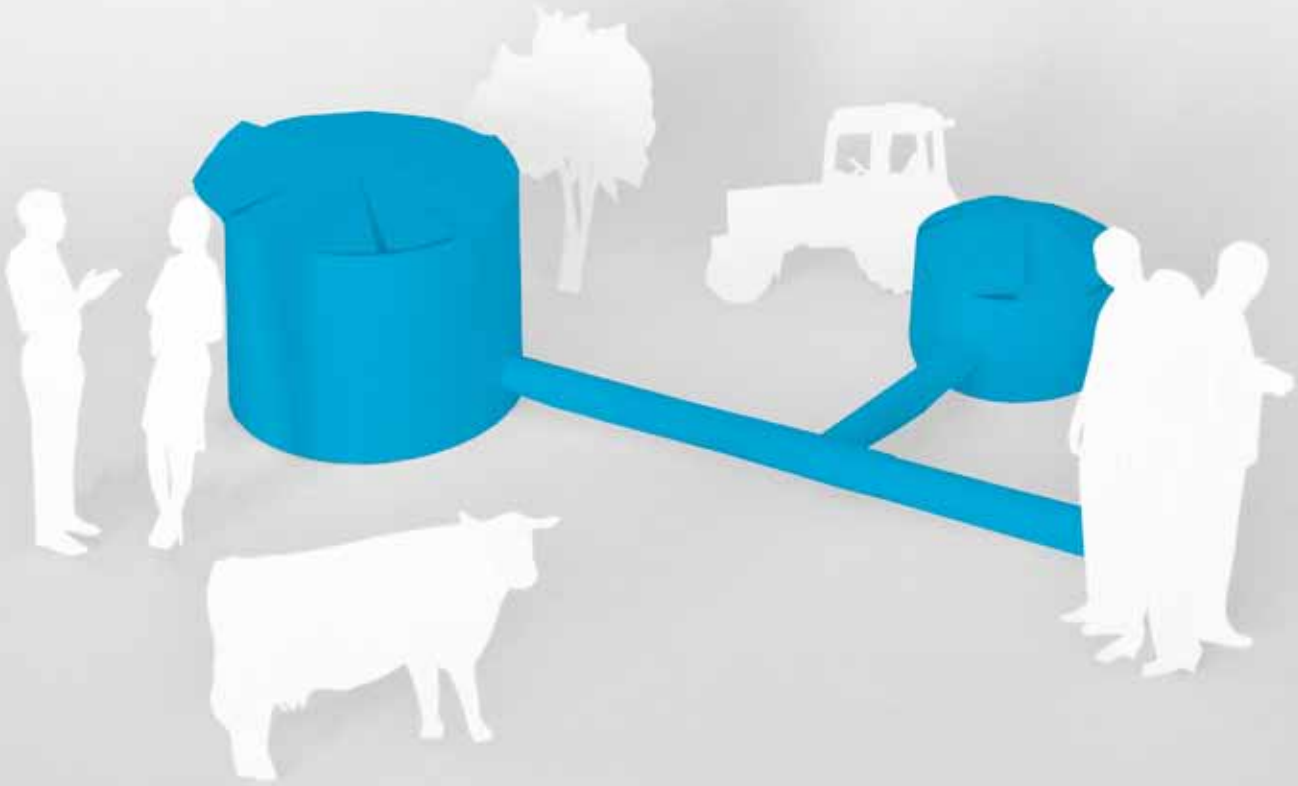
CA-RES

WORKING GROUP 7

Biogas networks



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In a Nutshell

Appropriate transposition of the Renewable Energy Sources Directive (Directive 2009/28/EC) demands EU Member States to ensure that the national legal and administrative framework provides transparent and non-discriminative access of biogas to the natural gas grid (Art. 16 (7)), and that the national regulations require an assessment as to whether the existing gas network infrastructure has to be extended, thus enabling access of biogas to the grid (Art. 16 (9)). Additionally, the EU-MS can design and implement different support schemes which incentivize biogas producers to upgrade and subsequently inject biogas into natural gas grids, as a means for reaching the national mandatory targets (Art. 3 (1)).

Working Group 7 (WG 7) of the CA-RES addressed in a series of working group sessions - each dedicated to a specific question - issues directly linked with the implementation of Directive 2009/28/EC, as well as aspects which are affiliated with the further integration of biomethane in the national energy systems.

One of the major goals of the process– among many other important objectives - was to exploit the considerable potential for sharing know-how among the representatives of the Member States to identify the major legal, technical, administrative and economic barriers and to jointly develop and disseminate approaches to overcome such hurdles.

The topics covered in the working group discussions can be structured into two groups. The first group comprises the policy framework that is currently implemented in the Member States, ranging from the regulatory rules over technical standards to existing support schemes. The second group of topics focuses on the perspectives for the future integration of biomethane in the national energy systems, the alternative pathways that can be used, the existing barriers and possible solutions to overcome them.

The main concrete results of this working group are a wide ranging exchange of information and experience, and the presentation of various examples for policy approaches. Based on this work, the following crucial conclusions can be drawn:

- The framework for biomethane in the EU-MS is very heterogeneous, and strongly dependent on the existing natural gas infrastructure and supply.
- The support for biomethane focuses mainly on direct support instruments.
- The direct on-site use of biogas as fuel in CHP plants is in competition with the injection of biomethane into natural gas grids.
- The transport sector is a promising option for a stronger integration of biomethane in national energy systems by enabling – in the case of full exploitation of the potential – the application of economies of scale.
- The possibility of flexible electricity production of biogas and biomethane CHP plants provides a new role for these technologies in a future energy system.

The beneficiaries of the valuable outcome of this working group are the institutions and bodies of Member States that are either experienced in the use of biomethane or starting to prepare to do so. The “forerunner countries” can learn from the exchange of experience to improve their existing policy framework, whereas the “starter countries” can benefit from this information to avoid ineffective and inefficient approaches.

2 One Topic in the Spotlight

The production of biomethane and its subsequent injection into natural gas grids is – more or less - of minor importance in the national energy systems in all of the EU-MS which participated via their experts in WG 7. The main reason for this situation is that biomethane is basically methane, thus directly competing with natural gas, but handicapped by higher production costs.

This unfavourable aspect is currently the main barrier to gaining the benefits that can arise from the use of biomethane, namely the reduction of energy import dependency and GHG emissions. To overcome this barrier, political and (subsequently) financial support for biomethane is necessary.

The key question that arises from this situation and which has been addressed in the discussions of two WG sessions is: what are the utilisation pathways for biomethane that provide opportunities for cost reductions through economies of scale and which trigger additionally the removal of legal and administrative barriers that currently hinder a wider deployment of biomethane grid injection?

This crucial question was discussed in the first of these two sessions, in a more general way by two subgroups that focused on the production and consumption side of the biomethane utilisation pathway, respectively.

As an outcome regarding the “production side”, the reduction of costs associated with the production, upgrading, cleaning and compression of the biomethane were regarded as the most important issues to be tackled. In addition to this, a stable investment environment - in particular in relation to potential regulatory risks- and a clear national strategy regarding the utilisation of biomethane are important.

The results from the “consumption side” indicate that a successful strategy has to incorporate two aspects, namely the identification of core sectors (that allow biomethane to develop a significant market size) and the recognition of niche markets (that broaden the application basis for biomethane as whole).

The Swedish example demonstrates that the transport sector is a promising way of increasing the utilisation of biomethane with the least necessary financial support. Within 10 years, Sweden increased its Compressed Methane Gas (CMG) consumption in the transport sector ("vehicle gas") from a low level to more than 1 TWh per year, of which 60% is biomethane. This has been achieved by the so-called "Green gas concept" which enables consumers to order 100% biomethane, by a set of various investment subsidies for biomethane production and other infrastructures. The attractiveness of natural gas vehicles is also improved by some non-financial benefits like exemptions from congestion charges and relevant taxes or free parking benefits. For all biofuels tax exemption is given until the end of 2013, for biomethane in particular the tax advantage is around 68 €/MWh compared to petrol, and 52 €/MWh compared to diesel.

In the initial phase, public procurement played an important role since public authorities required public fleet operators to decarbonise and reduce pollution caused by their vehicle fleets, thus paving the way for usage of biomethane in this important and highly visible sector. As Sweden has only a very small natural gas grid, it was a good decision to build up CMG infrastructure near public return-to-base vehicles fleets (buses, garbage trucks, etc.). Biomethane is often produced from local (municipal and industrial) sewage sludge and organic waste at existing sewage gas or co-digestion plants. As soon as a critical mass of consumers was achieved, to ensure reasonable return on investment, fuel stations were subsequently extended for public supply as well.

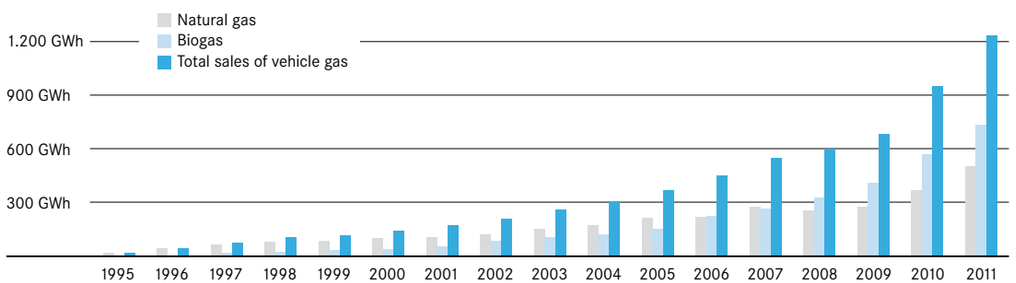

Figure 1: Development of biomethane consumption in transport in Sweden; Source: Swedish Gas Association

Following this outcome, the question of what role biomethane can play in the transport sector was explored in more detail. It was found that the main application, today and in the near future, will be its use as a fuel for passenger vehicles, buses and light trucks. At the moment, 5 countries, which intensively took part in the discussions, already use biomethane in their transport sectors. 6 countries estimated that by 2020 biomethane can account for 2% or even more of their 10% RES-T target.

Following the (former) structure of the support schemes, biogas is still very often (mainly) used as fuel in CHP plants, thus is in competition with the upgrading of biogas to biomethane and the subsequent injection into the gas grid. Additional barriers are the risks resulting from the uncertainties in the investment environment, in particular the potential regulatory risks. Another important aspect arises from the fact that the perspectives of biomethane are closely linked to the general development of CNG in the transport sector.

Currently the use of biomethane in the transport sector presents the most interesting opportunity for a stronger integration of biomethane in national energy systems. This conclusion is based on two main aspects:

- The financial support necessary for biomethane to achieve economic competitiveness with the other transport fuels is – compared to its use in combined heat and power production, room heating or other industrial appliances – comparatively low, thus enabling a more efficient use of financial resources.
- The transport sector faces – given the latest development concerning the sustainability criteria of biofuels and the limitation of crop-based biofuels to 5%[1] – some challenges in reaching its 10% RES target, and biomethane is a very interesting option to fill this gap.

The main issues which have to be addressed in order to overcome the existing barriers are cost reduction potentials in the production process of biomethane, the creation of a stable investor friendly environment and clear national goals that support this strategy.

[1] See: Proposal for an Amendment to the Renewable Energy Directive: "Fuels and energy from renewable sources: transition to biofuels to deliver greenhouse gas savings" 2012/0288 (COD), 17. October 2012

3 Challenge Meets Solution

Biomethane as an energy carrier is a promising option for using renewable energy sources for a variety of applications. Currently, a number of issues prevent biomethane from contributing to a larger extent to today's energy supply.

In the working group sessions of WG 7, a number of issues were discussed that can be addressed by policy makers to improve this situation. These issues are:

- Biomethane as a new energy carrier that has to be integrated into the existing grids without discrimination with respect to natural gas;
- The slightly different properties (again with respect to natural gas);
- The usually higher production costs (due to feedstock costs, cleaning, upgrading and pressure increase), thus
- Leading to higher costs of the resulting products (the useful energy, but also secondary energy carriers like district heat and electricity).

To address these issues, 6 WG sessions were organised to provide a platform for the participating experts to exchange their experience related to these issues. The topics of these 6 WG sessions were:

- WG Session 1: Regulator
- WG Session 2: Technical Standards and Authorisation
- WG Session 3: Economic Aspects of Biomethane Feed-In
- WG Session 4: Alternative Pathways of Biomethane Utilisation
- WG Session 5: Perspectives of Biomethane: Biomethane in Transport
- WG Session 6: Market integration of Biogas CHP Plants

The WG session 1 focused on the role of the regulating bodies in charge and the rules applied when biomethane is injected into the existing natural gas grids. WG session 2 addressed the technical standards biomethane has to comply with for grid injection. The economic aspects of the grid injection were dealt with in WG session 3. WG session 6 completed the picture for biomethane by discussing its use in integrated Biomethane/Biogas/Power2Gas systems. The findings of WG session 4 and 5 have been summarised in section 2.

3.1 Member States' Experiences

One can say that whatever subject was dealt with, the regulations for each topic are very heterogeneous among the EU-MS. Having said this, employment of biomethane beyond the regional "borders" faces severe difficulties. Such barriers arise by applying significantly different regulations, diverging technical standards, variable subsidy and varying target markets. All of these hurdles have to be considered against the background of missing competitiveness of biomethane induced by the high production costs. In order to improve the status of biomethane in a competitive environment, there is a need – among others - for:

- Harmonisation of regulations in the EU-MS
- Political commitment to the envisaged role of biomethane in the energy strategy
- Lowering of production costs, and last but not least
- Reaping of economies of scale by entering markets which allow access and further on to extend to several niche markets

One could argue that the status quo is similar to the situation in the early stage of the network energy liberalization process. It might make sense to request more devotement of the regulatory authorities to the potentials of the biomethane sector.

3.1.1 Regulatory authorities

Although biomethane grid injection is taking place in only a small number of countries - out of the participating EU-MS in WG 7- it is obvious that the current status of the regulatory framework for biomethane is very heterogeneous in the EU.

In some countries a specific framework, covering the issue of injection of biomethane, has not as yet been set up. The regulatory framework of the countries that are already injecting or plan to do so ranges from a preferred treatment with priority access to the simple approach of treating biomethane in the same manner as natural gas.

3.1.2 Technical Standards and Authorisation

Another important issue is the need for compliance of the biomethane quality with the defined technical standards – mainly included in the relevant grid codes - in order to be allowed to inject biomethane into the existing natural gas grids.

Analysis of the information gathered via questionnaires and from various WG discussions showed that the technical standards for biomethane injection differ among the countries. The applied standards strongly depend on the existing natural gas supply sources of the particular country (which can originate from domestic production, from pipeline imports from one or several countries or regions, and from LNG imports). This fact is indicated – among others - in the bandwidths of the allowed Wobbe[2] number (Figure 2) and the applicable ranges for certain impurities (Figure 3).

[2] the Wobbe number is an important parameter that defines the required gas quality in terms of the energy content and the physical density.

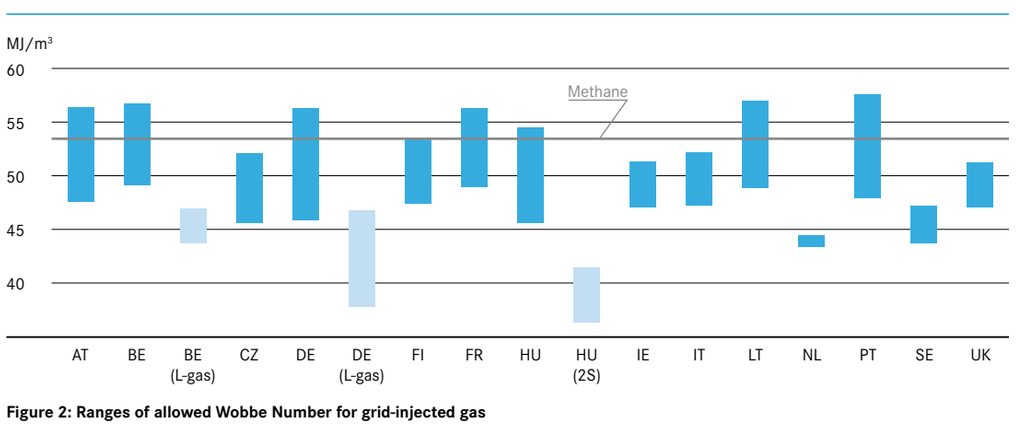

Figure 2: Ranges of allowed Wobbe Number for grid-injected gas

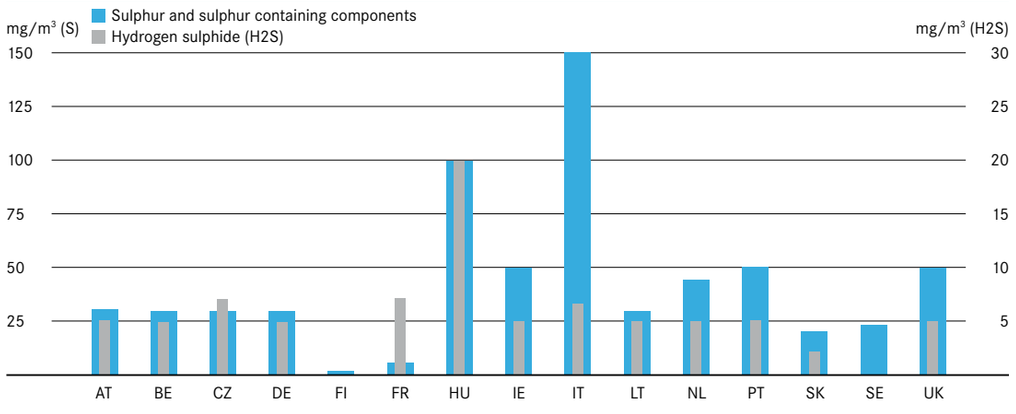

Figure 3: Limits for selected impurities

The barriers that arise from the technical standards can be grouped into gas related barriers (like the calorific value range, the feedstock, or monitoring requirements), and grid related barriers – the latter have to be grouped into transmission and distribution networks barriers and are linked to the question of access to the grid or to storage facilities, subsequently to the choice of the injection point.

3.1.3 Economic Aspects of Biomethane Feed-In

Almost all of the countries that contributed to the discussions – taking their preceding preparations as very valuable arguments - have already set up a support scheme for the grid injection of biomethane, with the majority of the countries having implemented direct support instruments (see Figure 4).

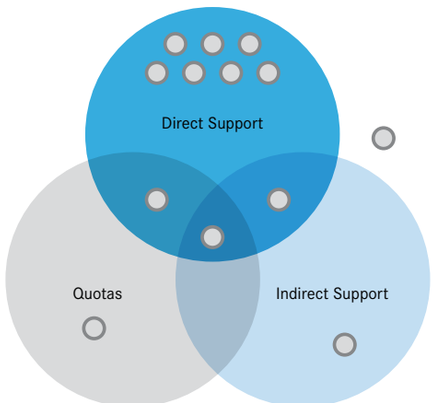

Figure 4: Approaches for biomethane support

The discussions clearly showed that for the design of the support scheme several aspects are crucial, like the used (or forbidden) feedstock for the production of biomethane, the preconditions arising from the existing supply and demand of natural gas, and the goals of the national energy and climate policies. These aspects determine whether the support schemes concerning the upstream (i.e. how the financial support is collected) and downstream parts (i.e. how the financial support is distributed) of the support scheme can be both effective and efficient.

3.1.4. Market Integration of Biogas CHP Plants

As wind power and PV are expected to become the backbone of the decarbonisation of our electricity system and the potential for development of new hydro pumped storage plants is limited, biogas and biomethane will remain relevant options for delivery of system services with regard to stable and secure electricity supply in the future.

Currently one country has already started to create the necessary framework that allows biogas and biomethane CHP plants to transform their role and to contribute to grid stability by a combination of gas storage and increasing and decreasing electricity production where required. This example and the discussions showed that despite the existing barriers especially regarding the flexible biogas plant operation, like possible heat storage needs, higher maintenance costs, the rise of feedstock prices and uncertainties of control energy price development, there is a significant potential for biogas and biomethane plants playing a new and important role in future energy systems.

3.2 Good Practice

Germany was able to establish supportive framework conditions for an impressive market increase of biogas plants which upgrade biogas to natural gas quality and inject it into the public natural gas grid. Figure 5 shows the development of that market – starting in the year 2006. With 116 operating plants by May 2013 Germany takes the lead in biomethane production and grid injection in Europe. These plants have a total feed-in capacity of 72,000 m^3/h. Currently further 35 plants are under construction and 31 plants are planned.

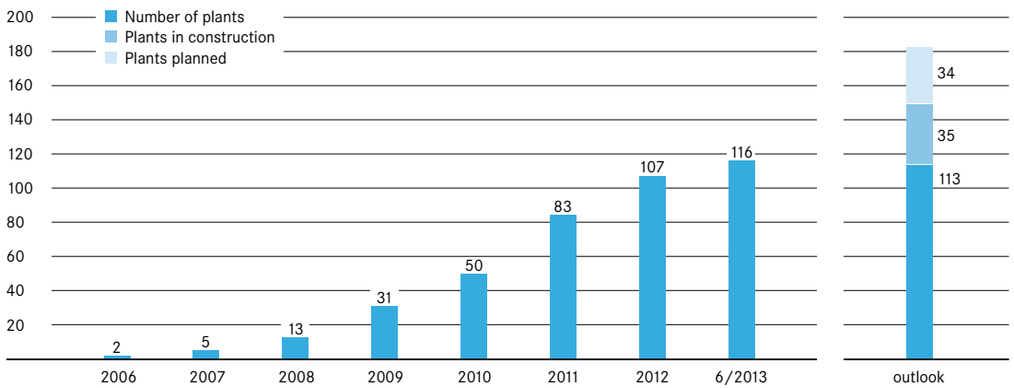

Figure 5: Number of plants in total

Main drivers for this development were the feed-in tariffs for electricity produced at combined heat and power plants (virtually) fired by biomethane fed into the public natural gas grid (under EEG) and supportive conditions for gas network access (GasNZV[4]) with reduced access and transport fees. The EEG was revised in 2008, 2011 and 2012,[5] in particular in regard to biomethane. The GasNZV was revised in 2008 and completely redrafted in 2010. The EEG guarantees priority access to electricity networks and attractive feed-in tariffs, fixed for a period of 20 years.

The injected amount of biomethane is balanced by the extracted amount within one year. GasNZV[6] guarantees priority access to the gas grid and a beneficial splitting of connection costs among the grid operator and the supplier. The network operator has to pay 75% of all capital expenditures of the grid access including a connecting pipe for a distance of up to 10 km. The network operator is the owner of the network connection and responsible for maintenance and operation costs. Despite this the costs to the biomethane supplier is limited to 250,000 EUR for the installation of the grid access and the first kilometre of the connection pipe.

The access point can be chosen by the supplier. The grid operator must guarantee a minimum of 96% permanent availability of the network connection. Access refusal is only possible in cases of technical impossibility (only in very extreme cases imaginable) or because of economical unreasonableness. The grid system usage fee is beneficial for biomethane too: The biomethane supplier receives an avoided mains fee charge for otherwise imported natural gas. The provision amounts to 0.7 cent/kWh biomethane.

[4] Gas Network Access Ordinance (GasNZV) and Gas Network Tariff Ordinance (GasNEV) are ordinances of the Energy Industry Act (Energiewirtschaftsgesetz, EnWG)
[5] In 2012, a limit on the use of maize (whole crop) as feedstock (max 60% mass-input per year) was introduced following a „maizening of the landscape“ debate
[6] For further reading: The biogas handbook: Science, production and applications, Woodhead Publishing Ltd. 2013, ISBN 0 85709 498 X

4 Main Findings and Achievements

As mentioned above, the major intentions – among others - of the CA-RES WG 7 were:
- Appropriate transposition of the legal requirements, like Directive 2009/28/EC, having an impact on the biomethane sector – taking the intended role of biomethane into consideration
- Share of knowledge and experience and
- Compilation of a fruitful strategy for the extension of the biomethane sector.

The discussions and results of the WG 7 process clearly indicate a:
- Common understanding of the issues to be dealt with (a common language could be established in the sessions)
- Sharing of knowledge – as intended among the forerunner countries, among the starter countries and between the forerunner and the starter countries – so learning from each other
- Speedy and efficient improvement of knowledge in this complex and challenging sector
- Raise the awareness for the issues to be tackled in the short-, mid- and long term and the required environment for such processes.

During the on-going process important data was provided by the representatives of the EU-MS, which should be used in procedures intending to underpin the biomethane sector in the EU. At the same time it has to be emphasized that the results of other projects, dealing with similar topics and goals, like the EU GreenGasGrids[7] project, might help to effectively achieve the envisaged targets.

[7] The project is financed by the European Commission within the Intelligent Energy Europe programme.

Topic	Issue	Outcomes	Future
Regulator	Approach towards biomethane in terms of subsidy schemes, access to grids and quality requirements	Need for harmonisation of provisions (not unification) and implementation of subsidy schemes which are adapted to the updated situation	Deposit the topic at ACER[8]
Technical Standards	Allocation of costs should provide incentives to develop RE projects in most cost effective sites whilst maintaining affordability of RE and equity of grid users.	Find ranges of quality requirements which are applicable beyond "regional borders", thus contributing to cheaper and at the same time reliable equipment, hence lowering spare part costs as well	Deposit the topic at CEN and other relevant institutions which deal with standardization issues. Of course there is a need to pave the way for such an approach by the biomethane sector
Economic Aspects	High production and dissemination costs	Awareness of the need to benefit from economies of scale and size	Develop a roadmap on how to successfully enter the transport sector including (small scale) vessels
Biomethane in Transport	Offering of different biomethane qualities in different countries, which do hinder long distance transport	Standardization of biomethane quality needs is a must	Look for further cooperation with car manufactures and or NGVA.
Biogas CHP plants	New role in the electricity market as a provider of system services	Promising options and existing barriers have been discussed	Follow closely progress in technology and push for corresponding R&D activities and the prerequisite financial means

[8] The Agency for the Cooperation of Energy Regulators (ACER) is the European Union body created by the Third Energy Package to further progress on the completion of the internal energy market both for electricity and for natural gas.

5 The Way Ahead

Basically one can say that the process (approach, analysis of status quo, determination of work packages and the related output as well as fixing of required next steps) can be regarded as a success story so far because:

- "Forerunners" and "starters" could exchange views and learn from each other
- The common knowledge basis was improved
- The network was established, counter parties identified and business relations were strengthened
- The main hurdles for further extension of the biomethane sector were identified and agreed on
- Potential markets which enable benefits from economies of scale and niche markets were identified and focused on

What remains to be done in - and potentially beyond – this process is:

- Exchange the results of the entire CA-RES programme among the WGs and analyse the impact of the output of the other WGs on WG 7;
- Merge the results of other activities related to biomethane like the outcome of the EU GreenGasGrids project;
- Take the results of ongoing activities, which provide input to EC guided actions, like the results of the Natural Gas Vehicle Association or standardization bodies etc. into account when determining the next steps;
- Elaborate a roadmap which should serve as a structured way ahead;
- Disseminate the results among the participants of the CA-RES programme and to other relevant activities;
- Deposit the intentions in the NREAPs and further on at EC – thus enabling a bottom-up approach (EU-MS to EU-MS and to EC) and a top down approach (EC to EU-MS) which finally should end up in a counter flow approach
- Also take institutions, which act in a cross border manner and which could help to a certain extent in the biomethane sector, like for example ACER, into account;
- Convince the relevant stakeholders – either on a national or international level.

Abbreviations

Abbreviation	Full name
ACER	European Agency for the Cooperation of Energy Regulator
CA-RES	Concerted Action on the Renewable Energy Sources Directive
CEN	Comité Européen de Normalisation (European Committee for Standardization)
CHP	Combined Heat and Power
CMG	Compressed Methane Gas
CNG	Compressed Natural Gas
EC	European Commission
EEG	Erneuerbare-Energien-Gesetz (Renewable Energy Act)
EnWG	Energiewirtschaftsgesetz (Energy Industry Act)
EU-MS	EU Member States
GasNEV	Gasnetzentgeltverordnung (Gas Network Tariff Ordinance)
GasNZV	Gasnetzzugangsverordnung (Ordinance of gas network access)
GHG	Greenhouse gas
LNG	Liquefied Natural Gas
NGVA	Natural & bio Gas Vehicle Association
RED	Renewable Energy Sources Directive 2009/28/EC
RES-T	Renewable Energy Sources in Transport
WG	Working Group
WG 7	CA-RES Working Group 7: Biogas Networks

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