BIO-METHANE REGIONS

Promoting High Quality Biogas and Biomethane Production across Twelve Regions of Europe

Co-funded by the Intelligent Energy Europe
Programme of the European Union

Promotion of bio-methane and its market development through local and regional partnerships

Executive Summary

The overall objective of the project was to see more renewable energy generated and thereby see greenhouse gas emissions reduced. Greenhouse gas emissions reductions often result from an anaerobic digestion plant, particularly where the feedstock is a waste product that would otherwise be dumped, but for the purposes of the project the additional renewable energy production would come from a number of potential options:-

- New digesters being commissioned
- The optimisation of existing digesters to produce more biogas
- The switching of gas utilisation from electricity generation to biomethane production
- The increased utilisation of heat from a combined heat and power unit

The partners pursued these related objectives in a number of ways that varied according to their roles within the project and the circumstances within their particular regions/countries. The University partners provided technical expertise.

Removing the barriers to the construction of new anaerobic digesters was a fundamental beginning point for all partners and much of the activity of the promotional partners was ultimately focussed upon this.

Making the best use of new and existing digesters was a key part of the project and the advice produced in respect of effective monitoring regimes for anaerobic digesters is really valuable. Several plants in the UK and Austria were used as case studies – with the project experts engaging with their operators to see if gas yields could be improved through active monitoring. In all cases the answer was very positive.

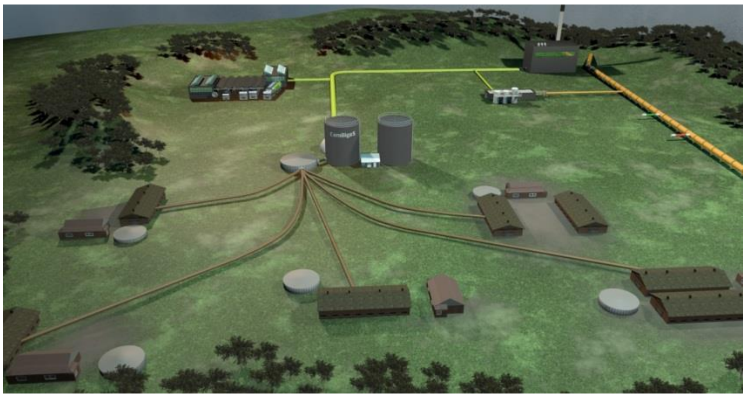
The increasing of the efficiency with which the gas is converted to useable energy involves looking into the possibilities for converting the biogas (carbon dioxide and methane)to biomethane (almost pure methane) and/or the effective utilisation of the "waste" heat from any electricity generation engine. The upgrading process from biogas to biomethane can be undertaken using various technologies and choosing between them is not straight-forward. The guide and calculator produced by the Technical University of Vienna are valuable tools that aid with this decision-making process. The value of the calculator is demonstrated by the fact that since it was available on the web site, it has been downloaded more than 2700 times.

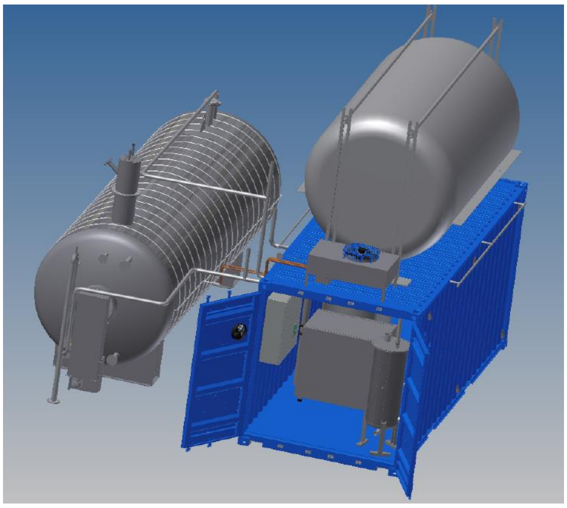
A number of the promoting partners have been able to assist in bringing into existence a number of biomethane plants. Our Swedish partner has worked really hard in bringing together all of the key players in order to implement digesters, gas up-grading and vehicle fuelling facilities. This has also meant a commitment from the county public transport administration and the purchase of a fleet of gas-powered buses. The Danish partner has assisted with the implementation of ten new digesters, most of which will eventually be linked with biogas pipelines that will combine the output from many digesters in order that it can be upgraded and injected into the natural gas grid at a central location. Partner AILE in west France also saw a new biomethane production plant commissioned whilst other partners (eg RAEE in Rhone Alp) have supported projects that are likely to come into existence in the future. The Italian partners worked with university researchers to look at the possibility of building biomethane production plants in their region. An existing biogas plant is to be converted to upgrade to biomethane in the near future. Injecting gas into the gas distribution system is a relatively recent phenomenon and there has been intervention necessary in

many countries to facilitate the process in a practical and economical manner. Our Rhone Alp partner has been involved in a working party at national French level to see such conditions introduced.

Several partners concentrated on smaller-scale on-farm developments where the heat output from the combined heat and power unit can often be effectively utilised because it is in closer balance to the available heat demand. The Slovenian partners concentrated specifically on the design and piloting of a modular “micro” biogas plant and the first three of these are completed or underway. The UK partner worked closely with livestock farmers in order to try to encourage them to use relatively newly marketed modular digesters that are economic at smaller sizes. The Hungarian and Croatian partners worked hard in a market that is only really in the infancy stages but both managed to engage with six potential schemes.

All partners were involved in activity that promoted the technology to potential developers, politicians and decision-makers. Seminars, study tours and written material were supplemented by specific events designed to disseminate the results of the project to a wide audience. Some partners were particularly successful in influencing the future policy for biogas and biomethane production in their region.





1. Introduction

There are several points that should be made in order to set the context for the Biomethane Regions project.

- Anaerobic Digestion (AD) technology offers the opportunity to generate renewable energy from readily decomposable biomass products whilst recycling the nutrients that lie within that material for use as fertiliser. It also offers a means to handle biodegradable wastes in an environmentally sensitive manner.
- Several of the partners had been involved in a prior project (Biogas Regions) and so there was a certain level of momentum that had already been established in those teams.
- The opportunity to up-grade biogas (a mixture of methane, carbon dioxide and minority components such as sulphur) into almost pure methane (the vast majority component of "natural gas") was emerging as a "mainstream" technology and was thus ready to be promoted and encouraged.
- The generation of electricity via an engine had been the almost exclusive route to renewable energy production but this would waste at least half of the available energy (in the form of heat, unless this could be productively used
- The legislative and financial situation in partner countries was (and still is) very varied
- The level of maturity of the Anaerobic Digestion industry varied/s from country to country and even region to region.

The Biomethane Regions project used a collaboration of 15 partners from 12 regions and 11 countries to promote and encourage the development of high quality production of biogas and biomethane across Europe. The intention was to facilitate the development of entirely new digesters, the switch from electricity production to direct gas utilisation where this would see increased efficiency, and the increase in productivity from existing and future digesters. The partners to the project were:-

- Severn Wye Energy Agency from Wales and South West England (UK) – coordinator
- Economic Development Agency for Swäbisch Hall, Germany
- Technical University of Vienna, Austria
- Rhônalpénergie- Environment, Rhône Alp Region, France
- Landesenergieverein Steiermark, Energy Agency for Styrian Region of Austria
- Centre Wallon de Recherches Agronomique, Walloon Region of Belgium
- University of South Wales (University of Glamorgan at start of project), Wales, UK
- Regione Abruzzo, Energy Agency for Abruzzo Region of Italy
- Agriculture Institute of Slovenia, Slovenia
- Energikontor Sydost – Energy Agency for SE Sweden
- Knowledge Centre for Agriculture, Denmark
- Energetski Institut Hrvoje Pozar, Energy Agency for Croatia
- National Agricultural Research and Innovation Centre (Hungarian Institute of Agricultural Engineering at the start of the project), Hungary
- European Federation of Regional Energy and Environment Agencies

- Association for Local Initiatives in the Field of Energy andEnvironment, Brittany and Pays de La Loire, France

The partners had varying roles, responsibilities and priorities but in essence there were 12 promoting partners, 2 research partners and one pan-EU promoting partner. The remainder of the report will concentrate upon project outcomes rather than the activities of particular partners.

Project partners at a consortium meeting in Pescara, Abruzzo Region

2. Applied Approach and Methodology

The overall objective of the project was to see more renewable energy generated and thereby see greenhouse gas emissions reduced. Greenhouse gas emissions reductions often result from an anaerobic digestion plant, particularly where the feedstock is a waste product that would otherwise be dumped, but for the purposes of the project the additional renewable energy production would come from a number of potential options:-

- New digesters being commissioned
- The optimisation of existing digesters to produce more biogas
- The switching of gas utilisation from electricity generation to biomethane production
- The utilisation of biomethane as a vehicle fuel
- The increased utilisation of heat from a combined heat and power unit

The first stage in the process of achieving the objectives in each of the regions was to establish the current situation. It was only with a thorough understanding of the current situation in respect of the deployment of the technology and the reasons for it being as it was, could the partners move on to address the objectives of increased production. The findings of this early research were by no means uniform with huge variations. The German and Austrian partners were faced with a relatively mature industry based very much on the growing of energy crops such as maize – and thus the emphasis for them was on the efficiency of the existing plant and opportunities to upgrade biogas to biomethane. The Italian and Croatian partners were at the opposite extreme with virtually no plant and a policy regime that was not particularly encouraging. The Swedish partners were faced with a situation that was very different to other countries – very little additional demand for low-carbon electricity and a very limited natural gas grid into which biomethane could be injected. They did, however, have a developing market opportunity for biomethane as vehicle fuel. The Danish partners were already working on the options for connecting up the production from a number of on-farm biogas units for central upgrading into biomethane. The other partners were "somewhere in the middle" with a maturing market that had the opportunity to learn, review and potentially modify policies and practices as compared to the Germans and Austrians and which had financial and legal structures that were being refined.

With the knowledge of the existing situation came the opportunity to plan and strategise to see positive change. All of the promoting partners used an Advisory Group to guide and assist with this process and in some cases this group had real authority to take matters forward. In other cases the action plan developed by the partners/advisory group guided the project but had no semi-statutory status.

2.1 New Digesters

Armed with the information, knowledge and inspiration that came from the training provided during the first two project meetings, as well as from the activity performed in collaboration with their local stakeholders, guidance reports published, general partner guidance and sharing of best practices, the promoting partners concentrated largely upon removing the barriers and assisting developers to get through the various practical, legal, administrative and financial hurdles that lay in the way of building a biogas plant (digester). This activity took various forms which had a common template but a wide variety of practical implementations.

A biogas calculator had been produced during the Biogas Regions project and, having been verified by the Technical University of Vienna, this was used by promoting partners in order to assist potential developers to assess whether the feedstock at their disposal would be sufficient to run an economically viable digester.

Not all of the activity was aimed at potential developers as there is clearly a role for policy-makers, politicians and public opinion in the mix of matters that ultimately influences the development of a market. The partners produced non-technical brochures and newsletters to seek to influence those that are able to put in place positive policies and decision-making, as well as those who simply need to know about the technology. Wherever there was an opportunity to promote anaerobic digestion to an audience of farmers, waste managers, politicians or community groups, these were taken.

2.2 Optimisation of Biogas Production

The project partners were determined to assist the owners of existing digesters to make more gas from the same feedstock. Our academic partners were utterly convinced that many digesters are running at below optimum gas production simply through a lack of routine monitoring – with appropriate remedial actions. This theory was to be put to the test through the activity of the University of South Wales/Glamorgan and the partners in Austria. They identified digesters, the owners of which were content to cooperate with a systematic and on-going monitoring regime instigated by project partners. These interventions would be written up as case studies.

In parallel, the same partners jointly wrote guidance notes on best practice monitoring and these were translated into the appropriate languages of all project partners.

2.3 Biomethane Production

The upgrading of biogas to biomethane is generally the most efficient way in which to utilise the available gas resource. Even the most efficient gas engines are only able to convert somewhere between 30 and 44% (depending upon the size and quality of the plant) of the available energy into electrical energy and it is often rather difficult to get the available heat energy to a location where it can be productively used – especially during the summer. By stripping out the carbon dioxide and other gases from the biogas, the biomethane can then be used in just the same way as natural gas. It can be injected into the gas main for efficient conversion to energy (usually heat) where it is needed, or compressed and used in vehicles to displace fossil fuels – usually diesel. It is for these reasons, along with the relatively novel aspects of biogas upgrading, that considerable effort was put into disseminating and promoting the benefits to developers and society at large.

Because the technology for upgrading biogas to biomethane is relatively new, there was seen to be a gap in the knowledge immediately available to the potential investors in such equipment. There are a number of physical and chemical means by which the gases can be separated and manufacturers have developed equipment to exploit these opportunities. There is no clear leader in terms of costs or efficiency and thus it was seen that information was needed to assist potential investors to assess the available alternatives via impartial advice. The Technical University of Vienna was charged with this task.

The University was also charged with the development of a "calculator" tool that would be freely available on-line, and would enable potential investors to input their production figures and other variables in order to get information that would be particular to their individual circumstances.

All project partners were charged with the dissemination of the documents/tools to be developed as well as the very clear opportunities for carbon reduction and energy security that arise from the production of Biomethane. Few countries/regions had yet developed strategies, policies or procedures that would clear the way for the efficient, sustainable and economically viable production of biomethane and it was the intention of the Biomethane Regions project to help facilitate the necessary changes.

2.4 Increased Efficiency in Biogas Utilisation

It will not always be practical for an individual anaerobic digestion facility to upgrade its biogas production to biomethane. The unit cost of production of biomethane benefits hugely from the economies of scale and the gas output from smaller digesters would usually be too low to justify the cost of an upgrading plant – especially where the standards necessary for grid injection are to be met. Many on-farm plants would be remote from suitable gas grid infrastructure and so even if the gas upgrading costs were reasonable, the cost of transporting it to an injection point would be exorbitant. The Biomethane Regions project would address these difficulties from several perspectives:-

- Combining the production of biogas from several digesters and transporting it to a central upgrading plant
- Combining the feedstocks from several farms so that one digester (possibly with gas upgrading capability) caters for all of the available material
- Examining ways in which upgrading costs could be reduced for vehicle fuel use (which may have lower standards of purity than the gas grid)
- Increasing the efficiency of utilisation of biogas that is combusted in combined heat and power (cogeneration) engines by encouraging greater productive use of the heat.

The red pipework and green "box" on this plant in Styria is kept busy dumping unwanted heat from the combined heat and power system (the engine) into the atmosphere.

3. Results and Findings and Impacts Achieved

3.1 New Digesters

The digesters obviously lie at the core of biogas and/or biomethane production and there clearly needed to be a primary level of activity that sought to promote the construction of these. Whilst much of the detailed outcomes are described later in the report, this section describes the activity and the statistics that tell the overall story in respect of this key part of the efficient production of renewable energy and the reduction in greenhouse gas emissions.

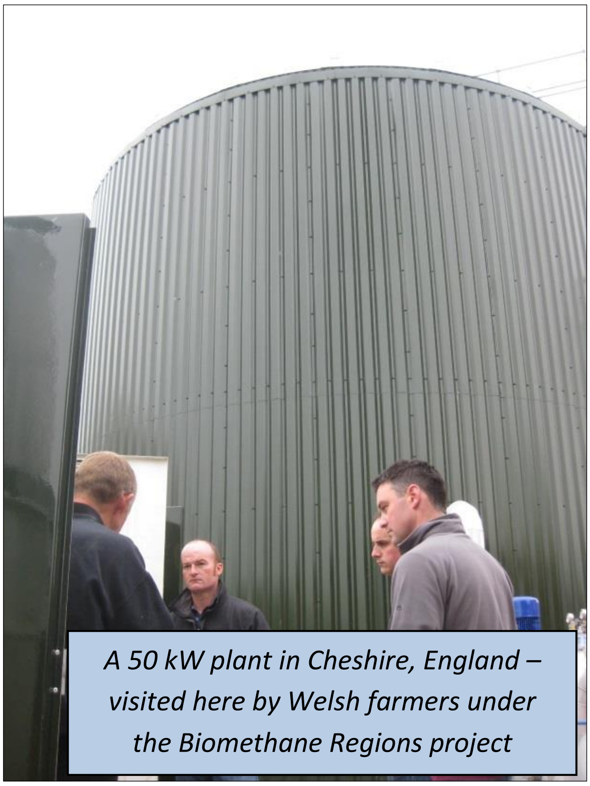
All promoting partners were seeking to see new digesters built within their regions and all had the specific task of engaging with those that might be interested in doing so. This task was easiest where the market conditions and the financial and policy support mechanisms were favourable. In the Schwäbisch Hall region of Germany, the capacity for new digesters was extremely limited due to virtual saturation of the available opportunities for the spreading of digestate. In Austria, the number of larger, often energy crop based systems, had had its influence on energy and agricultural policy and the once very positive climate for biogas had turned very flat. The Austrian partners looked to new models and the improvement of existing plants. The situation in Slovenia was, in some ways, similar to its Austrian neighbour with government policy turning away from biogas production based purely on energy crops (usually maize silage) and seeking a minimum content of "wastes" (usually manures) in the feedstock mix of new plants. Our partners in Slovenia sought to give much of the attention to the development of very small digesters and energy generation systems that are appropriate for single livestock farms. These developments are of great interest to all partners – but the Austrians have taken great interest in particular.

To the east of Austria and Slovenia the situation was quite different with a much less well developed biogas industry in both Hungary and Croatia. The Hungarian partner was able to take advantage of improving market conditions and engage with a number of prospective plant developers. Of the six potential schemes to which assistance was given, four have been constructed. They were all at a medium scale using agricultural substrates, and involved the generation of electricity via an engine. The National Energy Efficiency Action Plan for Hungary (until 2020) states that the government would like to achieve a much higher biogas potential compared to the current number. Despite this, the rate of increase of the number of the biogas plants decreased slightly in recent years – probably due to the market, including financing questions as well as the low electricity feed-in tariffs. Most of the plants have been implemented with agricultural support, with a particular focus on the treatment of liquid manure.

The Croatian market was still very slow and the partner there had to work hard to generate interest. Despite the difficulties, six opportunity studies have been completed and there is a reasonable likelihood that one or two might proceed in the medium term.

The Swedish partner worked very deliberately on the task of utilising the available feedstock to generate as much gas as practically possible for biomethane production. This feedstock was largely based around "wastes" and thus, in one case led to the decision to construct a "dry digestion" system. The usual system that shreds the feedstock into small pieces, and adds water if necessary, in order to produce a pumpable "soup" is known as "wet". Wet systems work on the principle that the digestion process is generally continuous because a little fresh feedstock is added frequently and a very similar quantity of digested material is removed simultaneously. A dry system digests higher solid content feedstocks fed either in batch or on a continuous basis. Batch feeding systems are typically associated with multiple digesters working in parallel at various stages of digestion so that the biogas produced can be more constant. The digesters facilitated by our Swedish partner were few but each had a high capacity.

The Danish partner already had developed a concept of getting farmers to collaborate. The intensive livestock industry on the Jutland peninsula has a massive bi-product of manure. The possibilities presented by anaerobic digestion to turn this problem into a sustainable success story are enormous but the farming units are often too small to take full advantage on their own. This opportunity became much more likely to come to fruition when the Danish government introduced a favourable financial regime about 6 months into the Biomethane Regions project. Many of the biogas plants subsequently assisted by our Danish partners are themselves taking manure from multiple farms and the ambitious plans to join up the biogas output from multiple digesters is described later.



A 50 kW plant in Cheshire, England – visited here by Welsh farmers under the Biomethane Regions project

The UK partners (based in the west of the UK where livestock rearing predominates) looked to take advantage of improving market conditions and the recent development of smaller-scale systems to assist potential developers of smaller on-farm systems - making use of available manures. The high level of interest has not yet translated itself into large numbers of plants being built but this is likely to improve as the Welsh Government policy shifts in a favourable direction – the situation in England has already moved to provide greater financial support even over the last six months or so.

In some ways, the French partners (particularly in western France) have followed a similar approach to the UK partners. The economic incentives to farmers to build biogas plants in circumstances where the heat output can be effectively used are quite different in the two countries but they are designed to achieve the same objective (these are described later). It is probably the availability of capital grant in France that has allowed greater success for the French partners in translating their early feasibility type advice into realised projects.

The Belgian partner did not manage to engage with potential developers during the project but the Walloon government has now resolved to seek to encourage the development of smaller-scale on-farm systems. This does seem to be an emerging trend in several of the partner regions.

The situation in respect of the financial incentives for gas grid injection in Italy changed quite dramatically during the early part of the Biomethane Regions project. The Italian partners, with their consultants from the University of L'Aquila decided to concentrate efforts on exploring the opportunities to switch the few existing anaerobic digestion plants in their region to biomethane production.

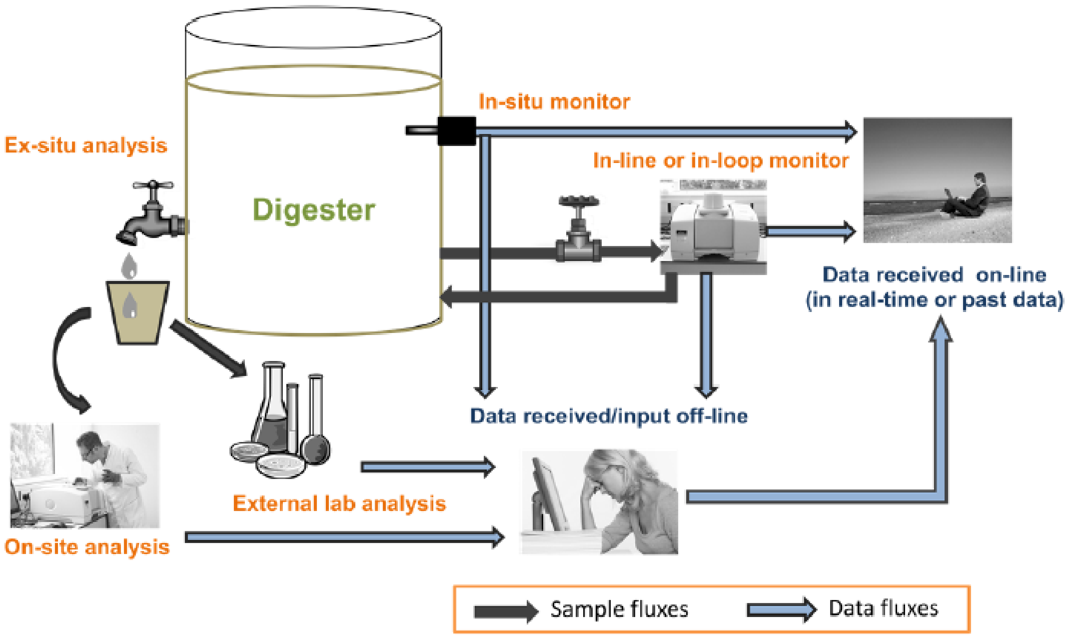
The situation in respect of the various partner regions is summarised in the table below.

Region	*Opportunity Studies completed*	*Full Feasibility Studies completed*	*Plants fully consented*	*Plants Under construction or completed*
Schwäbisch Hall, Germany	0	1	0	0
Slovenia	4	3	3	3
Styria, Austria	0	3	1	1
Croatia	6	4	0	0
Hungary	4	5	4	4
Wales & W.England	14	3	2	2
Brittany and Pays de La Loire, Fr	16	13	4	2
Rhone Alp, France	9	9	2	2
Walloon Region, Belgium	0	0	0	0
Abruzzo Region, Italy	3	3	0	0
S E Sweden	5	4	4	4
Denmark	20	14	14	10
Total	81	62	34	28

3.2 Optimisation of Biogas Production

The documents produced and the experiences described in this area of the project's activities are potentially extremely valuable. The variety of different feedstocks together with the complex and hugely variable biological, physical and chemical processes that occur within any anaerobic digester will determine the volume and composition of the gases that are produced – and the content and characteristics of the digestate. Whilst it is usually the primary interest of the operator to generate as a high a volume of methane as possible, the characteristics (especially in terms of stability and odour) of the digestate are often of great significance. The digestate is usually spread to agricultural land and well-digested material has lower greenhouse potential and normally lower odour which dissipates quickly. Poorly digested material is far more likely to generate complaints from neighbours. It will have a higher organic load which will end-up on land, and may follow with impact onto water receptors. At the same time these digestates are likely to continue to yield methane outside the plant or in open stores, which will then potentially be emitted to the atmosphere, creating significant impact. So greater stability of digestates is critical.

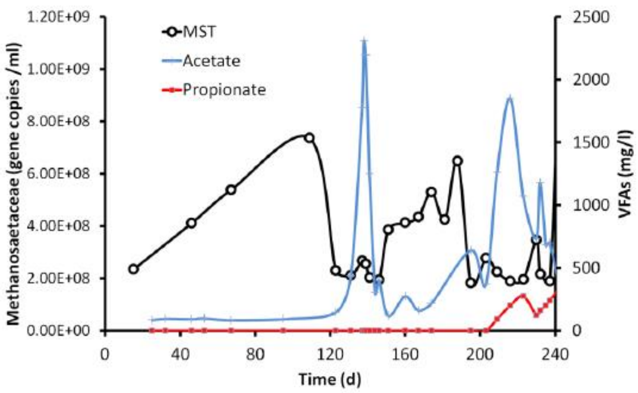
The project partners in Austria and Wales (University of South Wales), in recognition of the fact that most plant owners and operators are not bio-chemists or micro-biologists, have developed case studies and guidance notes that set out the importance of regular monitoring and make recommendations for the avoidance of, what can be catastrophic collapses, in the populations of the methanogens (the microorganisms which produce the methane). There is no shortage of things that could be monitored in and around a digester – all of which would have varying costs attached to them. A key point in the guidance emanating from this project was the recommendation of the indicators for a healthy and productive digester ecosystem. In other words the tests that could be conducted on a regular basis that would provide pointers to any problems that might be developing. These will vary between, on the one extreme, digesters with little variation in their feedstock and long retention times (the average time that the feedstock remains in the digester) through to those with varied feedstock material and a high loading rate (short retention time). The more change that is introduced into the system, the greater the likelihood of a deleterious impact upon the microbial community.



One of the figures from the guide.
Concepts/terminology used to define sample monitoring and data gathering regimes.

In order to demonstrate the principles behind the guide several live studies were embarked upon. A plant in Austria that was fed on energy crops was monitored over an initial period of operation and recommendations made in respect of its operation. The result of the intervention from Biomethane Regions was a 14.3% increase in electricity production (resulting from a deduced increase in gas production (not measured)) in 2012 as compared to 2011. This was achieved on the basis of a decrease in the amount of maize silage being fed into the digester (i.e. increasing the retention time). The high cost of maize silage and poor health of the operator led to drop in the following year but the lessons had been learned and the capacity for improved performance established.

As a contrast to this relatively uncomplicated example, a case study in Wales, performed by the University of South Wales, involved a digester receiving commercial food processing type wastes from a range of sources. The monitoring was rather more extensive and the results were even more dramatic. This diagram illustrates some of the issues highlighted. The black line indicates the population of one of the primary methanogenic bacteria whilst the blue line indicates the concentration of one of the volatile fatty acids. It can be seen that the blue line shoots up following a sudden drop in



the black line. This reduced methanogenic activity in the digester is going to lead to reduced methane yields and it was therefore important to discover what had triggered the sudden collapse in the methanogenic group. Following the intervention from the Biomethane Regions project, the plant shifted from generating at 250 kW to 400 kW – control actions used were a reduction of feed rate and the timely addition of micronutrients based on microbial abundance and diversity which have allowed maintenance of digester stability and an increase in power produced.

A third example, also delivered by the University of South Wales, this time at a sewage treatment works in Cardiff, is showing great promise with the possibility of significantly increasing energy output. The evaluation revealed two management options for the Cardiff site that could yield more than 20% of methane for the same substrate if load management was improved and potentially a further 20% of the current energy produced, if the digestate could be further co-digested with the digestate from another site. An additional 40% of electricity would equate to significant generation as the site has 4.5 MW CHP rating. Additionally, this study has identified a series of other opportunities for improvements that can be further investigated. This programme will continue on post-Biomethane Regions and there may be results from this study that could see dramatic increases in gas production at many digesters where sewage sludge is the feedstock.

The team that produced the case studies and guides have been very actively disseminating the message and have used opportunities at conferences that were specifically created by the Biomethane Regions project – as well as those that have come by invitation. The presentations at major events for dissemination to large audiences have been in the UK, Austria, France, Spain and Malaysia.

3.3 Biomethane Production

3.3.1 Trans-national Working. The value of trans-national working came to the fore during this aspect of the project. The situation in respect of the opportunities and incentives for the generation of biomethane is different in almost every country represented on the project. The opportunities to share were very significant and some of the highlights were:-

- **Presentations on the Innovative Approaches in Denmark**. The project partners received a fascinating set of presentations at a training session in Copenhagen. The directly relevant programme that was described to us was the scheme to link the biogas production from a number of on-farm digesters so that upgrading could happen at a remote location. This scheme was not only ambitious in terms of the novelty of piping biogas in this way – it was enormously ambitious in terms of the number of digesters proposed. The ambition, within Denmark, is to use electricity generated by wind turbines to produce hydrogen (via the electrolysis of water). Via a further step the hydrogen (H_2) would be converted to methane (CH_4). The Carbon would be derived from a number of sources but some of it would be the carbon dioxide (CO_2) stripped from biogas to make biomethane. The methane generated from this process would be pumped into the vast network of underground stores that already exist to store North Sea gas (also methane).
- **Visit to Emmertsbühl Biomethane Plant in Germany.** Our German partners, WFG, arranged for us

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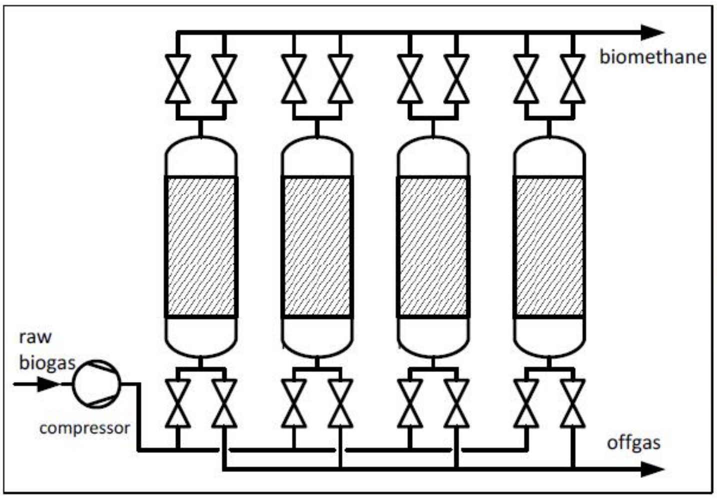
plant within their region in order that we could learn about the innovative way in which biomethane is injected into a local, low-pressure gas main that cannot, on occasions, cope with the quantity of gas being produced. When the demand for gas in the local villages is low, the pressure in the gas main rises because of the gas being injected at Emmertsbühl. When this happens, a pump at the intersection of the low pressure main with the distributor main automatically kicks in and the excess gas is pumped out of the local main. This was the first such installation in Europe – although something similar has now been undertaken in the UK and the French partners are involved in on-going studies in France.

- **Trans- National Study Tours.** Our **Belgian** partners took a party of 21 to a biomethane plant in **Luxembourg.** Our **Italian** and **French** partners undertook a study tour to the region of our **Swedish** partner. The **Slovenian** partners joined our **Austrian** partners as they toured a biomethane plant near Salzburg. The **Croatian, Slovenian** and **Hungarian** partners collaborated to take participants in their study tours to both **Slovenia** and **Hungary**.
- **Biomethane Presentations at Biogaz Europe 2012.** The event at Nantes included presentations from several Biomethane Regions partners – including one from Hannele Johansson from our Swedish partner relating to the transport fuel projects being developed. Michael Harasek from the Technical University of Vienna gave a presentation on the various upgrading technologies and the tools developed under the Biomethane Regions project. There was also a presentation about the plant at Emmertsbühl – as arranged via our German partner. Andy Bull from the UK described the issues relating to waste licensing and regulation of anaerobic digestion in England and Wales.
- **Other Presentations by Partners Outside of their Own States.** The decentralised model being developed in Denmark has been of huge interest and presentations were given in Estonia, Wielkopolska in Poland and Leipzig, Germany.

3.3.2 Influencing Policy-Makers and Politicians.

Bringing the advantages of biomethane before politicians and decision makers at national, regional and local level was an important aspect of the project in that this sort of activity is vital in the removal of barriers to implementation. Valérie Borroni from Rhone Alp Energy and Environment Agency (*second from the right in this photograph taken when the National Advisory Committee visited a biomethane plant in Lille*) played an important role at national level having been involved in the discussions/negotiations relating to the injection of gas into the grid – particularly the low pressure grid where there is limited capacity in the summer. The regional strategy developed by Austrian partner, LEV was adopted by the Regional Energy Minister as the official Road Map for Styria for the period 2013 -25. The action plan for the region that was developed by our Swedish partner really was a plan of action – and it was very much a product of long discussions and real commitment from the Advisory Committee as well as regional and local stake-holders. Severn Wye Energy Agency teamed up with the University of Glamorgan and gas grid company Wales and West Utilities to undertake a briefing session on Biomethane for key civil servants in the Welsh Government. The study tours mentioned above were, in part for policy makers and designed to show them what was possible. The Biomethane Regions project has facilitated a Regional Action Plan for the Croatian region of Zadar and whilst this has yet to be formally adopted it is still under consideration. The Danish partner has been hugely influential at both national and EU level with the Energy Minister himself inaugurating the first demonstration plant in the hugely innovative Ringkoebing-Skjern de-centalised biomethane production network (see later in the report). The National Agricultural Research and Innovation Centre were in direct discussions with Agricultural and Rural Development Agency (an arm of the Hungarian government) and subsequently prepared an anaerobic digestion study which contains the current situation of the Nitrate Directive, manure and digestate storage, nutritional values of organic fertilizers and digestates as well as the necessary compliance regimes.

3.3.3 Providing Impartial Advice Tools. Perhaps one of the most significant ways in which the Biomethane Regions project has assisted potential developers of a biomethane production facility is via the guidance and calculator tool written by the partners at the Technical University of Vienna.



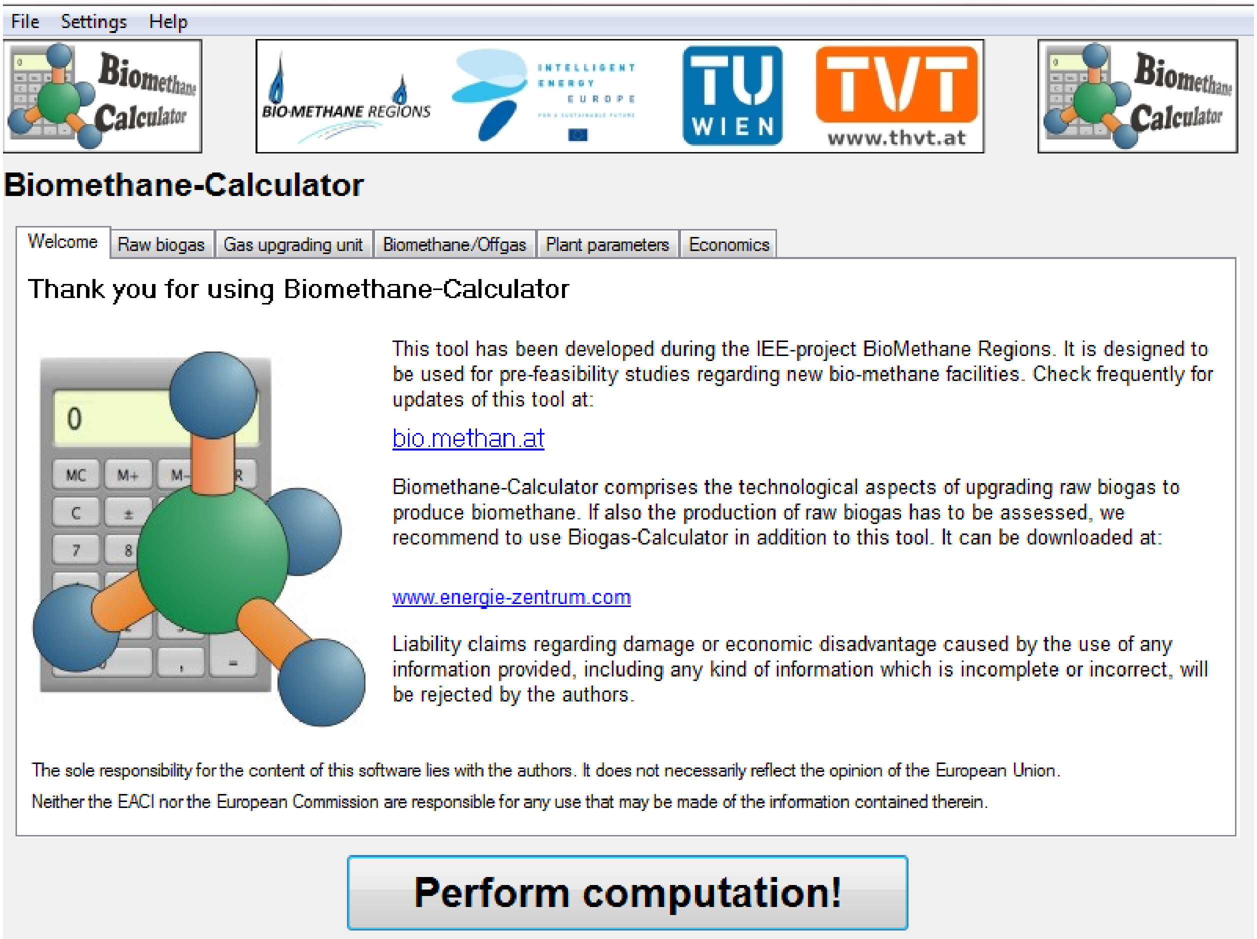
The guide commences with a description of the various solutions that are currently commercially available for the removal of Sulphur Dioxide from biogas. This is a vital first step in gas clean-up. The guide then continues with a section on each of the commercially available technologies for the separation of the carbon dioxide and methane:-

- Pressurised water scrubbing
- Organic physical absorption
- Amine scrubbing
- Pressure Swing Absorption
- Gaspermeation or membrane technology

The guide sets out the advantages and disadvantages of each method in as impartial manner as possible – with the intention that the reader can fit the most appropriate equipment to the particular circumstances in question.

The final section of the report examines the issue of "off-gas" – the carbon dioxide rich gas that is usually unwanted. Because the separation techniques are not perfect, some methane will inevitably remain in the off-gas and this should not be released to the atmosphere as it is a very powerful greenhouse gas. Burning the methane in a flare is one possible solution – but this would, ironically, not be possible if the concentration of methane in the off-gas is too low. This conundrum is discussed and solutions suggested.

As a very valuable follow-on from the guide came the calculator tool.

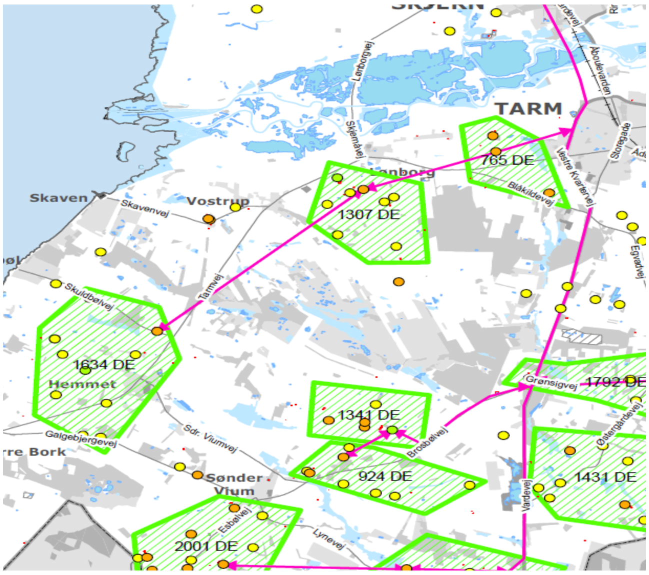


The calculator uses data in respect of the raw biogas that can be gained via the calculator developed under the Biogas Regions project that preceded Biomethane Regions. Armed with the quantity and characteristics of the biogas that is being or will be produced, enquiry can be made of the biomethane calculator that will allow cost and other comparisons between the available upgrade technologies. The capability of this independent examination is clearly valued as the calculator has been downloaded from the web site over two thousand, seven hundred times.

3.3.4 Biomethane Installations Assisted by Project Partners

a. Knowledge Centre for Agriculture – Demark

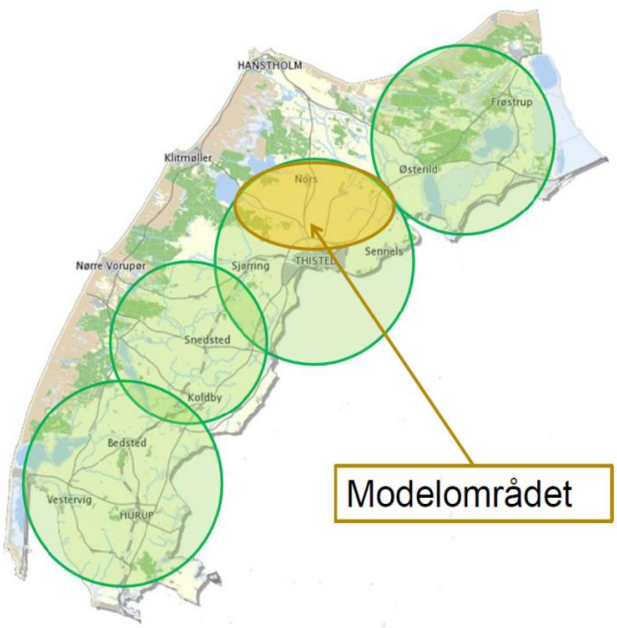
A special outcome has been shown in several municipalities planning for biogas for larger areas and utilising 50-80 % of the manure in rural districts with intensive animal production. The idea of erecting more biogas plants and possibly reaching economy of scale when collecting biogas from more than one producer and planning for upgrading and injecting in to the gas grid. The project has inspired the regional projects and the planning work in several local authorities, e.g. Ringkoebing-Skjern, Thisted, Frederikshavn, Mariagerfjord, Vesthimmerland, Skive and other municipalities. Here, the municipalities are aiming for enhanced sustainable energy and climate solutions and the authorities plan to integrate the bioenergy planning in to the municipal action plans and thus obtain a local framework of biogas activities and business development. They also have achieved to implement a coherent plan, which indicates directions for the agricultural sector and the local energy sector, which often is represented by gas grid operators.



The map shows an area of RingkoebingSkjern municipality where a biogas grid is sketched to collect biogas from several biogas plants situated in the green areas and each biogas plant is supplied by manure from 8-12 farms producing 1-3 mill. m^3 methane annually.

A biogas grid is established to collect biogas for supply to industry , utilization in CHP plants and upgrading for the natural gas grid.

The planning areas are strategically selected by the relevant municipality in order to represent existing and planned biogas plants and their supply areas. The aim is to develop an optimal biogas model covering the agricultural area and utilizing high amounts of animal manure and waste products. Transportation of slurry and manure is reduced and a common upgrading structure is made possible, when all the planning areas start to produce biogas.



The map shows four planning areas in Thisted municipality, at the north-west coast in Denmark.

Within the municipality of Mariagerfjord a scenario has been established where three large digesters supply the four largest industries around the city of Hobro. The potential is for 35 million m^3 of biogas to be collected and upgraded and used by local industries. This is seen as giving the municipality a high reputation for climate protection along with very significant local economic benefits.

b. The AgriBioMéthane Plant at AILE – France

This biomethane plant is a cooperative venture between four farms and ten individuals. It has recently been commissioned and is producing 65 m^3 of biomethane to the grid with Pressure Swing Absorption as the chosen method of upgrading.

It was on the 30th November 2011 that AILE first met the project partners for a presentation of the project and to have information about how to proceed with the development. Cooperation by the farmers and the other associations was discussed. Information requested from the the Biomethane Regions project was obtained and transferred.

On 27th June 2012 a new feasibility study was presented to local politicians for a decision in respect of a possible grant. AILE provided technical expertise before and during the grant application process. The partner also assisted with public dissemination events about the project.

It was on the 9th December 2013 that the injection point into the gas grid was inaugurated.

AILE is supporting further biomethane production facilities that are well progressed – including one, relatively small plant, that will produce biomethane fuel for vehicles.

c. **Energikontorsydost and Biomethane Vehicle Fuel**

Sweden is a relatively small nation in population terms but large when measured in area. It already has a very low carbon electricity supply and its buildings are generally well-insulated with low-carbon energy sources for heating. By far the greatest challenge to the reduction of carbon emissions lies in transport. The decision has therefore been to concentrate its efforts relating to anaerobic digestion towards the production of biomethane for road transport. Unlike Denmark, there is little opportunity to use the gas grid as a storage medium for the biomethane (because there is a very very limited gas grid network in the country) and there is therefore a constant requirement to find as close a match as possible between supply and demand. This has required the Swedish partner to work really hard on stimulating demand as well as promoting supply and this has been largely achieved by work in partnership with the private sector, local government and public transport operators. The result of the huge effort in south east Sweden has been the construction of four large biomethane plants and the construction of a public biomethane/natural gas refuelling station and a private one for buses in Växjö. There are currently 38 buses in Växjö with the eventual capacity at the re-fuelling station catering for 50. A second public refuelling station will be completed at Alvesta in the near future. The circumstances in Sweden might be rather different to most other countries but the story of the conversion of a significant proportion of the road transport to run on compressed or liquified biomethane or natural gas is never-the-less inspirational. The work under the Biomethane Regions project in south east Sweden is part of that story.

Left. Treatment of food waste at the VMAB dry digestion plant. Co-digestion of household waste and gardening waste. Production target 22 GWh/yr. of biomethane Below.The Växjö bus filling station. Below left – our colleague Hannele Johannsson filling her own car with Biomethane.

d. Regionne Abruzzo, University of L'Aquila and Upgrading Demonstrator

The regional government in Abruzzo has teamed up with the Engineering faculty at the University of L'Aquila to design and install a demonstration gas upgrading facility at an existing biogas plant in their area. Whilst the cost of the plant itself will be met by the owner, the input of the university will be sponsored by the Region. The plant will be using "membrane" technology and should be moving ahead in the very near future. This move to gas upgrading has only really become viable since the final approval in December 2013 of new legislation in Italy relating to the encouragement of the injection of biomethane into the natural gas grid.

e. Other Biomethane Projects in Development

RAEE (Rhone Alp) is supporting three biomethane production projects – all of which are progressing well. One is particularly innovative (for France and most of Europe). It is located such that it would not be practical to inject gas into the grid and there is no available heat load for a combined heat and power plant. It has been decided to follow the Swedish model and concentrate production on biomethane as a vehicle fuel. The gas would be destined for use by the bus fleet of a local municipality and would be transported to the re-fuelling depot by truck. This could well be the first plant of this type in France.

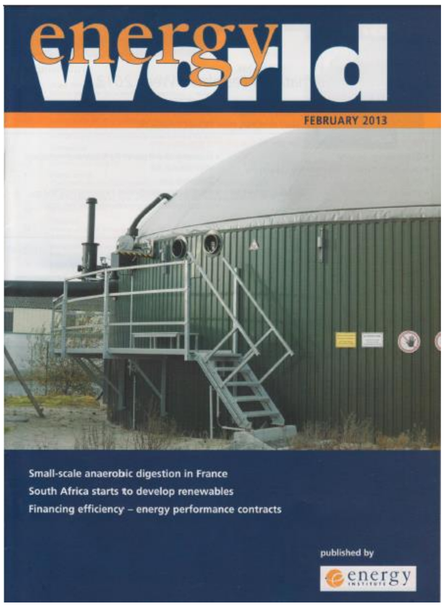
The Croatian partner has, possibly inspired by a similar plant in Hungary that was the subject of one of our published best practice case studies, undertaken a feasibility study to introduce gas upgrading at Croatia's largest anaerobic digestion plant – the sewage treatment works for Zagreb.

3.4 Increasing the Efficiency of Utilisation of Biogas

As the technology stands at present, the upgrading of biogas to biomethane (for grid injection at least) is too expensive to consider at many smaller anaerobic digestion plants. Many on-farm plants are also too remote from a suitable injection point to the grid to render such an option economic or sensible. There is always, therefore, likely to be a number (possibly the majority) of plants that will convert the generated biogas into electricity via an engine. It was the intention of the Biomethane Regions project to explore ways to encourage the greater utilisation of the heat energy that comes as part of the process of electricity generation.

The German partner investigated the economic and practical feasibility of providing a biomethane refuelling station in the small town of Wolpertshausen – based upon the planned expansion of an existing biogas plant. The study suggested that the proposal was uneconomic at this time but did provide an alternative suggestion whereby a small combined heat and power system, running off gas piped from the fairly remote biogas plant, would provide heat to the local district heating main which is currently supplied with heat by a woodchip boiler only. Under the revised scenario the woodchip boiler would only be used to supply the peak demand.

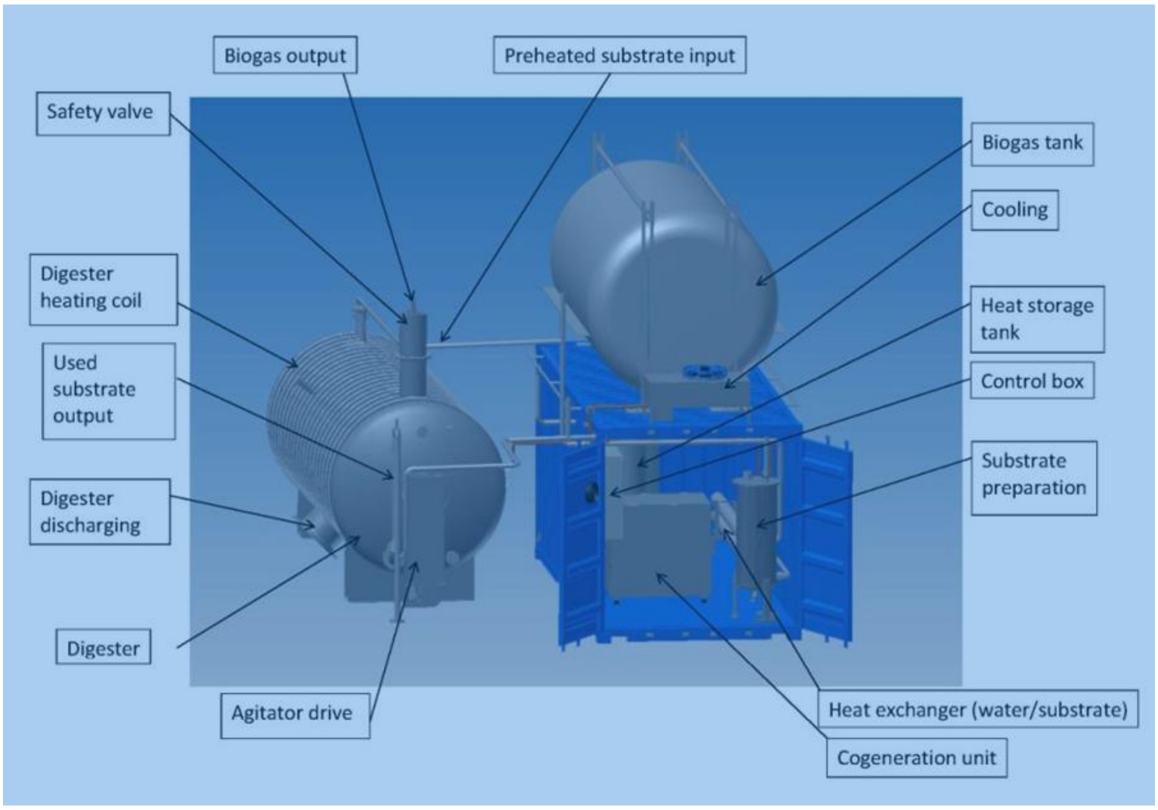
The reduction in scale of commercially viable biogas plants emerged as quite a distinct theme in several countries/regions. At the start of the Biomethane Regions project it was generally accepted that electricity generating biogas plants would not be viable at less than around 250 kW. It was clear even shortly after the project started that technology was being developed to bring down this threshold significantly. Where such units are located on farms – often deliberately remote from houses and other buildings in third-party ownership, there is usually very little opportunity for the effective use of the available heat energy. The bigger the generator, the larger the quantity of surplus heat - and with every increase in heat availability came a reduced likelihood of their being a local heat demand of that scale.



When UK partners, policy-makers and potential developers visited Brittany with partner AILE, it became clear that the UK and French governments had both appreciated the desire to increase efficiency by incentivising heat utilisation – but had approached this in different (but equally effective ways). The UK government had announced the introduction of the "Renewable Heat Incentive" that directly rewarded productively used renewably generated heat, whilst the French government was providing bonuses to the feed-in-tariff rates for electricity that reflected the proprtion of the available heat being productively used. The findings of the study tour were of such interest that the Energy Institute not only published an article of the subject – it was the cover page lead. One of the participants on the tour has since gone on to construct a biogas plant on his farm – using the heat in his pig farrowing units. Another attendee is still investigating the construction of a plant at his cheese-making centre, where he requires much heat for pasteurisation. There are now at least four companies in the UK that specialise in smaller scale on-farm plant and each has particular innovatory modifications that lend themselves to this scale. One of the issues for manure based systems is a greater need for insulation of the digester to reduce the need to use some of the heat to warm the digester contents. Three of the four manufacturers have moved away from storing the gas in flexible membranes above the digesters – at least partly so as to allow the top of the digesters to be insulated.

The two most recent opportunity studies completed by the UK partner related to farms with yet-to-constructed poultry rearing units. It is clear from such studies that these represent some of the best opportunities as they offer a high demand for heat energy – as well as a very valuable feedstock. The photograph (left) was taken at one of the farms visited in Brittany by the party from the UK. The 100 kW biogas plant was digesting (and effectively treating) the chicken litter from the adjacent rearing units and providing the heat necessary for the young birds.

The partner in Slovenia has taken the subject a whole stage further by working with commercial partners to develop a "micro" biogas plant with engines down as low as 17 kW. This is a complete contrast to the recent history of biogas development in the country where a generous feed-in-tariff structure had encouraged some very large energy-crop based biogas plants – largely utilising imported German technology. The Slovenian government had decided that this was a model that they no longer wished to follow and had introduced a minimum content of manure on farm-based systems. The Agriculture Institute took this as a cue to examine this radically different model. The containerised system with many standard components has brought down the cost of small units dramatically.



The Hungarian partner, National Agricultural Research and Innovation Centre, undertook an interesting feasibility and comparison study for a major new urban expansion planned close to Budapest. They modelled and compared the introduction of a biogas and biomass fired combined heat and power system to provide energy for the new development. The biogas option (499 kWel) came out as the preferred option – though the scheme is not yet at the stage where it is known to be proceeding.

One of the most efficient ways in which the heat can used from a biogas combined heat and power plant is for it to be fed into a district heating main which has a "base load" that is approximately equivalent to that available from the engine. Where the district heating circuit is serving largely domestic property this "base load" will be equivalent to the summer demand – which will be largely that required for the production of hot water for washing etc. In a system such as this, a woodchip (or other biomass) boiler can be installed in parallel to the biogas system heat exchanger in order to provide the space heating load for the buildings. The Austrian and Danish partners both worked on the upgrading of existing biogas plants which are used in this way.

Conclusions and Recommendations

There are a number of key underlying conclusions about the production of biogas via anaerobic digestion:-

- It is something to be supported in that it provides an indigenous source of renewable energy.
- The process is particularly valuable where the feedstocks to be used are of the nature of waste or bi-product which would otherwise be dumped, spread to land in their raw state or

aerobically composted. Where this is the case the savings in greenhouse gas emissions are increased.

- The active monitoring of a biogas plant is always going to be important in order that everything is working as it should be and that the digestion process is producing methane at optimum levels
- Where the scale of gas production justifies it and the proximity of a suitable gas grid allows it, the upgrading of biogas to biomethane is something that should be very seriously investigated
- Particularly in circumstances where there is an established network of compressed natural gas vehicle fuelling facilities, the upgrading of biogas to biomethane should be seriously considered. Any such development would usually need to be undertaken in parallel to a vehicle conversion programme – in order to approximately match supply and demand.
- Where the opportunity to upgrade the biogas is not practical or economic then the "traditional" route of electricity production via a gas engine should be rendered as efficient as possible by productively utilising the "waste" heat

Partner Fedarene put together a newsletter at the end of the project period of three years and it incorporated a brief piece from the promotional partners describing the impact of Biomethane Regions in their area. These are reproduced as they represent important perspectives:-

Benefits of the BMR project for Austria

The Biomethane Regions project was an important milestone in shaping the awareness of the region for the topic of biomethane. Especially the regional administration could be addressed in many ways. The good integration of the project into the present national and regional structures could improve its impact.
One highlight was the organisation of the Austrian "Biomethane Day" in Fall 2012, with the possibility of visiting a grid-injection plant in Salzburg and different high-class presentations. The Biogas and Biomethane Roadmap Styria 2025 is now the basis for policy and decisions on biogas and biomethane projects and is well integrated into the Energy Strategy of the region. Throughout the project, the potential of micro-biogas plants in Styria was identified and the topic is now a strategic target. The partners from Slovenia offered to visit their operational micro-biogas facility. The site visit will happen after the BMR project's end. The relevant approving authorities already stated their high interest in joining the visit.
The experiences that could be gained from the 2-year-long on-site process monitoring and optimisation form another real gain to our region. The usability of the produced monitoring guide could be proved, which makes the guide a useful tool. Many other presentations, brochures and tools make round the package.
All of this was made possible due to the projects nature of sharing knowledge and experiences throughout Europe and the involvement of the many European biogas and biomethane experts.

Benefits of the BMR project for Wallonia region, Belgium

For methanisation, green electricity production was up to now supported by the granting of a green certificates (GC) per MWhe. However these aids have known serious developments: the multiplier of the GC for the photovoltaic sector has been reduced drastically, without notice; what has undermined confidence in the system. This aid shall be reduced by a negative CO2 coefficient linked to the travel distance of the raw materials used in the digester. On average, the biogas plant's owner receives 0.8 GC per MWh provided elec. On the other hand, using decently the heat from the co-generation can also ensure the granting of an additional GC (maximum). In total, using the best heat, a biogas plant's owner can hope 1.8 GC per MWhe provided to the network. Taking into account the purchase price of electricity, income is of the order of € 127 per MWh elec. An income much lower than in neighbouring countries or in Flanders.
In 2014, an order took to assign a specific multiplier for the biogas production sector. Following this decision, it was agreed in April 2014 to revalue the aid to the sector by setting:
• For the period July to December 2014: 3 GC / MWh elec (to affect the CO2 from transport coefficient, but to decouple from the waste heat recovery)
• 2015: 2.5 HP / MWh elec (to affect the CO2 from transport coefficient, but to decouple from the waste heat recovery)
However, the total number of GC for the sector will be limited so as to avoid inflation thereof, to the prejudice of consumers. These aids are encouraging and will as soon as their effective realization of review the profitability of several projects put on stand-by at the present time. The issue of subsidies for production is however not the only key which decides the profitability of a project of biogas production. The different modes of gas (fuel, biogas injection, pure heat) are to explore on a case by case basis.

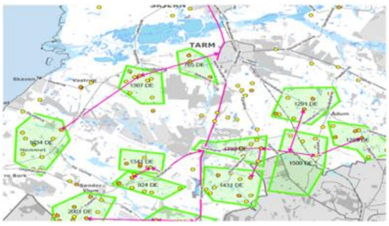
Benefits of the BMR project for Croatia

In Croatia the biogas market is still in its developing phase and bio-methane from anaerobic digestion (AD) plants have no use at all. Bio-methane Regions projects promoted the biogas and bio-methane production in Croatia analysing the reasons of the above mentioned slow development, offering best practice examples to facilitate new developments.
Several hundred people attended the events organised as project activities, 6 feasibility studies was provided to engaged investors, a bio-methane production feasibility study of the biggest biogas plant in Croatia showed the possibility to invest in bio-methane production at national level. Zadar Region Action plan was developed and is still under examination by concerned authorities.
The Plan seeks to promote efficient and effective conversion of organic wastes and agricultural substrates into useable energy and stimulate the market development of AD and bio-methane production.
Study tours in Austria, Slovenia and Hungary showed best practice examples and technology solutions not yet implemented in Croatia allowing the participants to obtain new information on procedures and investment ideas. Dedicated web-site is offering valuable information and data on EU state of the art in AD and bio-methane production reporting all the project activities and other events concerning biogas.
In conclusion the BioMethane Regions project provided valuable information and support to the

development of AD and bio-methane at national level. Regulators and investors/developers through the materials and activities realised as project deliverables obtained valuable support in development of AD and bio-methane market in Croatia.

Image overleaf right: 28th International Gas Professionals Meeting, held in Opatija, Croatia, 2013. A meeting was held there where Biomethane Regions presented a feasibility study on the possibility of biogas upgrading of a wastewater treatment plant in Zagreb.

Benefits of the BMR project for Denmark



A special outcome has been shown in several municipalities planning for biogas for larger areas and utilizing 50-80 % of the manure in rural districts with intensive animal production.. The idea of erecting more biogas plants and possibly reaching economy of scale when collecting biogas from more than one producer and planning for upgrading and injecting in to the gas grid. The project has inspired the regional projects and the planning work in several local authorities, e.g. Ringkoebing-Skjern, Thisted, Frederikshavn, Mariagerfjord, Vesthimmerland, Skive and other municipalities. Here, the municipalities are aiming for enhanced sustainable energy and climate solutions and the authorities plan to integrate the bioenergy planning in to the municipal action plans and thus obtain a local framework of biogas activities and business development. They also have achieved to implement a coherent planning, which indicates directions for the agricultural sector and the local energy sector, which often is represented by gas grid operators.

This picture shows how an area of RingkoebingSkjern municipality where a biogas grid is sketched to collect biogas from several biogas plants situated in the green areas and each biogas plant being supplied by manure form 8-12 farms producing 1-3 mill. m3 methane annually. A biogas grid is established to collect biogas for industry supply, utilization in CHP plants and upgrading for the natural gas grid.

Benefits of the BMR project for the Brittany and Pays de la Loire regions, France

Brittany and Pays de la Loire areas saw the biogas field start in 2006 but had to wait until 2011 to see first biomethane projects come to life. Of course, the national regulations were published in 2011, but Biomethane Regions project gave tools and experiences of other countries to help the first biomethane projects develop. The project developers managed to compare the upgrading technologies thanks to technology reviews, and AILE, which is in charge of economical and technical expertise of the projects, managed to compare the proposals thanks to the Biomethane Regions calculator (see end of newsletter).
During the project was also organised the first edition of the Biogaz Europe fair in Nantes, which combined partners meeting and European conferences with the presentations of several partners of BMR. The two study tours, one in Sweden and one in France, gave helpful opportunities to elected people and to project developers to discover the different applications of biomethane, biomethane for grid injection and vehicle usage. AILE made a great promotion of the guide to cooperative biogas to biomethane developments and we can expect that there will have several projects inspired from this concept in the next few years. Finally the first biomethane unit of the western part of Franc will be inaugurate in June 2014.

Benefits of the BMR project for Rhône-Alpes region, France

RAEE was able to help at national level the implementation of the biomethane value chain in France, in a technological, organizational and regulatory perspective. RAEE took part in the national “biomethane injection” working group that gathers about 30 other ex perts. Since 2011 the working group meets regularly to discuss different aspects such as feed-in tariffs, administrative procedures, projects management, studies to be carried out, specific contracts…. In that way, RAEE advocates on behalf of local authorities and project owners, within this workshop.
Sub-groups have been set up. RAEE has been involved in three of them: injection contracts in distribution networks and in the transport networks, and feasibility study to set up gas up-streaming systems. The contracts are now finalized. The work on the gas up-streaming systems is ongoing and will be finalized at the end of 2014.
At the regional level, during the project, the advisory committee was a successful tool involving stakeholders of the biogas sector (enterprises, technicians, financial bodies…). They were able to express their concerns, to share successful experiences, their know-how related to biomethane (upgrading systems, injection technologies) and also to participate in site visits. RAEE is now identified as an expert and will surely be in this position for a few more years; the objective are now the dissemination and transfer of know-how. Indeed all the topics developed within the Biomethane regions project, such as bio NGV, injection and from few LNG… have to be promoted.

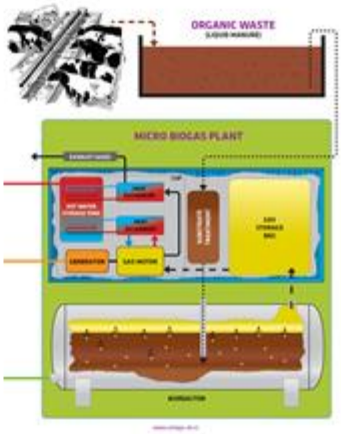
Benefits of the BMR project for Hungary

The biogas/biomethane market is expanding is Hungary. The first biogas plant has been built in 2003. Currently, the country has more than forty agricultural biogas plant and one biomethane plant, which is based in a wastewater treatment plant. Among others the spread of the anaerobic digestion technology is obstructed by a lack of knowledge. Due to the Biomethane Regions project we have achieved higher knowledge transfer among market participants and other interested parties. In addition, the technology acceptance has been also increased. During the project period, the first natural gas filling stations have been appeared for CNG vehicles which number up to four pieces. Two of them are located in the capital and the rest in the countryside. The first natural gas-powered buses are also appeared in the public transport of Budapest. In addition, several developer and biogas plant have been assisted by the MGI in the application of the proper fermentation and monitoring technology. Most important barriers to implementation for anaerobic digestion plants have been discovered and widely forwarded among others to the government. Unfortunately the first pilot project for biomethane injection to gas grid is still missing. The basics of the statutory conditions are given, but still incomplete. The right incentives and support system is still lacking. Regulation of the feeding of biogas of appropriate quality into the distribution network, there is no planned application deadline. Energy policy calculates with these measures in the long term.

Benefits of the BMR project for Abruzzo region, Italy

Regione Abruzzo joined Biomethane Regions project to go on with the very positive experience in IEE Biogas Regions project, that aroused great interest among Abruzzo citizen and technicians. A preliminary survey shows that, due to the legislative and economic framework, at the moment there were no running plants in Italy that feed biomethane into the g rid and there were few plants that use biomethane to use as fuel for its intercompany fleet. In December 2013 a new regulation has been issued on Incentives from biomethane injected in the gas grid but the Electricity Energy and Gas Authority has to define technical and economical regulation to connect biomethane plants to the gas grid. In spite of that, Biomethane topics are of great interest and IEE Biomethane Regions project succeeded in filling the lack of awareness of the product biogas/biomethane among farmers, breeders and citizen. People has been informed about the possible uses of materials such as manure, power crops and waste from agricultural industries could be resource and not waste, as they can be used to get a gas that can be used to electric energy and heat production but also could be injected into th gas grid or used as fuel in vehicles. Therefore also an economical potential. Moreover throughout seminars and technical documents technicians had the chance to get many practical and detailed information such as the different upgrading systems, the best monitoring procedures that allows also to optimize processes and already running plants in Europe. As results of this project we underline also the involvement of University that we put in touch with companies interested in Biogas plans and upgrading technologies and a further collaboration to realize a pilot plant is foreseen.

Benefits of the BMR project for Slovenia

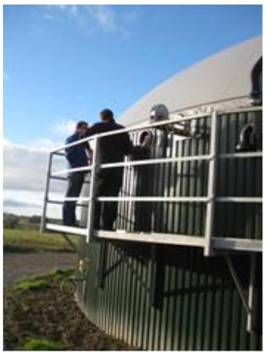


The project Biomethane Regions affected the major producers of biogas in Slovenia, who started seriously thinking about the possibility of introducing systems for cleaning and upgrading of biogas to biomethane phase on biogas plants in the future, after the expiry of life of cogeneration units. It would be possible to raise the efficiency of existing biogas plants which now producing only electricity on cogeneration units (95% of Slovenian biogas plants does not take advantage of produced heat from cogeneration units for energy purposes). In two cases, owners of large biogas plants are contemplating the possibility of cleaning and upgrading of biogas to biomethane phase and the use of biomethane for powering trucks to delivering the substrate which they need to run their biogas plants. In recent times, it has been making a major shift in the field of micro biogas plants, because we found with help of project Biomethane Regions that in the field of micro biogas plants for processing agricultural waste (manure, slurry, plant residues etc.), there is a completely untapped potential in Slovenia (currently we have not biogas plants under 100 kWe and dominate 1 MWe biogas plants). It has to be said that micro biogas plants can be placed in all parts of Slovenia, where is livestock and combined livestock and crop production. The micro biogas plants would significantly reduce the environmental footprint of agriculture and livestock and also carbon footprint of the final product (carbon footprint of food). In addition micro biogas plants would also reduce the dependence of agriculture on imported fossil fuels and mineral fertilizers and encourage the creation of new jobs in Slovenian rural areas. Two domestic producers offer on the market a micro biogas plant in modular versions and one producer also works in the field of systems for cleaning biogas. In the future mentioned producer also plan to extend offer of systems for cleaning and upgrading of biogas to biomethane phase.

Benefits of the BMR project for Southeast Sweden

Because of the lack of a gas grid in our region, the supply and demand of biogas/bio-methane have to be synchronized. To find both producers and consumers of bio-methane in districts where there is no production yet is an even bigger challenge. To overcome this barrier work has to be undertaken with different actors in the whole value chain. Moreover the high investment costs in infrastructure (filling stations) and in bio-methane plants are other obstacles. In Southeast Sweden one of the solutions is to work in networks in which different actors can cooperate in order to find viable solutions to increase the bio-methane production.
The Bio-methane Regions project, co-funded by the Intelligent Energy Europe programme, has made it possible for us to work in this kind of a network gathering together private and public key actors from the whole bio-methane value chain. The network or the Advisory Committee of the Bio-methane Regions project has thus been able to share knowledge through technical visits and study tours, often made in connection to the meetings where different challenges have been discussed and problems solved. This work has resulted in four new bio-methane plants and a regional strategy and action plan for 2014-2017 prepared in working groups and adopted by the stakeholders in the region.

Benefits of the BMR project for England and Wales



The UK is seeing a huge growth in the development of biomethane production plant with 20 units estimated to be constructed in 2014. The gas grid operators are universally helpful and the investment costs have been reduced significantly even over the last 12 months. Has any of this been as a result of the Biomethane Regions project? If we are honest, the answer is no – at least not directly. Who is to say however, that the part that the UK partners (Severn Wye and the University of South Wales) have played has not been significant in the momentum that has got us to this position. Whilst this grander scale of development is exciting, the real legacy of the Biomethane Regions project in Wales lies in manure! For one partner (Severn Wye) the emphasis has been in promoting on-farm, manure-based, smaller schemes and whilst none of those directly advised have yet commenced construction, there is real cause for optimism that some will eventually go ahead. What is for sure is that the policy framework for on-farm AD has improved tremendously and this is, in part, due to BMR activity. Manure of a different kind has been and will continue to cause excitement with colleagues at the University of South Wales as they work with Welsh Water to significantly improve gas yields from sewage sludge.

The benefits of the BMR project for Germany

In Germany, the production of biogas is already prevalent. Through the guaranteed feed-in tariff of the EEG, calculated risks were devoted to the operators and thus cleared the way for the construction of a nationwide structure. In many places the lack of heat utilization and thus the low efficiency of biogas plants were adverse. One way to increase the efficiency and the flexibility of

biogas plants lies in the mechanization. Bio methane treatment plants have been built in recent years in Germany mainly by major energy suppliers (e.g. from EnBW), because the treatment in relation to production is more expensive. For the majority of the biogas plant operators, which are farmers, this is so far due to the high cost not an option. Especially in rural areas, where most of the biogas plants are usually build, are also connections to the public gas network missing to feed in the produced gas.
Although on the one hand, despite to the already widespread use of biogas production and on the other hand, to the difficult situation of the gas processing in Germany the project Bio - methane Regions could yet cause a lot. Due to the transnational exchange, it was possible to look at the bigger picture and look at the efforts of other countries in the bio methane technology. Especially the view to Austria seems very worthwhile. Their strategy of micro - biogas plants could also grow up some potential in Germany if the legislative power works on this course. The progress in the cooperation of networks in Sweden are also encouraging in the rural areas in Germany to find also those affected people there to cooperate more and to find solutions that compensate the missing gas grid. There are still many practical examples, as well as Germany can benefit from these projects. A very important advantage is still the working with the two universities. The results of the monitoring or quality assurance report are very helpful for all plant operators. They are easy to understand and they bring measureable effects/success in the implementation. The additional costs are returned by the resulting higher yields in biogas production.
Rounding up the benefits of numerous helpful reports, studies and tools, such as the bio methane computer, which is available to all interested parties free of charge.

Key Overall Impacts

Whilst the impacts made by the project are widespread and varied, there are a few key statistics that give a very good impression of the overall effectiveness of the project activity. In the period up until the end of the project (April 2014) the project partners had assisted 28 projects that were either complete or under construction – with an investment value of approximately €94million. These will generate around 23000 tonnes of oil equivalent (TOE) of renewable energy per year - saving almost 83000 tonnes of carbon dioxide emissions.

Other schemes that have been assisted will see investment rise to almost €250m by 2020, with 90000 TOE of renewable energy generated each year and carbon dioxide savings of over 280000 tonnes.

Recommendations

The recommendations that would come through the experience gained as a result of implementing the Biomethane Regions project could include general messages that relate to the continued support for an industry and technology that clearly has much to offer, but it is perhaps more valuable to pick up several aspects of the work of this project that provide very specific areas where improvement is possible:-

- It is important that all anaerobic digestion plants are actively monitored and there are cost effective measures that can and should be implemented by all operators. Monitoring regimes should be targeted and a regular regime adopted. The recommendations contained within the report produced under this project are to be commended. They can be found on the project web site. www.bio-methaneregions.eu
- Any developer considering the introduction of upgrading facilities to produce biomethane should undertake a thorough comparison of the available options. The technology guide produced under this project is valuable and the calculator allows impartial analysis that can be tailored to the specific circumstances. Again see www.bio-methanergions.eu

There are many other documents of interest on the central project web site – many of which are available in the languages of the project partners as well as English. See www.bio-methaneregions.eu but also visit the web site of the project partners (available via links from the central site).

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