 2 green certificates per MWh electric and an additional one green certificate for facilities based on energy crops and/or having high efficiency cogeneration units.

10 Conclusions

A huge potential for heat utilisation from biogas CHP plants exist in 8 target countries of the BiogasHeat project (Austria, Croatia, Czech Republic, Denmark, Germany, Italy, Latvia and Romania). Even though the situation of heat utilisation from biogas CHP plants is different in each country, there are some common bottlenecks existing in all target countries.

In general, heating market still lacks legislative improvements in most of the countries. For example, heat utilisation concepts have to be considered only in new biogas plants, whereas older biogas plants are not obliged to utilise their heat. Also older biogas plants have a potential for optimisation and could consider heat utilisation concepts. Therefore the focus should also be given to combined heat and power production in existing biogas plants. Political push for the heat market is still missing in most of the countries. For example, stronger incentives for the development of new heating networks are still missing.

Lack of knowledge in different useful energy forms that biogas could provide among decision-, policy-, strategy- and legal framework-makers is a bottleneck as well. Therefore heat utilisation is often not taken into account. In addition, currently only Germany has a 'positive list' for heat utilisation from biogas CHP plants that is defined in the Renewable Energy Law. Definition of a 'positive list' for heat utilisation could help to clearly define which concepts should be supported and promoted.

Lack of incentives for utilisation of renewable heat in general, including biogas, also hinder broader implementation of heat utilisation concepts from biogas plants. Implementation of heat utilisation concepts requires additional investments from biogas plant operators and is related to additional risks if heat consumers are suddenly lost.

One of the barriers for heat utilisation from biogas CHP plants is the location of the biogas plant. Many plants are located in areas where there are no potential heat consumers. Incentives are still missing to increase biogas injection into the grid. New biogas plants should take into account heat utilisation concepts to avoid wasting of heat in the future.

Developments until the end of the project

At the end of the project, the situation across the target countries has not improved much. In many countries, operators face the same problems as in the beginning of BiogasHeat. In some countries the situation even deteriorated. The new German law aims at the full integration of RES in the energy market which leads to lower requirements but also less support, the support in the Czech Republic was cut heavily. Nevertheless, there are positive developments. The situation in Croatia has slightly improved due to the country joining the EU and receiving support for agricultural activities. Also, in Austria extensions of support schemes are under discussion. Generally, it can be said that although the regulations have not changed that much, the discussion of solutions and the general level of awareness have improved notably.

11 Abbreviations

CBP - Centralised biogas plants

CHP - Combined Heat and Power

GC - Green Certificate

ERO - Energy Regulatory Office

FBP - Farm biogas plants

RES - Renewable Energy Sources

RES-E - Electricity from renewable energy sources

RES-H - Heat from renewable energy sources