BIOSRF
Fuelling Biomethane

Fuelling the use of Biomethane for Grid Injection and as Transport Fuel

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IMPRINT

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WHAT IS BIOMETHANE, AND WHY SHOULD WE ENCOURAGE ITS USE?

Turning Waste into Fuel

Biomethane is a renewable energy source identical to “natural gas” and distributed via the gas transmission and distribution network to many businesses and households across Europe. It is made by cleaning up biogas, leaving just the methane, and then injecting it into the network.

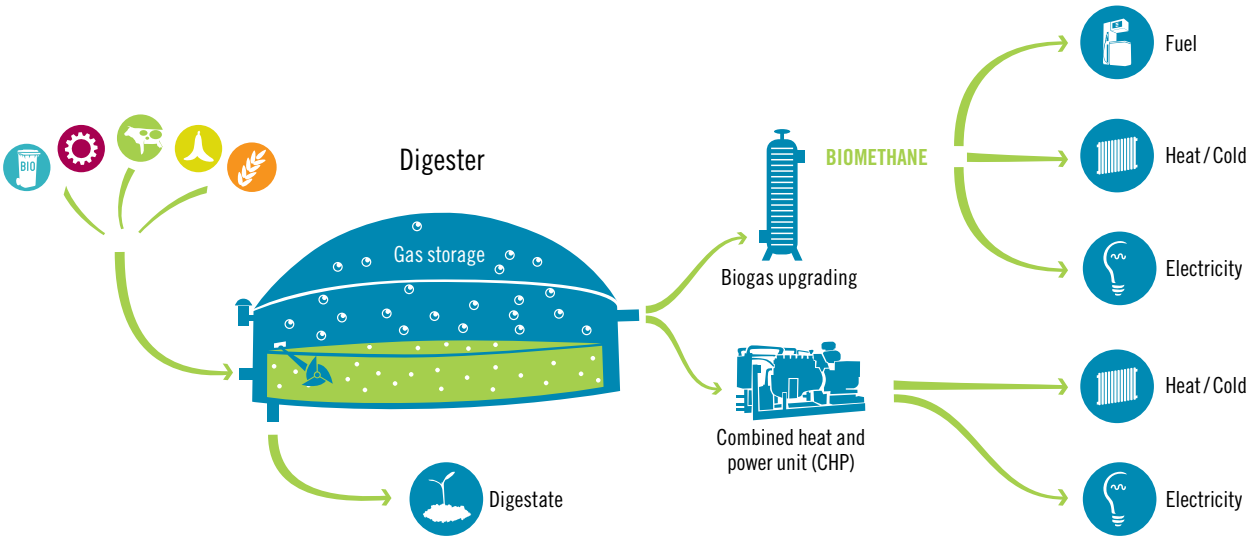
Biogas is produced by the biological degradation of biomass, primarily agricultural substrates such as manure, other agricultural by-products, cover crops (crops grown to enrich the soil), energy crops (maize, sorghum, rye, sugar beet, etc.), and organic waste from rural districts, towns and villages, such as cut grass, waste food and by-products of the food industry. These materials are fermented by bacteria in air-tight tanks, called digesters, producing biogas in a multi-stage process.

Like natural gas, the essential component of biogas that makes it a source of energy is methane (CH_4), a flammable gas. Depending on the substrate feeding the biogas plant, the methane content of the biogas can fluctuate between 50 and 65 per cent.

The second component of biogas is carbon dioxide (CO_2), which accounts for 35 to 50 per cent. The carbon dioxide (CO_2) generated in the biogas process is considered climate neutral because the biogenic material draws it from the atmosphere for its growth. Other components of biogas are water (H_2O), oxygen (O_2), and traces of sulphur and hydrogen sulphide (H_2S). If the biogas is upgraded to biomethane - with about 98 per cent methane - that biomethane has the properties of natural gas.[1]

Process Description of Production Use of Biogas and Biomethane

Credit: Fachverband Biogas e.V.



THE CARBON DIOXIDE (CO_2) GENERATED IN THE BIOGAS PROCESS IS CONSIDERED CLIMATE NEUTRAL

A Two-Pronged Fight Against Climate Change

When considering options to decarbonise the transport sector in Europe, biomethane offers a unique set of benefits and constitutes a powerful weapon against climate change. Anaerobic digestion of manure and similar materials helps avoid methane emissions, which are up to 23 times more harmful than CO_2. Without biogas technology, methane is released into the atmosphere from decomposing manure and waste, such as sewage sludge, municipal waste, agro-industrial runoff and agricultural residue. While burning biomethane does emit CO_2, the amount produced is of biogenic origin, meaning it is produced by natural, biological processes, and so it has no carbon footprint. In addition, methane emissions that arise from decomposing waste that is not processed into biomethane are avoided. As a result, the total carbon footprint is very low compared to fossil fuels, and can even go into the negative.

The use of biomethane or a blend with natural gas as a vehicle fuel significantly reduces pollutant emissions, such as hydrocarbons and carbon monoxide, compared to gasoline- and diesel-powered engines, and is also well below the levels of biodiesel and bioethanol[2]. This offers an ideal way to reduce harmful emission levels in cities, which currently cause 400,000 premature deaths a year in Europe.[3] Biomethane use in transport also has the indirect environmental advantage of contributing towards a circular economy. In addition to energy, the anaerobic digestion process that produces biomethane also supplies digestate, a valuable organic substance that can be used as an organic fertiliser in agriculture, replacing millions of tons of CO_2-intensive mineral fertiliser. Digesting waste and repurposing it for fuel is a much cleaner alternative to landfills and incineration[4].

[1] *Fachverband Biogas e V.: http://european-biogas.eu/wp-content/uploads/files/2013/10/broschre_2011_en_versandversion.pdf*
[2] *Fachverband Biogas e.V., 2011*
[3] *European Environment Agency, 2014*
[4] *Ibid.*

HOW DID BIOSURF "FUEL BIOMETHANE"?

From 2015-2017, BIOSURF (BIOmethane as SUstainable and Renewable Fuel) worked with 11 partners from 7 countries (Austria, Belgium, France, Germany, Hungary, Italy and United Kingdom) to increase the production and use of biomethane (from animal waste, other waste materials and sustainable biomass) for injection into the natural gas grid and for use as transport fuel, by removing non-technical barriers and by paving the way towards a European biomethane market.

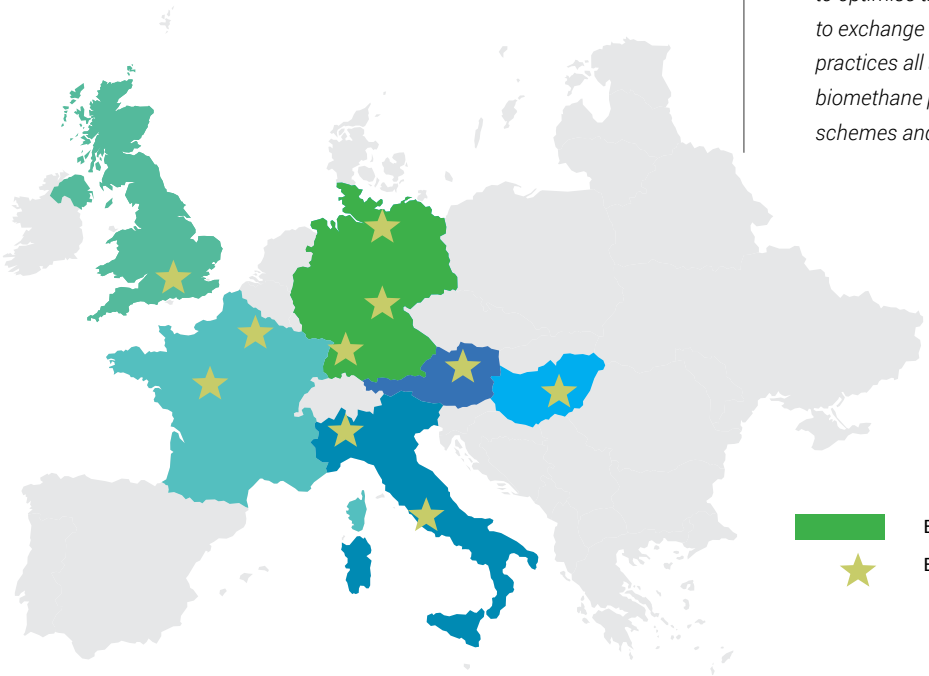
An EU-funded project under the Horizon 2020 programme for research, technological development and demonstration, the project increased the share of sustainable bioenergy in final energy consumption while looking at environmental impacts and encouraging public engagement. It boosted the volume of cross-border biomethane trade and developed better policy, market support and financial frameworks at the national, regional and local level.

The project analysed the value chain from production to use, based on the territorial, physical and economic features of different areas, such as biofuel for transport, electricity generation, and heating & cooling;

It also analysed, compared and promoted biomethane registering, labelling, certification and trade practices in Europe, to favour cooperation among the different countries and cross border markets in the partner countries involved;

It looked at traceability, environmental criteria and quality standards to reduce GHG emissions and indirect land-use change, to preserve biodiversity and to assess the energy and CO_2 balance;

Finally, it identified the most prominent drivers for CO_2-emissions along the value chain in order to determine ways to optimise these in the future, and to exchange information and best practices all across Europe with regard to biomethane policy, regulations, support schemes and technical standards.



THE PROJECT BOOSTED THE VOLUME OF CROSS-BORDER BIOMETHANE TRADE AND DEVELOPED BETTER POLICY, MARKET SUPPORT AND FINANCIAL FRAMEWORKS AT THE NATIONAL, REGIONAL AND LOCAL LEVEL

Image Credit : Pexels.com

Benefitting a Wide Variety of Target Groups and Stakeholders

First and foremost, the BIOSURF project provided politicians at the regional, national and EU-level with valuable knowledge to support them in making informed decisions for better and more sustainable production and for the use of biomethane as a renewable energy source. It also helped inform organisations and interest groups that want to increase energy efficiency, such as associations/organisations (farmers' associations, biogas associations); networks of municipalities, cities, and regions; public transport operators' associations; networks of energy agencies; the European Commission; and the European Parliament.

The project supported existing and potential feedstock suppliers (farmers, as well as sewage, wastewater and municipal waste companies/authorities) by focusing on the provision of alternative feedstock from undisputed resources rather than from a competing food supply. In addition, it helped biogas/biomethane plant investors and producers, including private and public companies, public authorities, and groups of citizens. These producers and investors were provided with viable approaches for the setting up and running of biomethane plants. Energy distribution companies, such as owners/operators of gas grids and public/private filling operators for use in transport, were also important stakeholders, as they are responsible for getting supply from the production site to customers. Finally, the project served municipalities, cities, regions and interest groups who want to set up a biomethane supply chain in their region or who are responsible for permits for biomethane plant construction.

BIOSURF'S IMPACT: THOUGHTS FROM OUR PARTNERS

Europe –

The European Biogas Association (EBA)

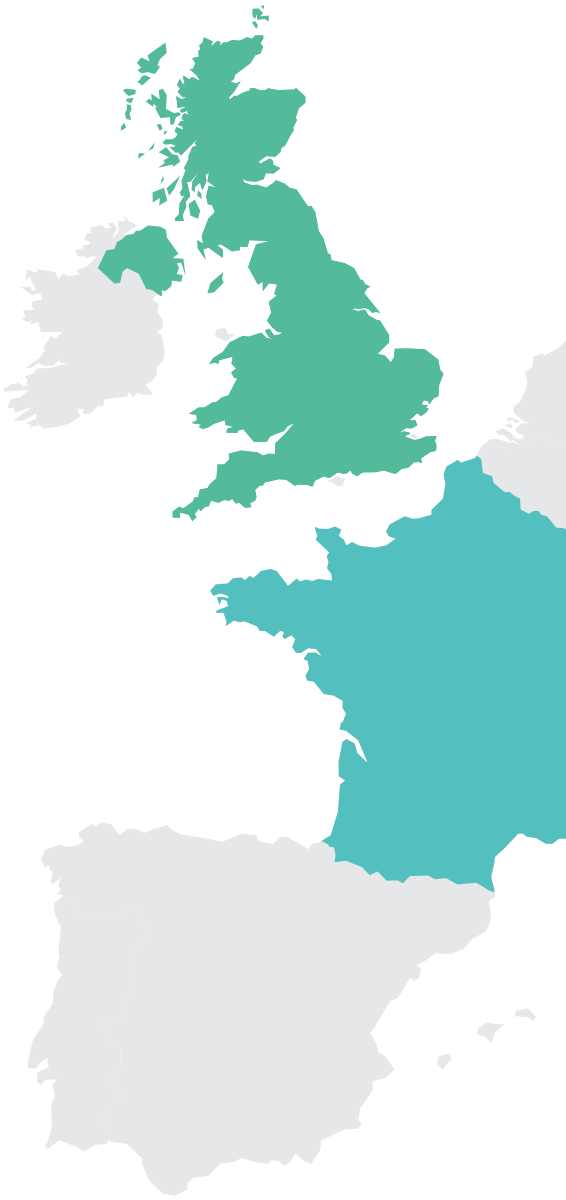
The biogas industry has experienced a number of major changes in recent years. These changes are natural answers to the continuous development of other renewable energy sources, along with changed framework conditions. Biogas upgrading and biomethane production and utilization are gradually becoming more important. The number of biomethane plants has seen a continuous two-digit annual increase. However, it is still not possible to place biomethane on a single European market, for this market does not yet exist. BIOSURF successfully addressed several obstacles to the establishment of a single market, and thus significantly pushed the limits of current development.

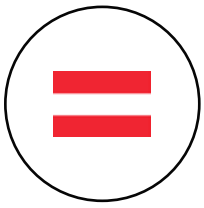
There were several reports produced, addressing various aspects and technical details of the biomethane single market. The major achievement of the project has been the creation, and support of the European Renewable Gas Registry (ERGaR), which is designed to be the cornerstone of the biomethane single market. In this regard, the impact of the BIOSURF project is unprecedented, compared to any other activity related to biomethane production and utilization.

Image Credit : Fachverband Biogas e.V.

BIOSURF SUCCESSFULLY ADDRESSED SEVERAL OBSTACLES TO THE ESTABLISHMENT OF A SINGLE MARKET

BIOSURF'S IMPACT: THOUGHTS FROM OUR PARTNERS

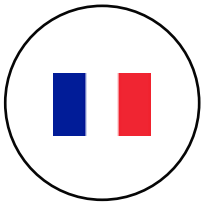




Austria AKB
Arge Kompost Und Biogas Österreich Verein (AKB)

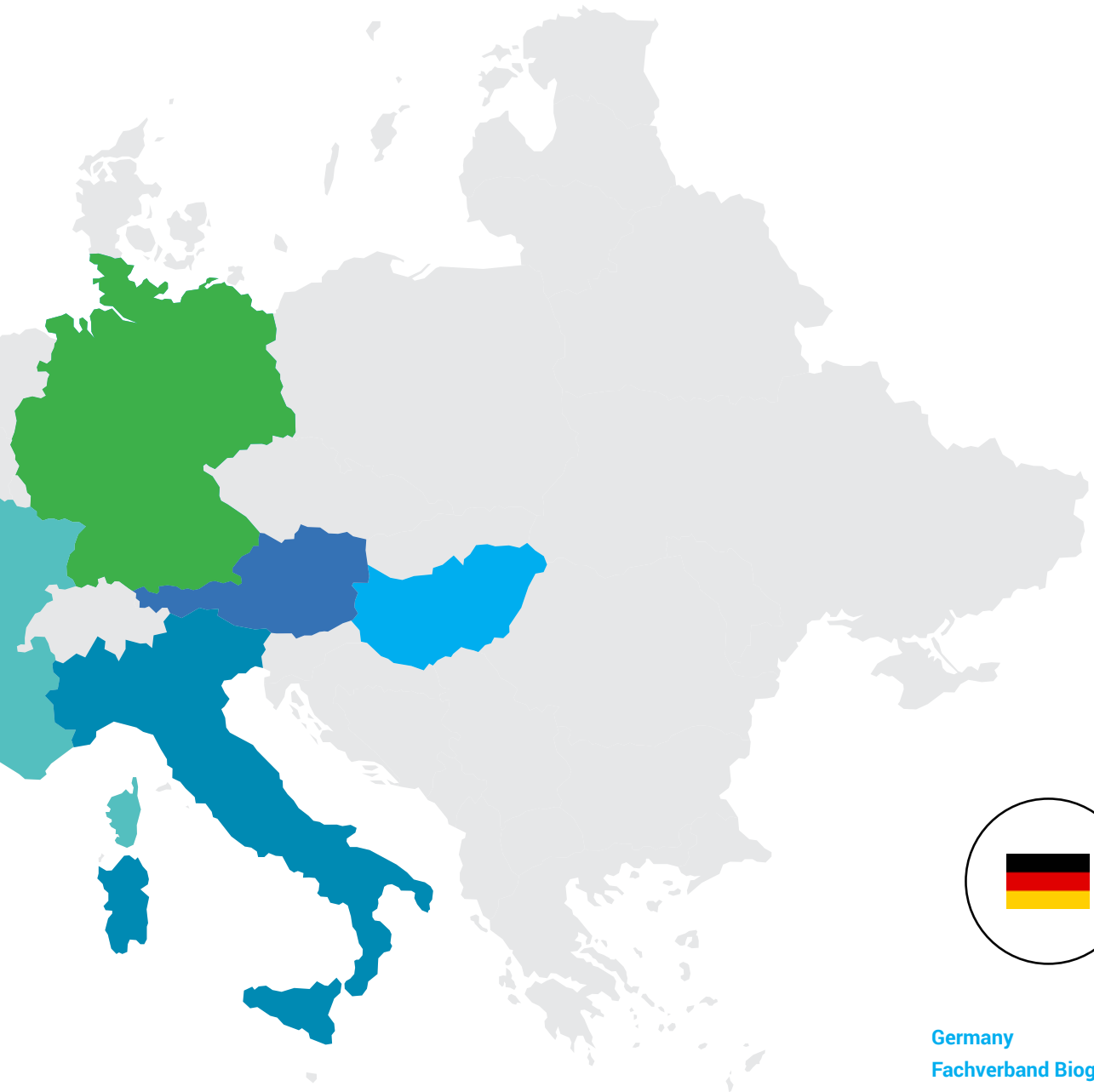
Within BIOSURF, AKB compiled relevant data on the GHG mitigation potential of digesting manure, straw, catch crops and biowaste streams. Digesting biowaste also brings nutrients back for nutrition and, in doing so, it reduces emissions from mineral fertilizer. These data formed a solid database that was brought to existing networks in the energy and environment field for further development of the biomethane sector in Austria. This spring, the Austrian natural gas sector launched their initiative to inject 2 billion m³ of biomethane into their grid. At the moment, several "Greening the Gas" meetings are taking place to further this goal and to set up activities to make it happen.

To fully develop renewables, cross border trade becomes more and more relevant, even vital. The Austrian biomethane registry is putting this on solid ground by finalising a first bilateral agreement in cooperation with the German biomethane registry operated by dena. In addition, we achieved a first virtual trade of GoO between Austria and Italy.



France
Association Technique Energie Environnement (ATEE), Club Biogaz

ATEE Club Biogaz joined the BIOSURF project at the end of 2015 to provide our European colleagues with the French vision of biomethane and participate in work between project partners. Work with our European colleagues has shown that the conditions for a single biomethane mar-

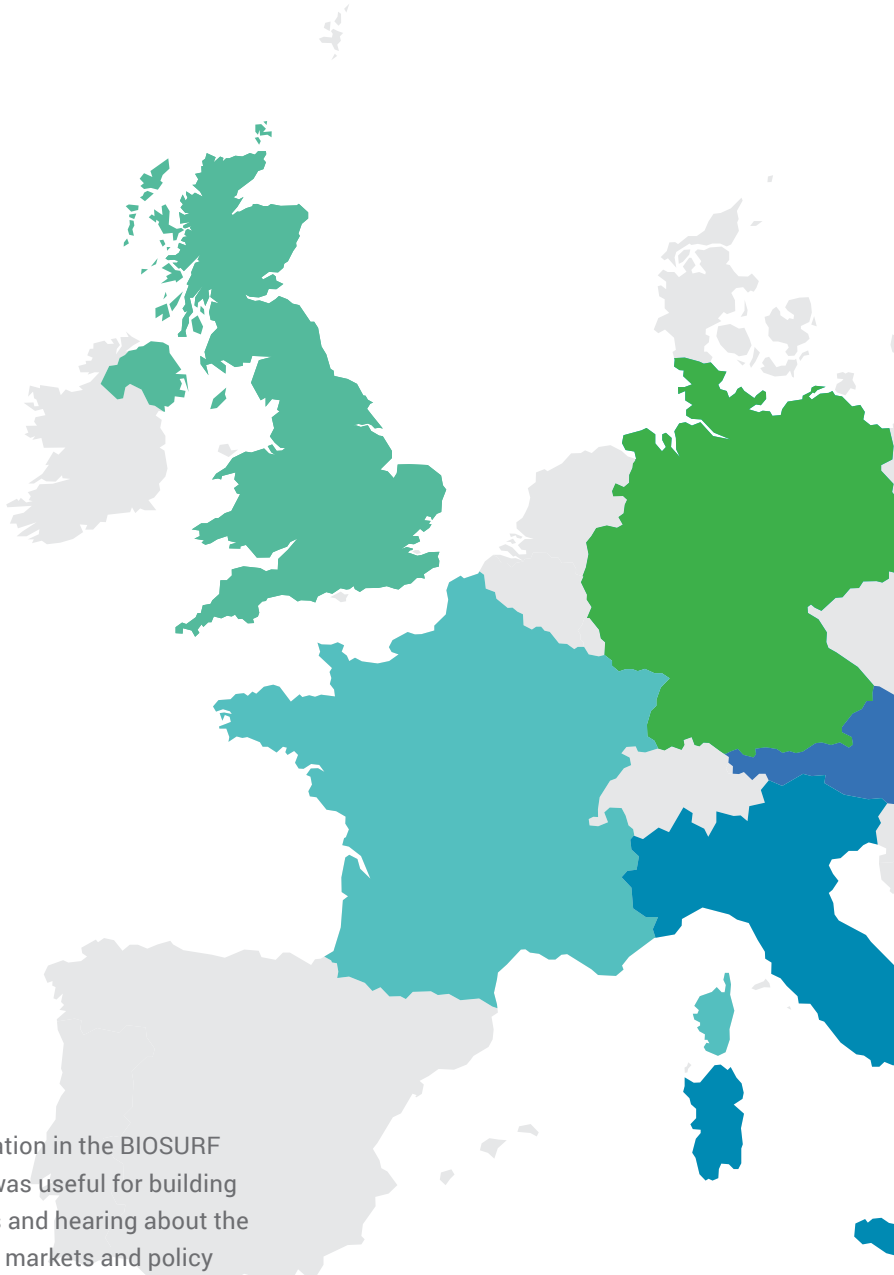


ket require the convergence of national legislation “by the top”. Through commitments to a green biomethane with greenhouse gas reduction commitments close to 100% and in all cases higher than the ambitions of the RED II directive, we can converge towards a common scheme. ATEE Club Biogaz will continue working with its European colleagues to remove the barriers to green biomethane trade, poor in main energy crops, comparable to the objectives for 3rd generation fuels with higher objectives than those of RED II.

Germany
Fachverband Biogas e V. (GBA)

Fachverband Biogas e.V. engaged in the BIOSURF project in order to enhance biomethane production, to develop the right framework conditions for biomethane trade and to spread knowledge about biomethane. The latter was achieved by a number of workshops that reached a large audience and profoundly enhanced the understanding of biomethane. The mutual exchange of knowledge within BIOSURF and the production of papers and reports contributed to the establishment of a biomethane trade platform named ERGaR which will enable biomethane trade within Europe. That is a great achievement of BIOSURF.

BIOSURF'S IMPACT: THOUGHTS FROM OUR PARTNERS

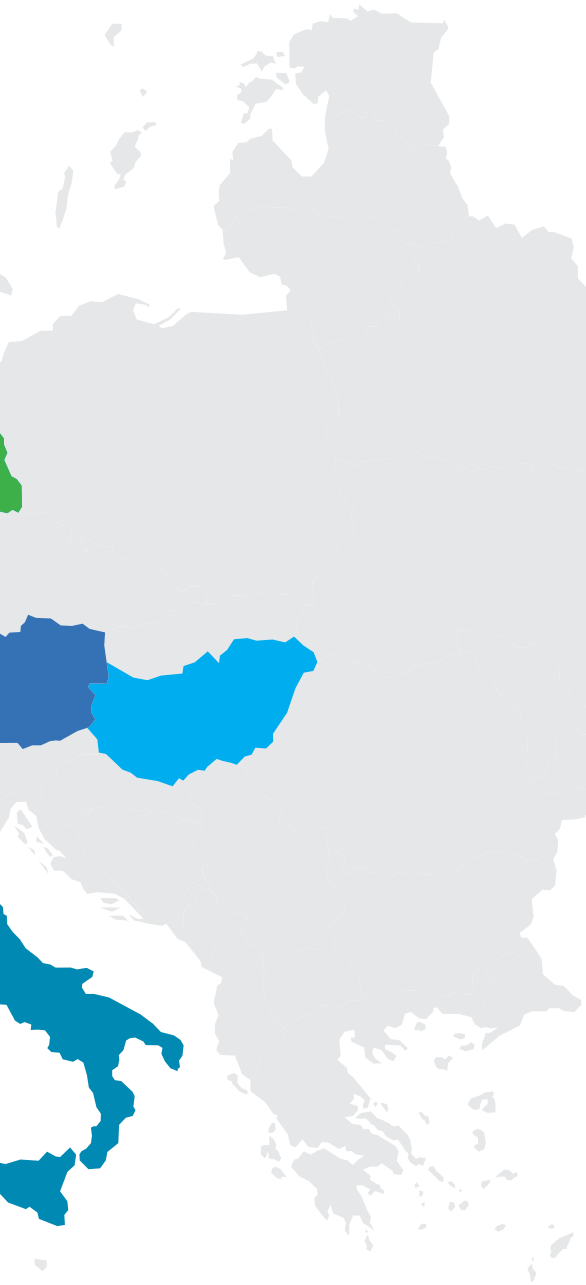


Hungary

Magyar Biogáz Egyesület (HBA)

Within the BIOSURF project, efforts were made to establish the national biomethane registry in Hungary. The preparations have not yet resulted in concrete administrative measures, while no positive business cases could be constructed for new biomethane investments in Hungary. Given the lack of sufficient political and financial support for biogas/ biomethane investments in Hungary, the interest in export deliveries is high. There is a growing expectation that an operational administrative framework for exporting biomethane into other European countries will be created. The interested Hungarian companies fully support the initiatives developed within BIOSURF, including the establishment of ERGaR.

Participation in the BIOSURF project was useful for building contacts and hearing about the different markets and policy instruments in other EU Member States. The UK is one of the leaders in terms of numbers of biomethane injection facilities, and has probably provided a useful example of what can be done for other countries. Despite this, we have a great distance still to go, and there is much we can learn from other Member States. BIOSURF supported a number of well-attended events in the UK, including a training day on maintaining healthy biology within anaerobic digesters, which was attended by over 80 plant operators.



Italy
CIB-Consorzio Italiano Biogas e Gassificazione (CIB)

With the BIOSURF project, we demonstrated the importance of sharing best practices and experiences developed in the forerunner countries to implement and improve the situation in Italy. The documents produced, the guidelines, the dissemination activities carried out by the partners of the project were fundamental for raising awareness among political decision makers on the necessity and importance of national biomethane registries. Italy is one of the most promising countries for the development of biomethane but at the moment the market is not yet established and it is still not possible to exchange biomethane with foreign countries. The main barriers are the inadequate support system and the delays on the biomethane regulatory framework.

The project activities allowed us to achieve a difficult political objective, the inclusion of a national register in the new Italian biomethane proposal, and to demonstrate the feasibility of the exchange of biomethane with foreign countries. In December 2016, a draft of the new biomethane decree was published, which solved most of the problems from the previous decree and introduced the "creation of an Italian biomethane registry", as well as the possibility to exchange the Guarantees of Origin (GoOs) with foreign countries. The registry gives the possibility of tracing biomethane origins and movements, raising the awareness of stakeholders.

The UK – Renewable Energy Association LBG (REA)

Participation in the BIOSURF project was useful for building contacts and hearing about the different markets and policy instruments in other EU Member States. The UK is one of the leaders in terms of numbers of biomethane injection facilities, and has probably provided a useful example of what can be done for other countries. Despite this, we have a great distance still to go, and there is much we can learn from other Member States. BIOSURF supported a number of well-attended events in the UK, including a training day on maintaining healthy biology within anaerobic digesters, which was attended by over 80 plant operators.

FUELLING THE USE OF BIOMETHANE IN THE EU

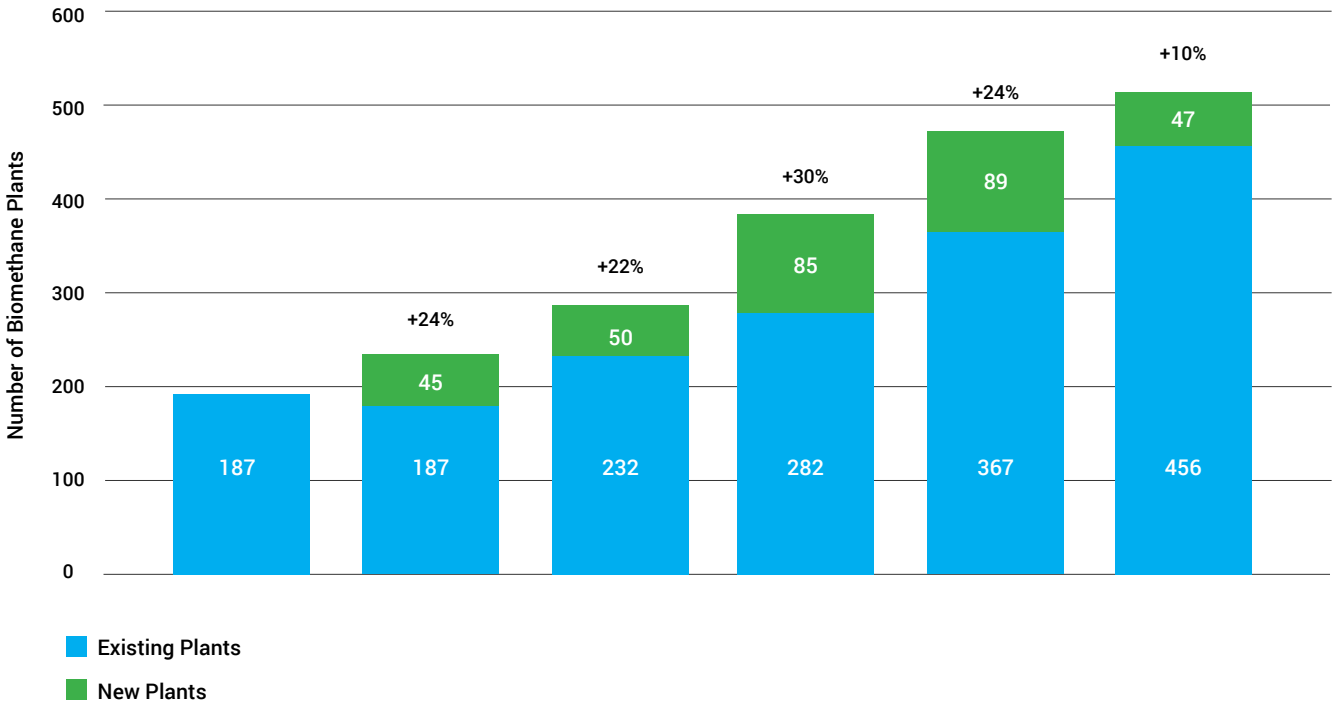
The European Context

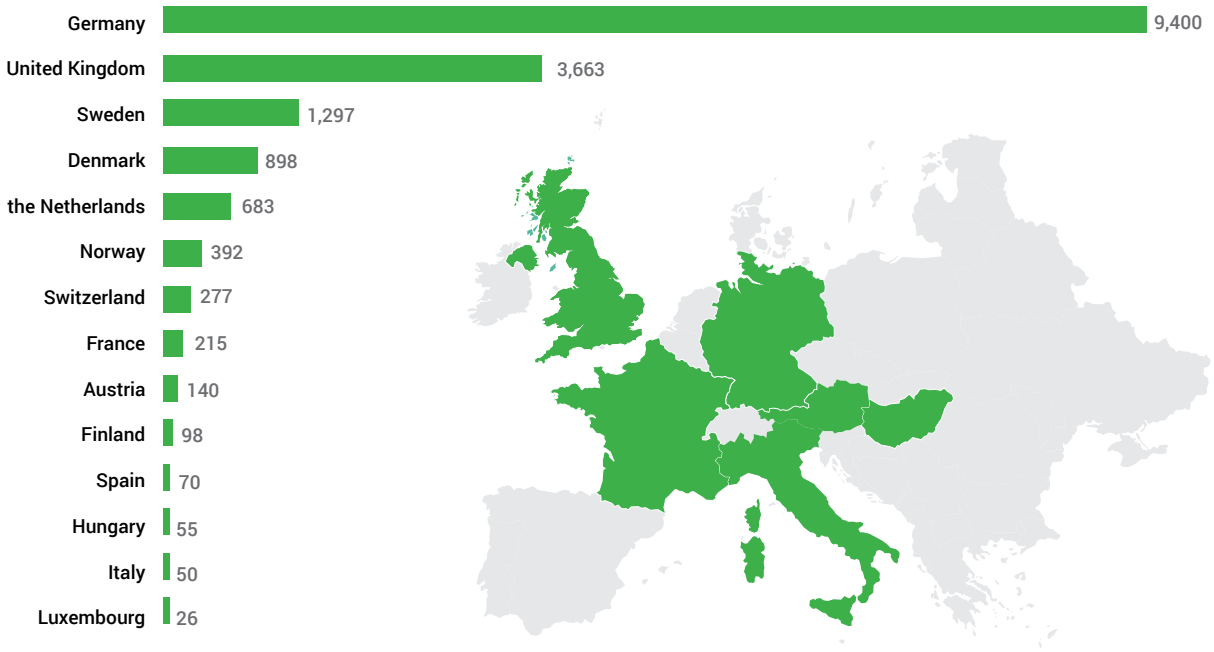
Between 2012 and 2015, the number of biomethane plants in Europe steadily increased by about 20% to 30% per year, indicating a steadily growing interest in biomethane production. The 92 plants that opened in 2015 bring the total number of operational biomethane plants in Europe to 459. While many European countries still do not have any upgrading units to produce biomethane, 15 countries now use upgrading techniques to produce it.

Germany, the market leader for biomethane and biogas, has 185 biomethane plants, while the other 14 countries have a total of 274. The Europe-wide increase described here mainly reflects growth in the United Kingdom (43 new plants), France (12 new plants), Switzerland (11 new plants), Germany (7 new plants) and Denmark (6 new plants). In most of the remaining countries considered there has been a slight increase in the number of biomethane plants, with the exceptions of Austria, which discontinued one plant in 2015, and the Netherlands, which decommissioned two plants in 2014.

Statistical Report of the European Biogas Association 2017

Credit: Deremince, Bruno, and Stefanie Königsberge - Brussels, Belgium, December 2017





Statistical Report of the European Biogas Association 2017

Credit: Deremince, Bruno, and Stefanie Königsberge - Brussels, Belgium, December 2017

THESE COUNTRIES INCREASED THEIR USE OF AGRICULTURAL FEEDSTOCKS

Agricultural feedstocks constitute the highest feedstock share in Europe because of their extensive use by Germany, Italy and the United Kingdom, three of the biggest biogas producers in Europe. The second most-used feedstock for biogas production is sewage, but this represents only 11% of all plants in those three countries. In other European countries, agricultural feedstock use is lower, being used by only 39% of the biogas plants in these countries in 2015, while 29% used sewage, 20% landfill and 12% other substrates. That said, these countries increased their use of agricultural feedstocks from 2011 to 2015, while sewage and landfill use fell.

With regard to Europe's legal framework, following the long-awaited publication of the package revising key legislation on renewables and energy efficiency, 2017 will see the European Council and the European Parliament addressing Commission proposals to prepare their positions. This will be an important opportunity to amend legislative actions on energy efficiency, renewable energy (including bioenergy sustainability), the design of the electricity market and the governance rules for the Energy Union. The debate on the Renewable Energy Directive could push towards a revision upwards of the proposed 27% EU-wide target, based on international decarbonisation goals. Sustainability criteria for bioenergy will determine the role that bioenergy plays in securing green power and green fuels to 2030 and this in turn will play a decisive part in the future uptake of biogas and biomethane.

Member States are busy drafting their integrated national energy and climate plans aimed at achieving the 27% EU target. These draft national plans in 2018 will serve as the basis for the Commission's recommendations to Member States on national objectives, policies and measures to meet common challenges or on issues with cross-border impacts.

The Circular Economy Package, consisting of a revision of the Waste Framework Directive and other sectorial waste directives, was published in late 2015 and discussed throughout 2016 within both the

FUELLING THE USE OF BIOMETHANE IN THE EU

The European Context (Cont.)

European Parliament and the European Council. In late 2017 or early 2018 these are likely to reach formal agreement at trilogue negotiations and adopt the waste package. A relevant non-legislative element of the Commission's Circular Economy Package is the Waste-to-Energy Communication published in January 2017, which highlights the importance of wastes and residues as sources of energy and provides guidance to Member States on the significance of the waste to energy sector. In addition, in March 2016, the European Commission published a proposal to revise the Fertilisers Regulation to include harmonised product requirements for organic fertilisers, thereby enabling the marketing of digestate and compost across the EU. The proposal is being considered by the EU co-legislators and it is expected that in 2017 both the Council and European Parliament will have their own positions. Both will seek a compromise in the first half of 2018, in which case the new provisions may come into force in the following two years.

The European Commission is also revising some legislation in the action plan for the Strategy on low-emission mobility, with the aim of promoting lower-emission fuels, gradually shifting to zero emission vehicles. These include vehicles using biomethane, enhancing the competitiveness of the sector. To achieve this, a first step will be to revise regulation concerning car and light commercial vehicles and proposing new provisions to support sustainable lorries, buses and coaches. In addition, improvement of procurement incentives and rules for vehicles will further prioritise climate-friendly transport.[5]

[5] *All information on the European context is taken from the EBA Annual Statistical Report 2016*

SUSTAINABILITY CRITERIA FOR BIOENERGY WILL DETERMINE THE ROLE THAT BIOENERGY PLAYS IN SECURING GREEN POWER AND GREEN FUELS TO 2030 AND THIS IN TURN WILL PLAY A DECISIVE PART IN THE FUTURE UPTAKE OF BIOGAS AND BIOMETHANE

Image Credit : Fachverband Biogas e.V.

DRIVING CHANGE IN EUROPE

Freeing the Way to Cross-Border Biomethane Trade

While biogas is mostly produced in an agricultural, rural environment, the majority of energy consumers live in cities, where energy is required for heating and cooling, for transport, and other uses. When biogas is cleaned of unwanted components, the quality of the resulting biomethane is equal to that of natural gas. Biomethane can be blended with natural gas in any proportion and can be transported through the dense natural gas pipeline network all over Europe.

The challenge is that after injection into the natural gas pipeline, biomethane cannot be technically differentiated from natural gas anymore. Nevertheless, consumers want to be sure that they are paying for a product from renewable sources, one which has not yet been sold to other customers. For this reason, we need a reliable, independent, professional administration system to give consumers confidence in the product.

EXPECTED OUTCOME: BIOMETHANE WILL BECOME A EUROPEAN PRODUCT THAT CAN BE PRODUCED & DISTRIBUTED TO CONSUMERS ANYWHERE IN EUROPE BY MEANS OF THE NATURAL GAS NETWORK

Several European countries have already established national biomethane registries to perform these functions on their domestic markets. These registries audit biomethane producers and make sure that the injected volumes are properly documented. BIOSURF sought to extend this administrative solution to the whole of Europe, enabling cross-border movements of biomethane through the European natural gas infrastructure. For example, biomethane can be produced on a big animal farm in Romania and the product can be used as renewable fuel in buses in the Netherlands, with the network of national biomethane registries reliably performing the related administrative tasks. The expected outcome is that biomethane will become a European product that can be produced and distributed to consumers anywhere in Europe by means of the natural gas network.

DRIVING CHANGE IN EUROPE

Safegarding Sustainable Raw Material Supply

Practically any biogenic material or feedstock, including solid and liquid manure, sewage sludge, starch rich crops, agricultural and food waste, residues, and organic municipal waste can be used for the sustainable production of biomethane. BIOSURF looked at the theoretical and technical biomass potential of the six BIOSURF countries (Austria, France, Germany, Hungary, Italy and the UK) within five biomass categories: starch rich crops, animal waste, other organic waste materials, residues and catch crops, focusing on current use and the best utilization pathways for limited feedstocks from both an economic and ecological perspective.

The available amounts of feedstocks were analysed in national and international studies, which showed a range of different types of biomass usable for biogas and biomethane production. The most important ones in terms of potential for increased usage as biogas/biomethane feedstocks are starch rich crops (except in France), animal excrement and straw. That said, all of the aforementioned feedstocks need to be included when discussing sustainable supply for biogas plants.

Political guidelines and regulations greatly influence the use of sustainable feedstocks, so it is essential that political decisions be based on scientifically proven facts. BIOSURF evaluated these regulations and the knowledge gap regarding sustainability criteria and indicators, at a time when most political frameworks focus on the 'greenhouse gas saving' approach. While mitigation of greenhouse gases is a key driver for renewable energy deployment, it is not the only one.

So far, the European legal framework for bioenergy sustainability criteria is provided by the EU Renewable Energy Directive (RED), which states that until 2018, biofuels and bioliquids have to save at least 60% in greenhouse gas emissions compared to fossil energy sources.

Other important legislation includes the Fuels Quality Directive, the Communication from the Commission on voluntary schemes and default values, and the Directive to reduce Indirect Land Use Change for Biofuels and Bioliquids (EU) Directive, but the most important one for the production of agricultural feedstocks is the Common Agricultural Policy (CAP). Farmers must also respect the Cross Compliance (CC) rules regarding food safety standards, environmental protection, animal welfare and land maintenance. Although this regulation is important for environmental sustainability, it does not include social impacts, which tend to be more difficult to monitor and quantify. These legal frameworks are an essential aspect of ensuring adequate feedstock supply.

Image Credit : Fachverband Biogas e.V.

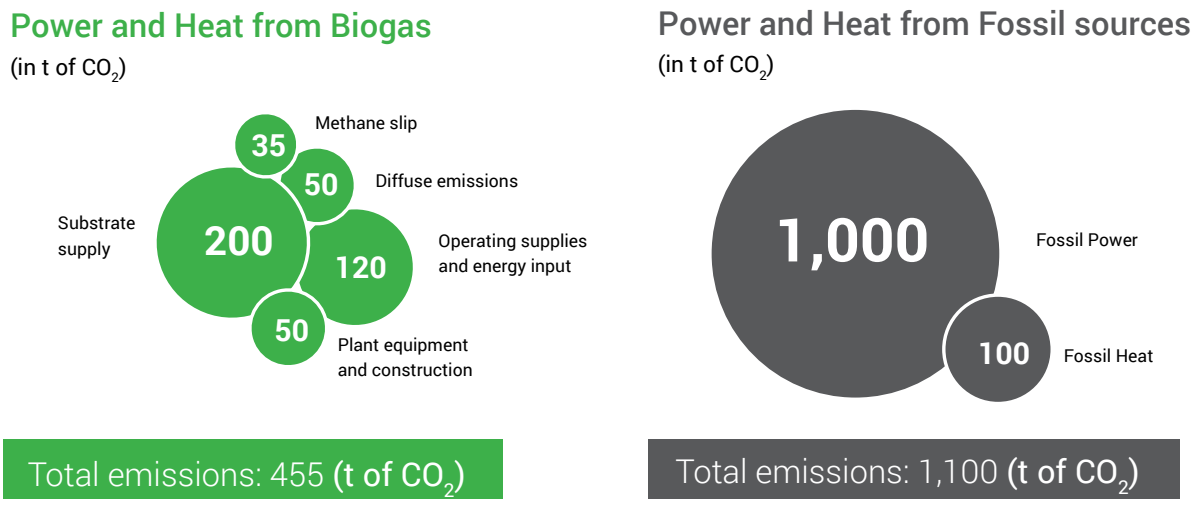
DRIVING CHANGE IN EUROPE

Achieving GHG Emission Reduction Certification

Bioenergy is a sustainable way to decrease greenhouse gas (GHG) emissions from the European energy and transportation sector. Anticipated GHG-mitigation effects from the use of these energy sources are, along with energy security and job creation in rural areas, a strong rationale for their promotion. However, the sustainability of large-scale bioenergy production has been the subject of intense debate in recent years. Some scientific publications have argued that intensified agricultural production, monocultures, inefficient biomass conversion processes and direct as well as indirect land use changes resulting from increased biomass production can negate the positive environmental effects of using bioenergy.

Greenhouse Gas Emissions of a 90-kW Biogas Plants as Compared to a Fossil Power Plant with the same Capacity

Credit: Fachverband Biogas e.V.



BIOSURF PROPOSED A CALCULATION APPROACH FOR BIOMETHANE THAT IS COMPLIANT WITH THE RED FRAMEWORK

Consequently, the EU Commission has introduced sustainability criteria as part of the RED. The fulfilment of these criteria is verified with a certification process recognised by the European Commission.

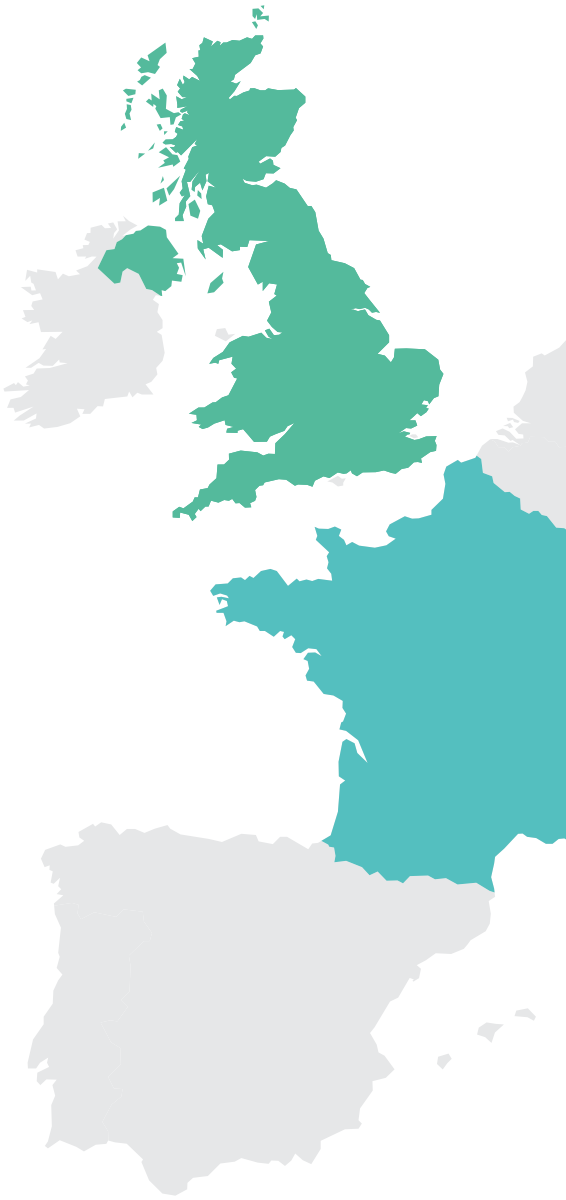
The sustainability criteria include requirements regarding the GHG mitigation potential of biofuels. Given that biofuel producers need to prove that they meet these criteria in order to promote national biofuel quota systems, the individual calculation of GHG emissions has become very important for them, as well as for certification schemes, certification bodies and auditors. While the RED focuses on renewable energy carriers for transportation, the general discussion about the sustainability of bioenergy goes well beyond that, so it is possible that the requirements of the RED, along with the character and methodology of GHG calculations, will be expanded in the future.

While sustainability certification and individual calculations are by now common practices for liquid biofuels such as biodiesel and bioethanol, calculations for biomethane are often associated with methodological and data-related uncertainties. BIOSURF sought to reduce these uncertainties by proposing a calculation approach for biomethane that is compliant with the RED framework. To do this, BIOSURF reviewed the general GHG calculation approach, along with its applicability to biomethane, and compiled the existing data and emission factors to assess the impact of processing agricultural and organic residues and waste materials. BIOSURF did substantial work on GHG emission calculation in the context of sustainability certification under the RED framework, as well as regarding the accounting of emissions from biomethane in the EU Emissions Trading Scheme (ETS).

In the EU ETS as well as in the RED framework, biomethane competes with other GHG mitigation measures and renewable energy sources. BIOSURF analysed how the price of CO_2 certificates in the EU ETS system can help close the gap between the costs of producing biomethane and fossil fuels such as natural gas. In addition, because using slurry/manure for biomethane production can significantly reduce emissions, we looked at how emission savings in the agricultural sector, due to biomethane production, can be monetarised within the EU ETS. Lastly, we calculated GHG mitigation costs for biomethane in the context of the RED/Fuel Quality Directive (FQD) framework.

By quantifying to what extent biomethane can reduce emissions, and weighing this against its production costs and how it scores in terms of sustainability, we can better understand how legal frameworks can encourage its use, leading to a healthier, cleaner and more sustainable Europe.

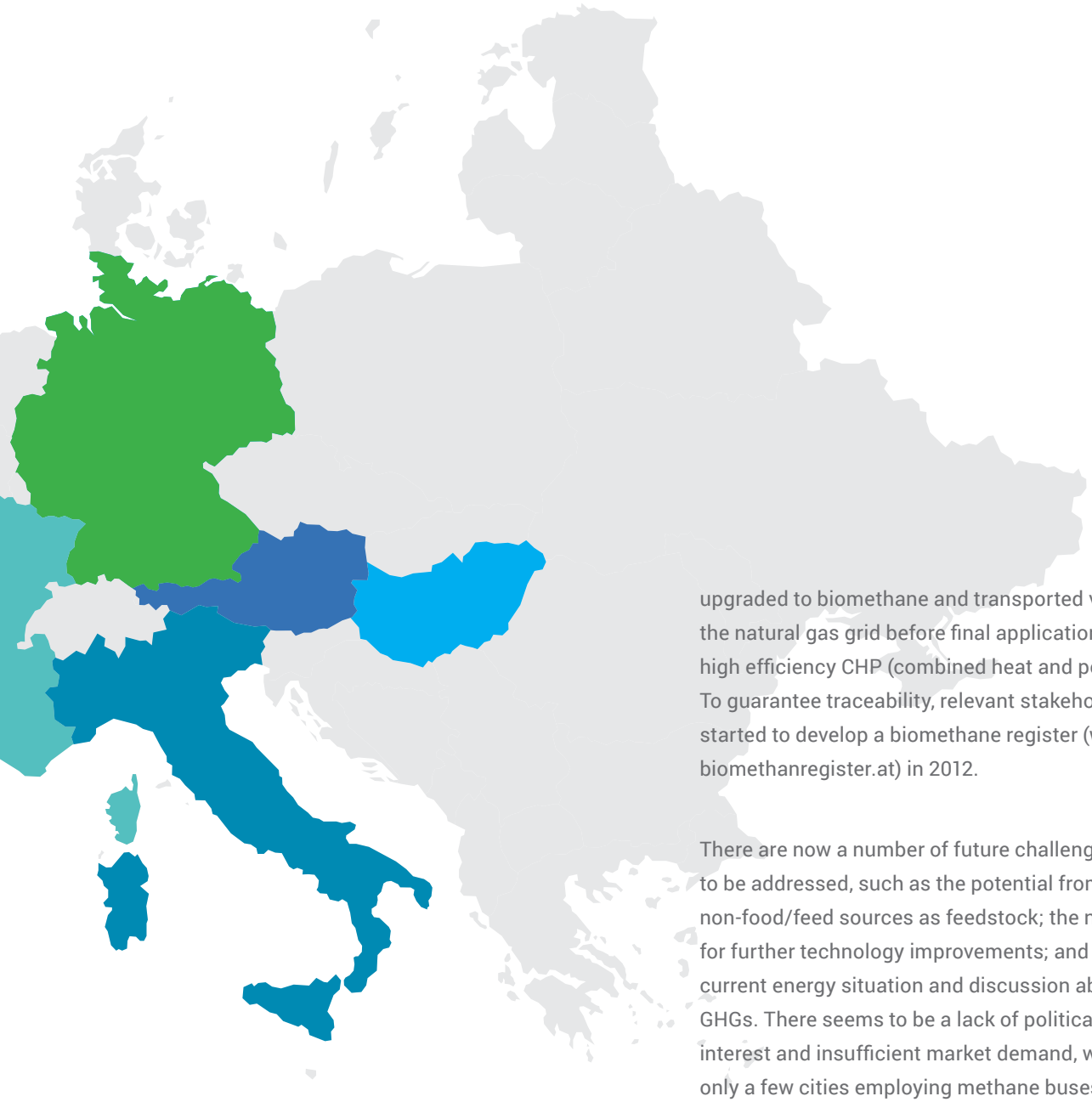
FUELLING THE USE OF BIOMETHANE IN MEMBER STATES



Austria

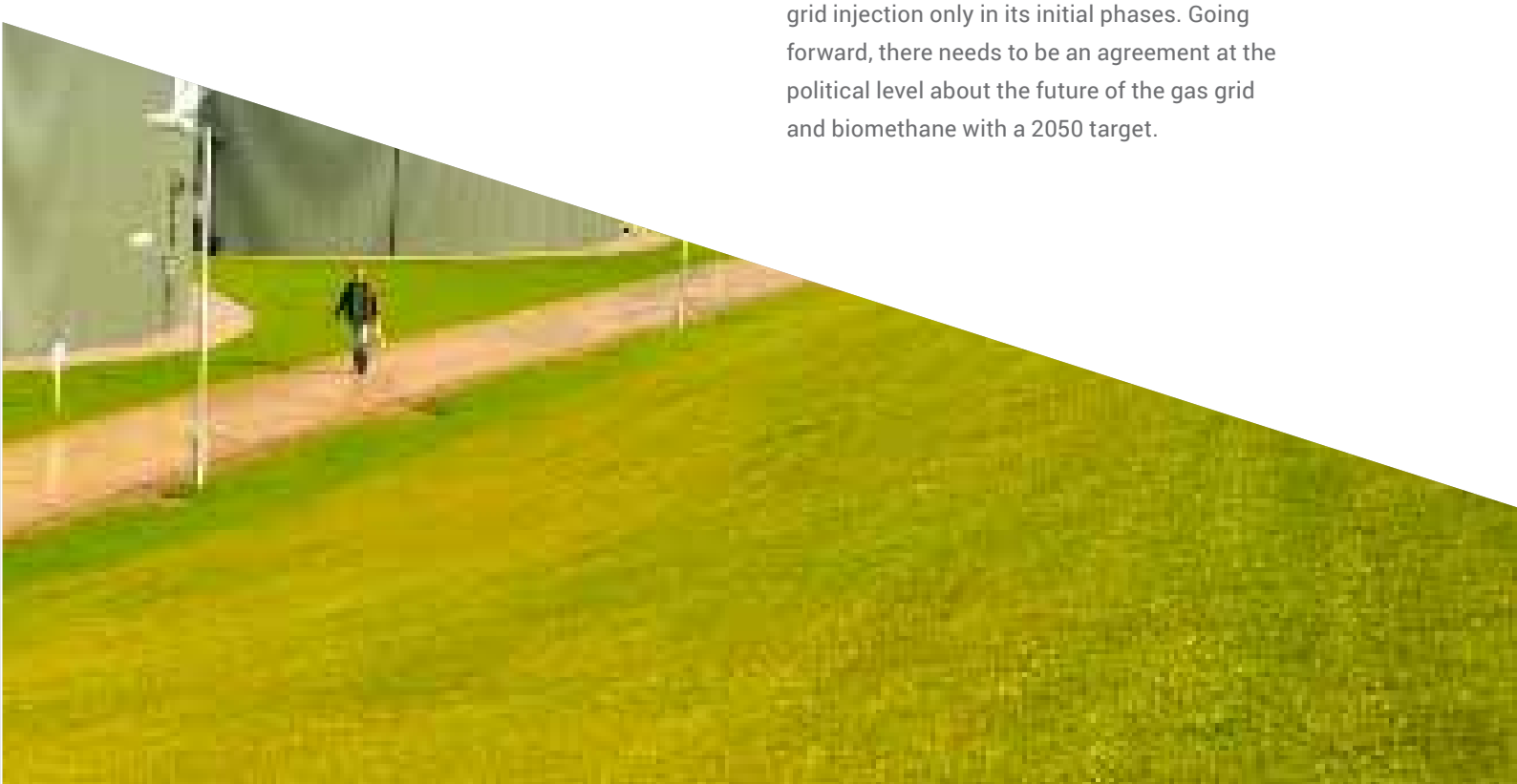
In 1999, Austria introduced a law for feed-in tariffs for electricity from renewable sources. These laws were amended in 2002 and became part of the Eco Electricity Act, or Ökostromgesetz. After this law, there were about 289 biogas plants producing electricity and heat from crops, manure and biowaste. In 2005, the first biogas upgrading and gas grid injection plants began operating. Since then, 12 biogas plants have installed an upgrading system and are now connected to the gas grid, while 3 of them also have a filling station at the plant or nearby. There is good cooperation between biogas and natural gas stakeholders, with 180 methane filling stations and around 10,000 methane cars already running.

Due to the rising prices of crops and discussions about the use of energy crops, scientists, companies and plant operators have started thinking about alternative substrates. The Ökostromgesetz sets out clear targets and feed-in tariffs for renewables, but there is only an indicative target regarding timing and no subsidy instruments for biomethane. Thanks to an amendment to the Ökostromgesetz, plant operators can also receive a bonus for electricity produced if the biogas used was



upgraded to biomethane and transported via the natural gas grid before final application to a high efficiency CHP (combined heat and power). To guarantee traceability, relevant stakeholders started to develop a biomethane register (www.biomethanregister.at) in 2012.

There are now a number of future challenges to be addressed, such as the potential from non-food/feed sources as feedstock; the need for further technology improvements; and the current energy situation and discussion about GHGs. There seems to be a lack of political interest and insufficient market demand, with only a few cities employing methane buses, a few lorries on the market and CHP after grid injection only in its initial phases. Going forward, there needs to be an agreement at the political level about the future of the gas grid and biomethane with a 2050 target.



FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

Austria

Driving Change in Austria

At the beginning of BIOSURF, one of the main barriers to the development of the biomethane market in Austria was the lack of political interest regarding climate change issues, which negatively impacted biomethane uptake. In fact, neither targets for biomethane (both for grid injection and use in transport), nor direct subsidies were foreseen.

Three years later, the situation has changed, especially in terms of increasing political interest, although the regulatory situation remains unchanged. This increased interest is the result of an electricity shortage in Austria last winter, which focussed the attention of important stakeholders on ensuring security of supply. Specifically, it was understood that biomethane could be injected and stored in the natural gas grid, and could produce a significant amount of renewable electricity when there is a lack of other renewable resources.

Within the recently amended Eco Electricity Act, biomethane injection and high efficiency CHP have become more important. Also, thanks to negotiations for the new government, there have been some positive discussions taking place on “Greening the Gas”, and it is expected that quantitative targets for biomethane will be set with the next amendment of the Gas Act. Moreover, after the Austrian agreement on Paris 2050, Austria started working on an energy plan to 2050 and the natural gas industry launched their ambitious objective to inject 2 billion m^3 of biomethane into the grid. This challenging

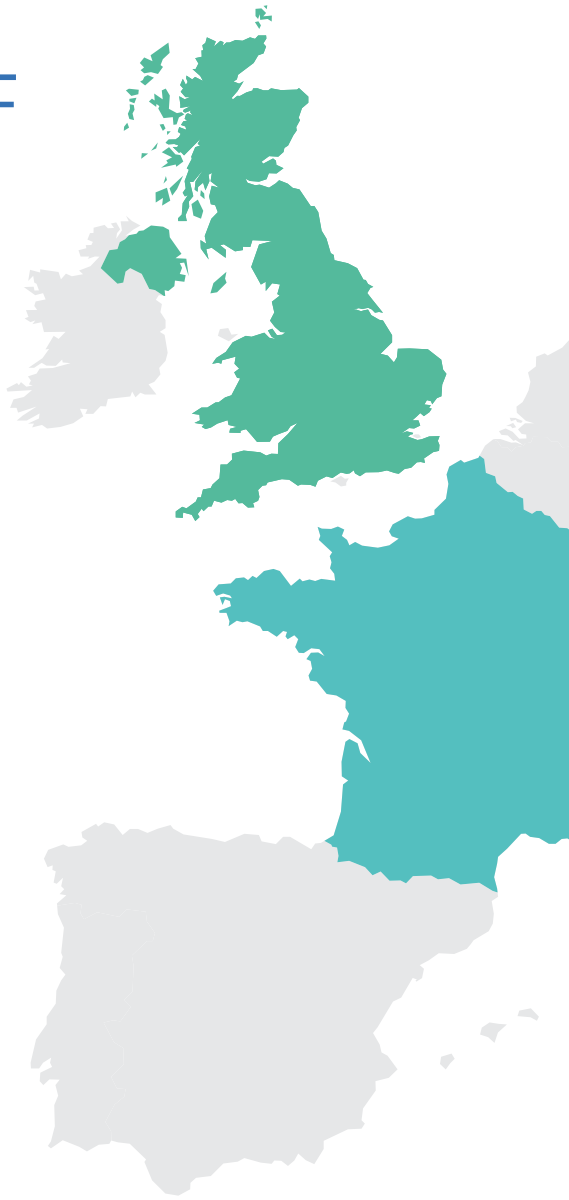
Image Credit : Fachverband Biogas e.V.

program was adopted because big cities, like Vienna, have a well-developed natural gas grid and, without a shift to renewable gas, the grid would have to be partially removed to achieve 2050 climate targets.

BIOSURF supported the dialogue between the biomethane and natural gas sectors, presenting biomethane as a solution for overcoming the problems of the natural gas sector. This dialogue has contributed to progress on CBG and CNG use in transport. At the beginning of BIOSURF, it was expected that the use of biomethane as transport fuel would be increased through subsidies or tax bonuses for investments in CBG/CNG fleets. While the results achieved fell somewhat short of expectations, over the next few years it is expected that steps will be taken towards these objectives; in fact, the natural gas and biomethane sectors will both promote this topic during negotiations for the new government.

In terms of concrete results, AGCS, a founding member of ERGaR, and UBA finalised a cooperation agreement on 20 June 2017 to exchange information on injected and withdrawn biomethane Guarantees of Origin in Austria. This step has excluded double counting for both systems. In addition, an agreement was concluded between the Austrian and German biomethane registries, while negotiations between the Austrian and Swiss registries are ongoing.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

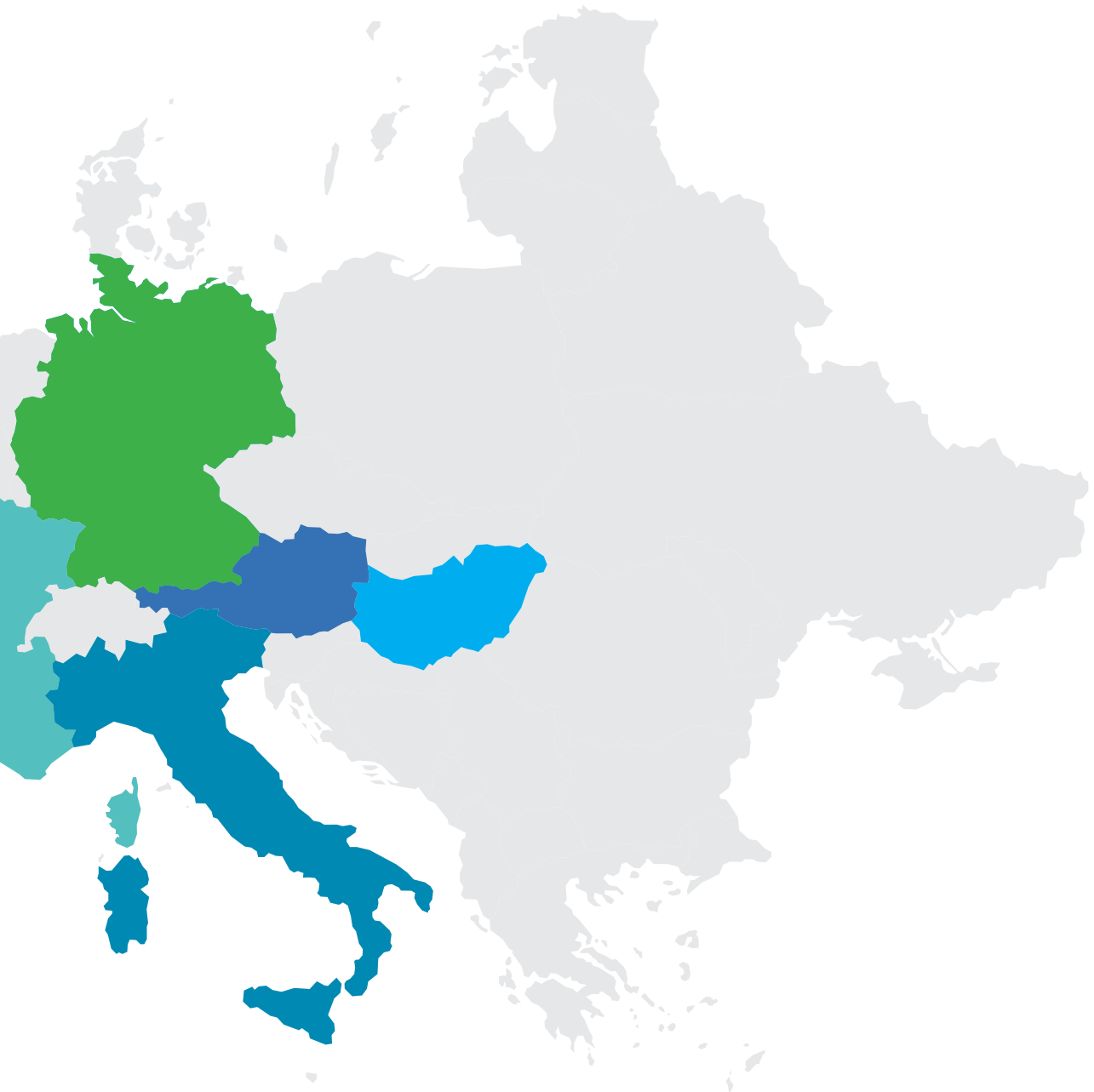


France

France is a promising market for biomethane with several strengths. Authorisation to inject into the grid has been granted since November 2011 and there are well-established rules and regulations, with registries are already in place and a strong demand for biomethane compared to other renewable electricity sources. There are 76 filling stations with 4 options: LNG/CNG/BioCNG/EcoCNG (the latter being 30% biomethane and 70% natural gas)[6], as well as a big and committed gas distribution grid operator covering the entire country. As of June 2017, there were 35 plants injecting for the equivalent of 533 GWh / year.[7] At the end of 2016, 241 projects were registered in the queue for grid injection (representing 5 TWh/year).

The government promotes biomethane through tax cuts, especially for biomethane used as a heating fuel, which has benefitted from a total exemption from the carbon tax since January 2017. However, it remains challenging to build stations and electric cars are still seen as a very competitive solution. BioCNG is mainly used for long-distance transport, as a substitute for diesel.

[6] *http://www.jcd-c.com/afgnv/map/*
[7] *GDRF, 30 June 2017*



FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

France

Driving Change in France

While progress has been made in recent years, there are still several obstacles to the development of biomethane in France. First, the very low penetration of natural gas in the transport sector has not encouraged the uptake of biomethane, though some improvements have been made and the share of NG vehicles in France has increased. Public awareness has improved, with people starting to show interest and to understand the benefits stemming from biogas/biomethane use, even if there is still a long way to go.

Feed-in tariffs for some units are still insufficient, though they have been increased for landfills. Injection has become a priority with respect to electricity production from biogas for units over 300 kW. As for non-injected biomethane, there are no feed-in tariffs yet, but ATEE Club Biogaz recently developed a proposal that was transmitted to the Ministry of Renewable Energy, and a dedicated working group on this topic has been created. There are also high costs, especially for small units, though French companies active in the agricultural AD sector are developing new components at a lower cost.

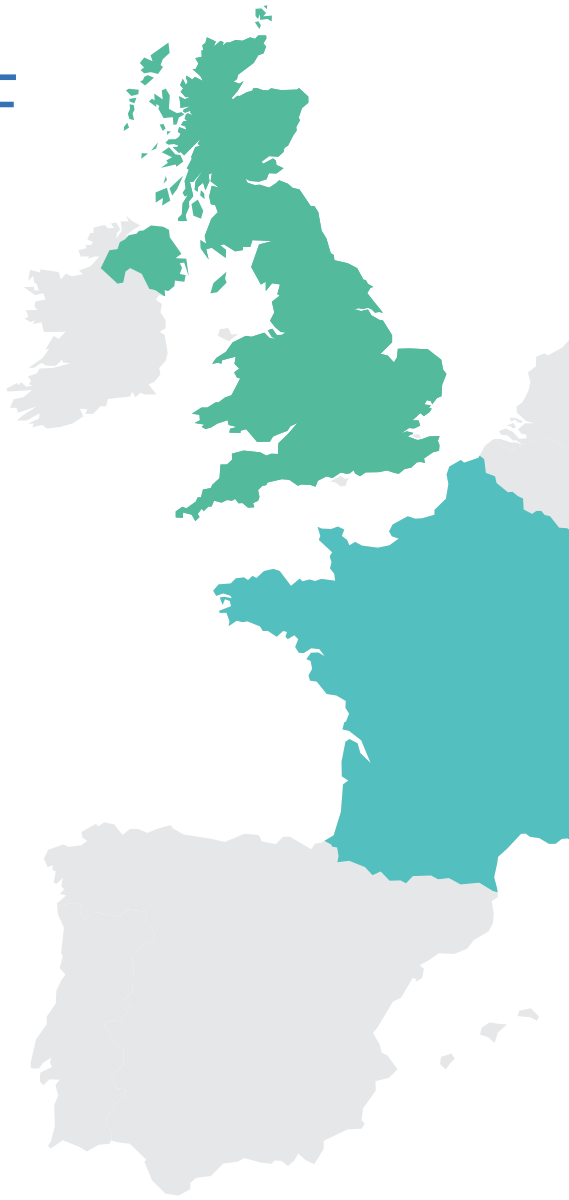
France's Energy Transition for Green Growth Law (LTECV), enacted in 2015, established an ambitious national objective: renewable gas must account for 10% of gas consumption by 2030. In addition, the Multi-Annual Energy Programme (PPE) sets out production targets

Image Credit : Fachverband Biogas e.V.

for biomethane injection of 1.7 TWh/year in 2018 and 8 TWh/year in 2023. These objectives are based on ADEME's (the French Environment and Energy Management Agency) Biomethane 2030 roadmap, which establishes potential biomethane injection at 30 TWh/year. This theoretical potential would represent a yearly average consumption of 133,340 buses running on Bio-NGV. All stakeholders in the biomethane anaerobic digestion sector, the first renewable gas production chain to date, are working together to improve biomethane production and the progressive decarbonisation of the natural gas network.

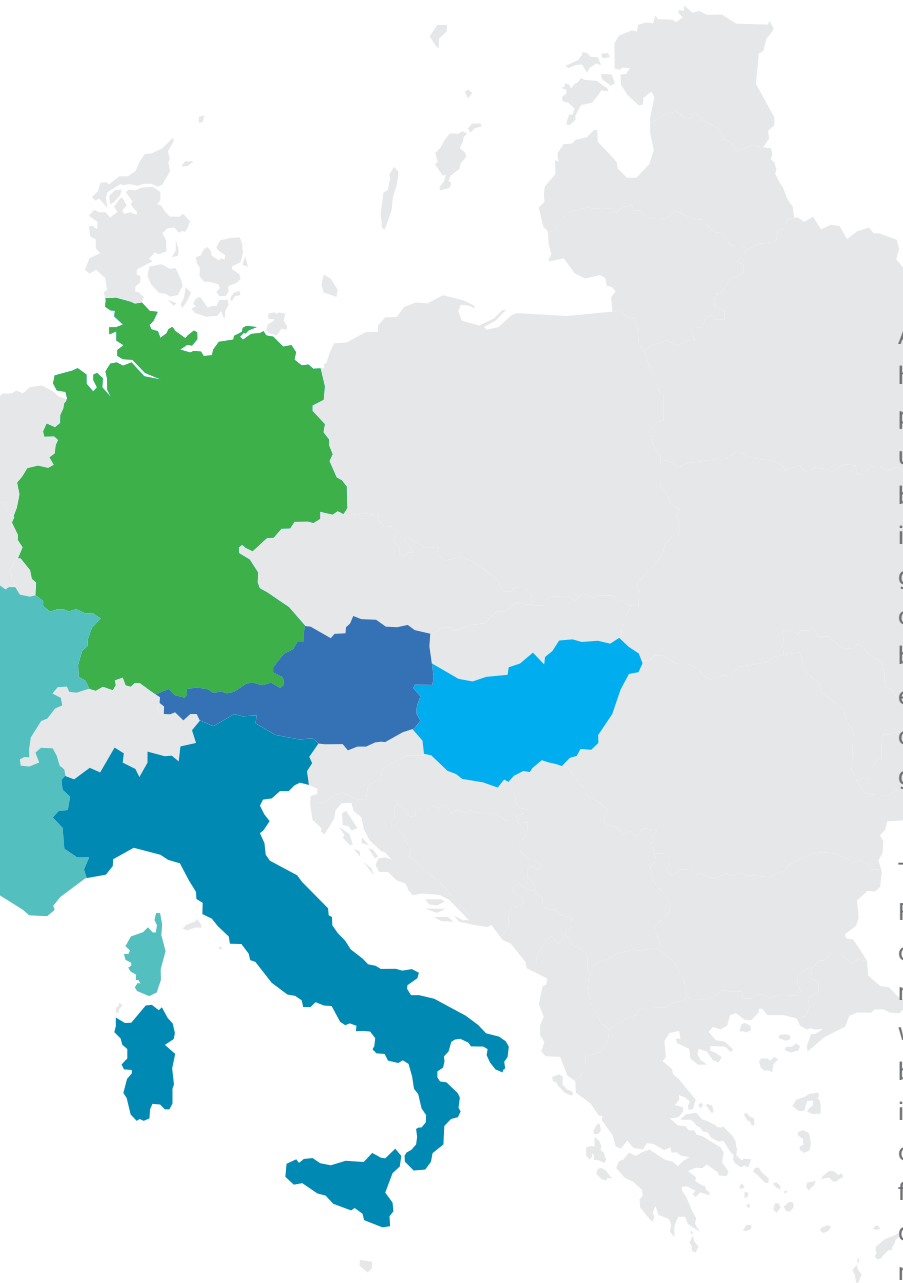
Over the last three years, much progress has been made in introducing biomethane into transport; there are currently 73 bioNGC supply points in France. Moreover, steps forward have been made in terms of cooperation between the natural gas and biogas/biomethane industries, with AFGNV (the French Association for NGV) and ATEE Club Biogaz carrying out common actions, while other associations (most of them local, like RAEE and AILE) work towards increasing public acceptance.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES



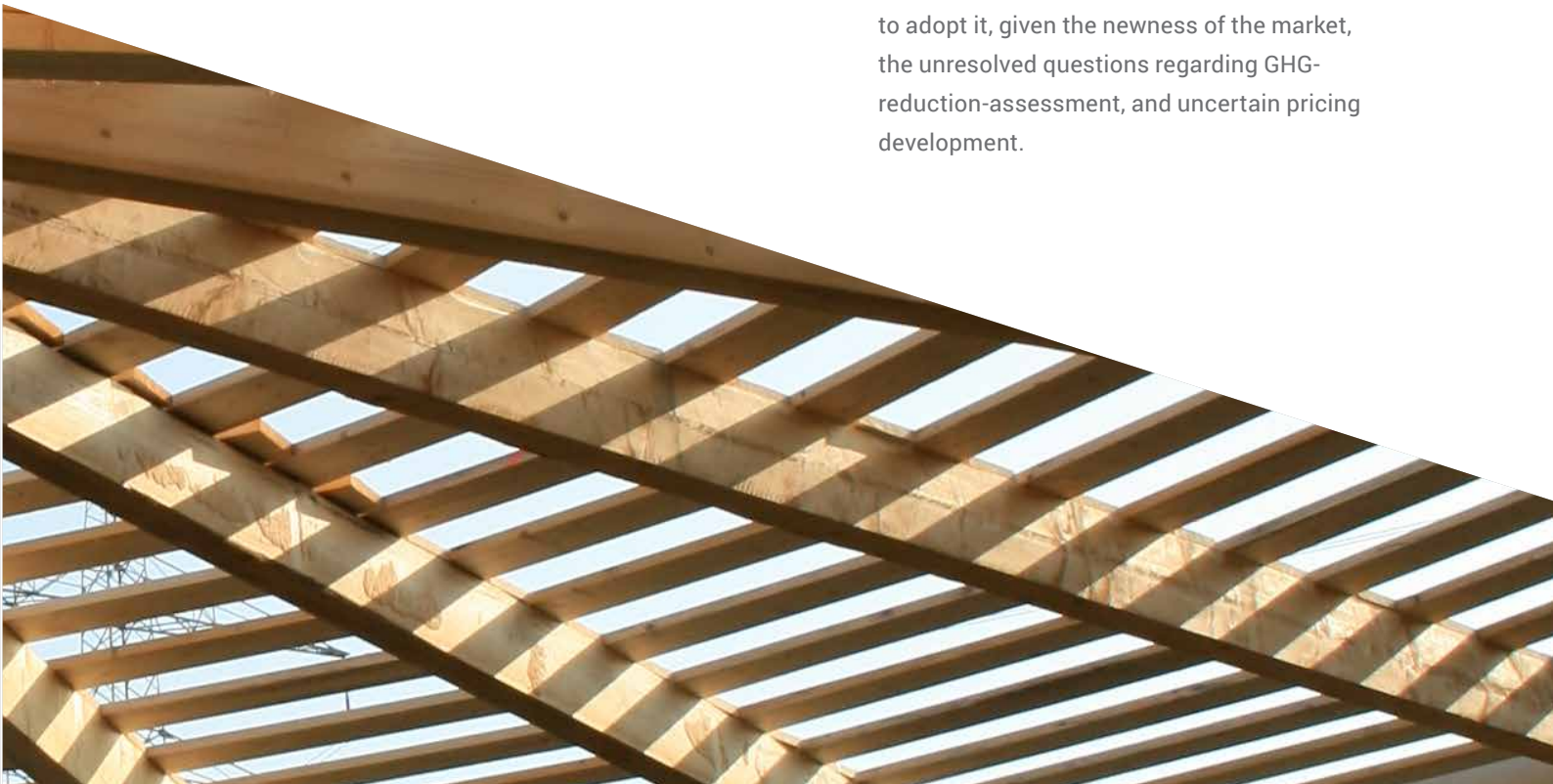
Germany

Germany is one of the leading countries in the biogas and biomethane sector, with 196 biomethane plants, around 920 CNG filling stations, around 100,000 CNG cars; and a very large, capillary gas distribution grid, with around 510,000 km of natural gas grid. The government has employed various measures to support biomethane and to develop demand in the market, with the most important instrument for the promotion of renewable energies being the Renewable Energy Act (EEG). Unlike for electricity generated from renewable energies, there is currently no guaranteed compensation per kWh for biomethane fed into the gas grid, and producers of biomethane have to market their gas individually.



Aside from its application to heat and combined heat and power (CHP), where it is indirectly promoted via the EEG, biomethane is also used in gas vehicles. Diverse regulations have been used to promote the feed-in of biogas in Germany. In 2014, however, the German government put further support of biomethane on hold, due to the relatively high costs of biomethane in relation to other renewable energies, which means that for now, the number of plants and the amount of biomethane in the grid will only increase very slowly.

The heating sector is regulated by the Renewable Heat Act which obliges home owners to implement energy efficiency measures and use renewable energy sources when they renovate. Biomethane is one option, but not widely used because it must be used in a CHP unit. For that reason, many home owners turn to other options that are a better fit. The fuel sector is regulated by GHG-based quotas; for example, mineral oil companies must prove increasing overall GHG reductions in their fuel portfolio. While biomethane is an option, the market is currently rather hesitant to adopt it, given the newness of the market, the unresolved questions regarding GHG-reduction-assessment, and uncertain pricing development.



FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

Germany

Driving Change in Germany

After several boom years (2007-2014), the biomethane market is now levelling off because the feed-in tariffs have been reduced and the bonus for biogas upgrading was eliminated. However, with the new German Renewable Energy Act of 2017 (EEG 2017), the biogas plants with feed-in tariffs ending in 2020 will have the chance to take part in tenders and win further feed-in tariffs. That said, the tariffs are so low that there is virtually no incentive for biogas producers at the moment.

Moreover, due to ineffective legislation, the heating sector is still undeveloped regarding the use of biomethane. In 2015, the Renewable Heat Act was amended to require newly-built public buildings to cover a certain share of heating-cooling demand with renewables, and it is estimated that biomethane could provide at least 30% of this demand. However, there have been no positive effects or further developments on biomethane in this sector. As for the fuel sector, the new GHG-quota regime that at first brought many risks for market actors due to gaps in the regulation, could generate many opportunities for the biomethane market, especially after the RED II Recast, which provides huge credits for the use of manure.

At the moment, there is no political will to push biogas or biomass development in Germany. There is also no room to expand the use of

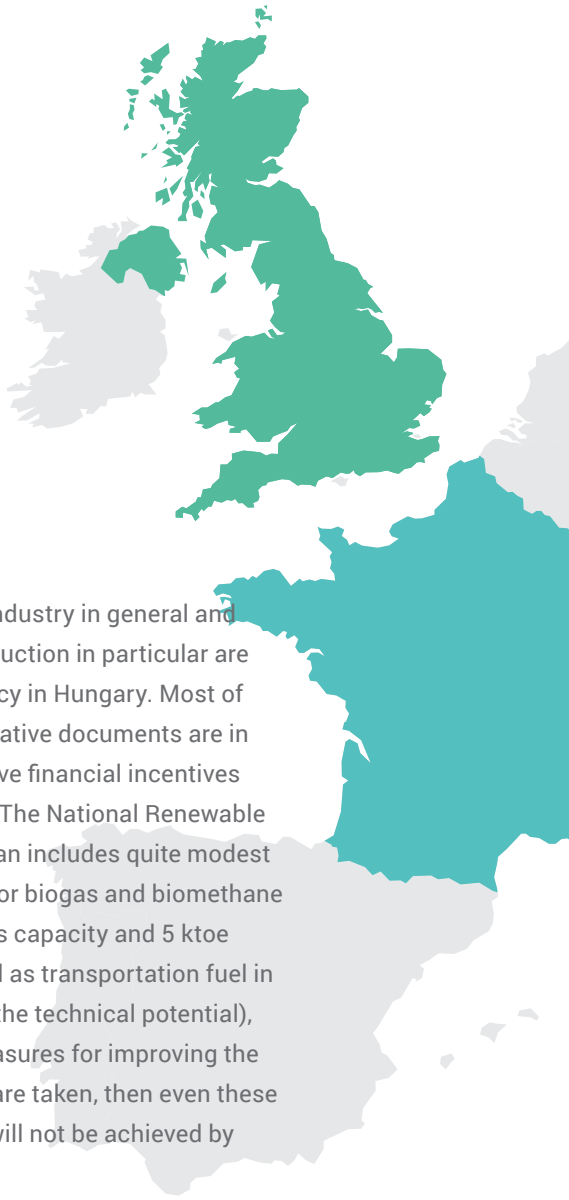
Image Credit : Fachverband Biogas e.V.

energy crops (which provided about 80% of biogas energy in the past). Contrarily, the use of maize silage in biogas plants is limited under the new EEG 2017. That said, it is hoped and expected that European legislation, especially with the RED II, will be more encouraging towards biomethane in the future, thanks to changes in greenhouse gas calculation methods that better reflect biogas systems.

From the policy point of view, national targets have been established in the electricity, heating and transport sector, but there are no specific targets for biomethane or biomass in any of these sectors. In addition, transport emissions are rising and the German target of reducing GHGs by 20% by 2020 will most likely not be met. This lack of attention towards the biomethane sector is because, generally speaking, biomass/biogas is not seen as a significant, crucial technology enabling the energy transition. Moreover, it appears that policy makers are not interested in developing more sustainable policies for the transport sector. Costs are also a big issue at the moment – other renewables are embraced because they are cheaper.

Thanks to the BIOSURF project, several stakeholders have started showing interest in the international biomethane trade, even if the legislation is not ready yet. In addition, BIOSURF's work will likely have interesting implications for the GHG calculation methodology that will be presented in RED II, and this will impact other European countries.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

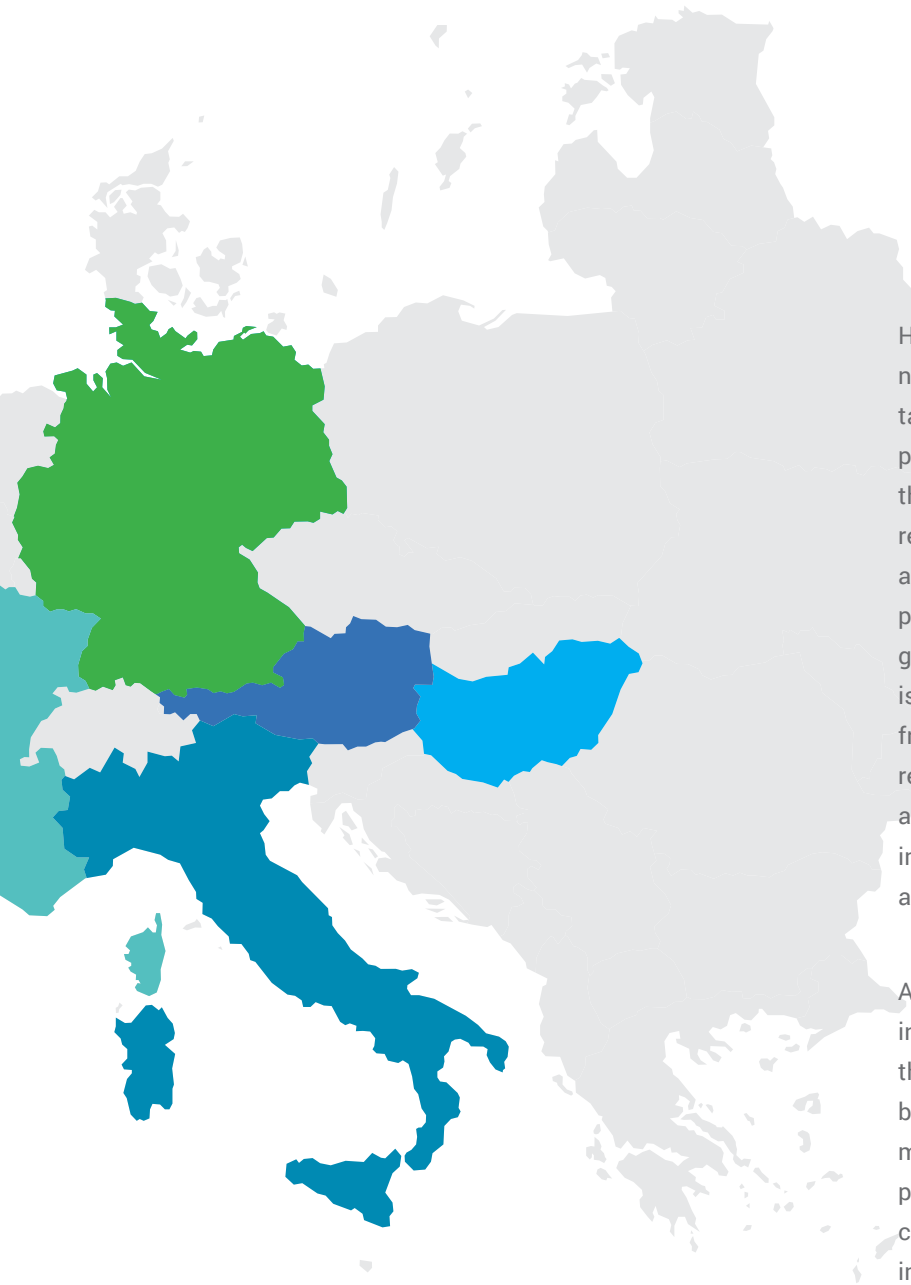


Hungary

For Hungary, where natural gas has the biggest share of the energy consumption mix (44%) and up to 80% is imported, partial substitution of imported natural gas by domestically produced biogas should be particularly appealing. The country produces a vast amount of organic waste and agricultural by-products relative to its size. Biogas-related research and development at Hungarian universities is remarkably strong and successful. All these aspects call for development of the biogas/biomethane industry and for the use of biogas/ biomethane for electricity generation, heating & cooling and as transportation fuel.

Unfortunately, this potential has not yet been exploited. Presently there are only two biogas plants equipped with upgrading units, producing biomethane. The growth of the biogas industry in Hungary is hampered primarily by the lack of straightforward and supportive policies. The result of the unfavourable political environment is that the biogas industry in general and biomethane production in particular are still in their infancy in Hungary. Most of the needed legislative documents are in place, but effective financial incentives are still missing. The National Renewable Energy Action Plan includes quite modest target numbers for biogas and biomethane (100 MWel biogas capacity and 5 ktoe biomethane used as transportation fuel in 2020 - far below the technical potential), yet if no new measures for improving the support system are taken, then even these modest targets will not be achieved by 2020.

Hungary has a very well-developed and dense natural gas distribution system. In principle, biomethane producers have rights equal to those of natural gas producers and biomethane can be injected into the natural gas grid.



However, the possibilities offered by the natural gas distribution network are not taken advantage of; there is only one biogas plant producing biomethane for injection into the natural gas system. There are several reasons for this lack of development. First of all, no feed-in tariff is offered to biomethane producers (feed-in tariffs are only available for green electricity) and no premium or bonus is offered for green electricity generation from biomethane. Secondly, the Ministry responsible for agriculture, rural development and environment does not acknowledge the importance of biogas technology in up-to-date agricultural technology and rural development.

Another challenge is the reluctance of financial institutions to take political risks; this means that substantial volumes of organic waste are being exported to neighbouring countries where more financial support is provided to biogas producers. Finally, public awareness regarding climate change, GHG emission risks and the importance of domestic renewable energy production is very low, and so political parties do not feel that voters expect them to push renewable energy industries forward.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

Hungary

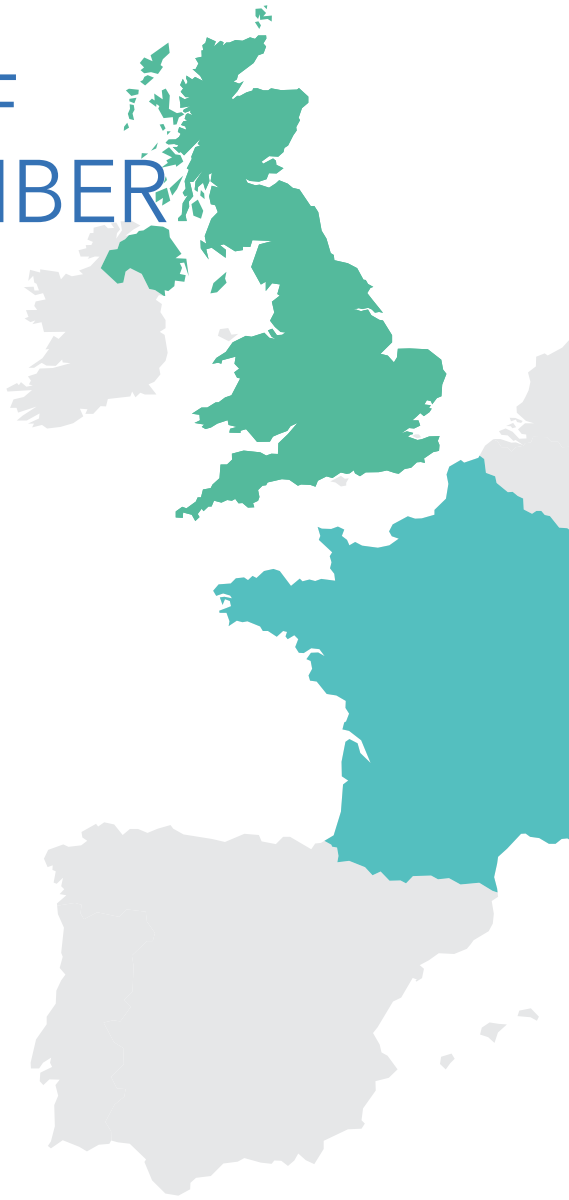
Driving Change in Hungary

In Hungary, there is very little political support for bioenergy and no biomethane-specific support scheme has been introduced. This is accompanied by very low public awareness, likely due to the Hungarian government's commitment to meeting GHG emission reduction targets through an increase in nuclear power generation capacity. Correspondingly, renewable energy sources are promoted on a very limited scale and there is no economic motivation for market growth.

Image Credit : Fachverband Biogas e.V.

Some steps forward were made over the course of the BIOSURF project, but more needs to be done to encourage the entry of biomethane into the Hungarian market. Hungary is gradually meeting its objectives and advanced negotiations are now going on to set up the national biomethane registry. In addition, a proposal to create detailed regulations for biomethane injection is under development. The BIOSURF project helped create the conditions for the development of biomethane in Hungary, particularly by generating awareness and interest among key national stakeholders.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES



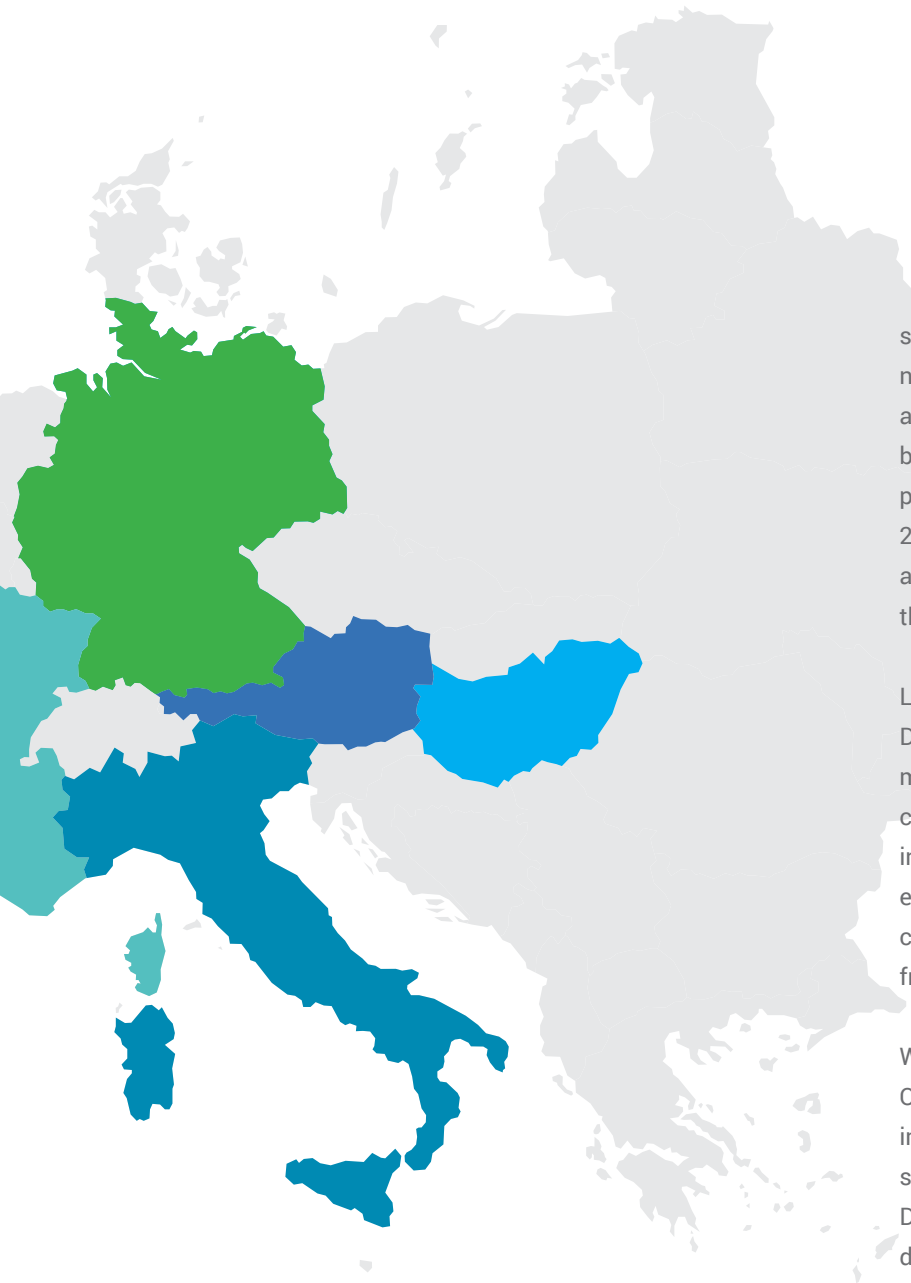
Italy

Italy is one of the most promising countries in Europe for the development of the biomethane market, having a very large and capillary gas distribution grid, with around 280,000 km of natural gas grid (mostly concentrated in the northern regions); around 1,700 biogas plants, with about 1,300 MWel of installed capacity; around 1,100 CNG filling stations; and the highest number of gas powered vehicles in Europe, with more than 1,000,000 CNG vehicles.

Despite this enormous potential for biogas and biomethane, the use of biomethane remains limited, with only two biomethane plants – one near Rome (from landfill) and one near Bergamo (from organic waste). Another five biomethane pilot plants have been built in the north of Italy but are not injecting biomethane into the natural gas grid yet. One reason for this is that there were no incentives for biomethane production in Italy until December 2013.

In addition, the regulatory framework regarding authorisation and installation procedures is fragmented, with no clear national policy about biofuel issues, nor a national policy framework supporting biomethane for transport (with subsidies existing for bioethanol production and tax exemptions for biodiesel production but not for biomethane). There is also a lack of information on biomethane production and use among citizens, farmers and foresters.

Regarding the use of biomethane as a transport bio-fuel, natural gas service stations are unevenly distributed, being widespread in northern Italy but limited in the centre and south. There are very few natural gas service



stations on Italian highways, and no self-service natural gas stations. This may be due to the long authorization process to obtain permission to build new stations (on average 2 years). As proposed by the European Commission in October 2012, legislation needs to validate the concept of advanced biofuel in terms of land efficiency and the reduction of greenhouse gas emissions.

Legislative Decree 28/2011, implementing Directive 2009/28/EC defines the general tools, mechanisms, incentives and institutional, financial and legal framework necessary for achieving the 2020 objectives on the overall share of energy from renewable sources in gross final consumption of energy and the share of energy from renewable sources in transport.

Within the National Energy Strategy adopted on October 2012, biomethane for transport plays an important role, reaching 10% of renewable energy sources in the transport sector by 2020. In December 2013, a ministerial decree was issued defining incentives for the production of biomethane that is injected into the gas transport and distribution gas grid. Even if some regulations are still needed to boost the market, Italy is set to become a leader in the European market over the coming years.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

Italy

Driving Change in Italy

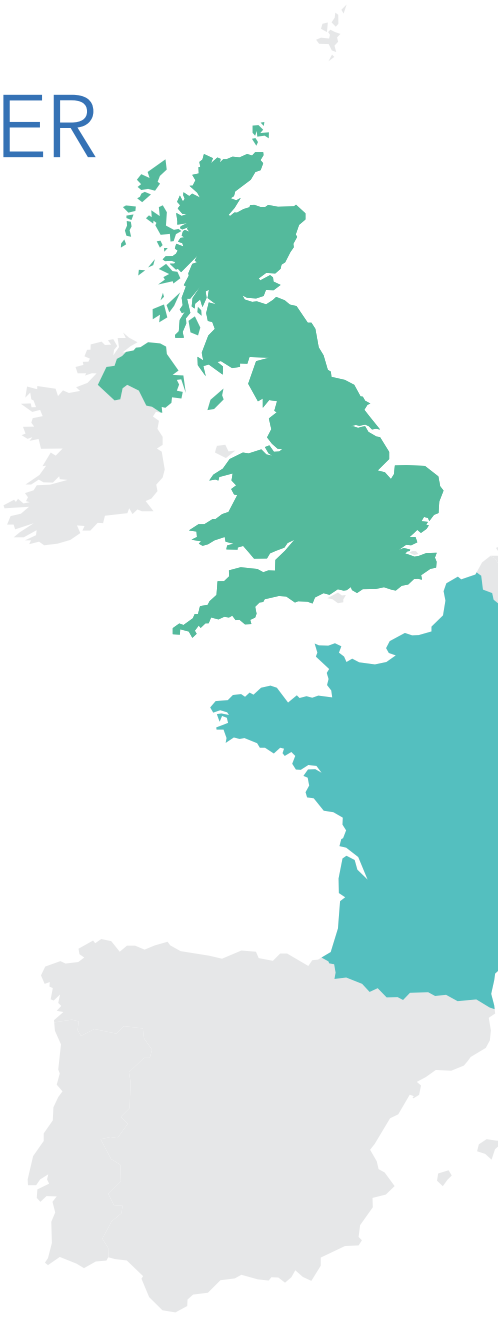
At the beginning of the BIOSURF project, many barriers hindered the development of biomethane in Italy. First, the lack of technical procedures for obtaining subsidies slowed down the development of the market. Moreover, uncertainties in the procedures for biomethane injection and for quality control as well as fluctuations in the value of the CIC (Certificato di Immissione in Consumo di biocarburanti - "Certificate for release for consumption of biofuels"), the certificate that biomethane producers receive when using biomethane as vehicle fuel, contributed to this situation. Now that the project is over, most of these obstacles have been resolved; the technical procedures have been published, the injection of biomethane is no longer a problem as adequate regulations have been established, and rules on

Image Credit : Fachverband Biogas e.V.

the natural gas grid have been updated.

In January 2017, the Ministry of Economic Development submitted a draft decree concerning biomethane incentives for public consultation, which would update the decree of December 2013, resolve the uncertainty of the CIC, and change a number of biofuel targets. After the publication of the new decree, expected for the end of 2017 or early 2018, the growth and development of the biomethane sector will enable the achievement of the targets set for advanced biofuels. In addition, the new decree contains indications for the establishment of a national biomethane registry, a registry that was drafted by CIB within BIOSURF. This registry will enable the exchange of biomethane with Austria and France and will set the basis for international trade with other EU countries as well.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

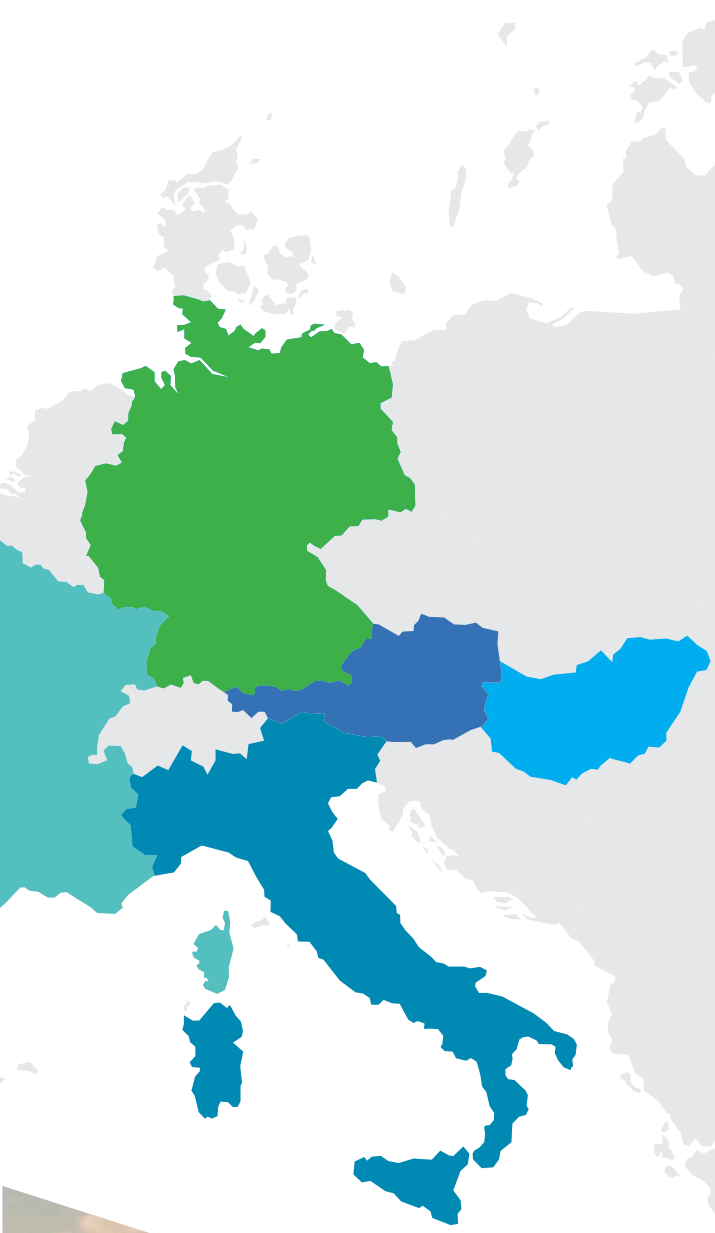


UK

The biomethane industry in the UK developed rapidly after the introduction of the Renewable Heat Incentive (RHI), which pays a "feed in tariff" for volumes of biomethane injected into the grid. There are now over 80 operational biomethane injection facilities. The UK has an excellent gas grid network developed for the offshore oil and gas industry which was landed in Scotland and the east of England and distributed all over the UK. The RHI is funded from general taxation (progressive) but other measures to support the deployment of renewable electricity (e.g. the feed-in tariff) are funded through electricity bills (regressive).

The Levy Control Framework limits overall spending and all of the UK's financial incentives now have strict budgetary controls. The biomethane injection tariff (along with all technologies supported under the RHI) is subject to automatic degression (reduction) in tariffs based on the amount of deployment.

The main legislative driver is the Renewable Energy Directive, with 15% of total energy (i.e. heat, electricity and transport) to be sourced from renewables by 2020. The main barriers to the deployment of the biomethane market are budget constraints; the availability of waste



feedstocks; the use of crops, which is still under debate; insufficient gas grid capacity at low and medium pressure in some areas; the high cost of grid connections, which are paid by the developer, as well as long delays in completing the connections; and the difficulty of matching the exact energy content (CV) of biomethane to the gas grid needing the injection of propane.

There is significant interest in fuelling heavy duty vehicles with gas, and there are now around 350 natural gas trucks supplied from around 26 fuelling stations. Car manufacturers, however, have little interest in developing right-hand drive CNG cars and only a few commercial gas vans are available with right-hand drive.

FUELLING THE USE OF BIOMETHANE IN MEMBER STATES

UK

Driving Change in the UK

A great deal of progress has been made in the UK biomethane market over the past few years, and with the support of the BIOSURF project, the industry has succeeded in garnering significant parliamentary and government support, despite faster than expected growth. The Renewable Heat Incentive (RHI) began in 2011 and is the primary policy that supports biomethane injection in the UK. It was the first use of a tariff payment/kWh for the provision of useful heat and biomethane injection. However, the automatic tariff degression mechanism caused the biomethane tariffs to fall too fast, and consequently deployment slowed. In March 2016, the UK government proposed resetting payment levels back to what they were at the beginning of the year, though this planned change has not yet been implemented.

The UK has also moved towards a simpler mass balancing system. The REA (a member of ERGaR) and the GGCS, as well as industry players, have been making the case for the use of certificates for mass balancing, and as a principle, certificates from the Green Gas Certification Scheme (GGCS) are deemed acceptable by the Department for Transport for mass balancing for the Renewable Transport Fuels Obligation (RTFO). The practicalities and administrative procedures are expected to be finalised by the end of 2017. Green Gas Certificates are traded between the UK and other Member States, but

Image Credit : Pexels.com

because of the RHI, consumer demand for green gas is not a driving factor in increasing deployment.

Incentives for biomethane for transport have been improved. Following changes to be introduced in April 2018, biomethane from syngas[8] will be classed as a development fuel, and receive added stimulus from the RTFO. There is also a growing interest in the use of biomethane for transport, thanks to the efforts of REA's biogas group that, alongside the Transport Fuel Group, published a Biomethane in Transport document.

One challenge facing biomethane is insufficient grid capacity at the local level, and this is becoming a limiting factor for some projects. Following the UK Biomethane Day 2017, a working group was set up to explore ways for gas distribution operators to be more innovative in their approaches to connecting BtG projects. In addition, the cost of grid entry units has been reduced somewhat, thanks to competition between suppliers. There are now limited examples of a facilitated transfer of gas between high-, medium- and low-pressure grids, and it is being considered for at least one future project.

[8] Syngas is a fuel gas mixture consisting primarily of hydrogen, carbon monoxide, and very often some carbon dioxide. Syngas is usually a product of gasification.

THE ROAD AHEAD: EUROPEAN AND NATIONAL RECOMMENDATIONS

Moving Towards an Improved Biomethane Trade

A European Mass Balancing System for Biomethane

The entire natural gas network operating within the territory of the European Union, the EFTA and the European Economic Community is to be recognised as a single, closed logistical facility regarding mass-balancing of biomethane injected into the system.

In addition, each domestic natural gas network operating within the territory of an individual Member State is to be recognised as a single, closed logistical facility regarding mass-balancing of biomethane injected into the system.

National Registries

The European Union should require national governments to establish national biomethane registries in every Member State.

It is recommended that national governments take measures towards establishing national biomethane registries in every Member State.

ERGaR RED

The BIOSURF consortium supports the application of the voluntary scheme named "ERGaR RED" developed by the ERGaR aisbl association for recognition by the European Commission under the RED.

Guarantees of Origin

The functions of the Biomethane Guarantees of Origin must include a qualification for counting towards EU and national renewable energy and GHG emission reduction targets. .

Image Credit : Pexels.com

Moving Towards More Sustainable Raw Material Supplies

Cover Crops

Cover crops with high starch content should be recognised among the raw materials (substrates) allowed for producing advanced biofuels.

The GHG emission calculation methodology should be adjusted to reflect the fact that cover crops are secondary crops.

Sustainability Requirements

The European Union and EU Member States should apply the same sustainability criteria for all uses of biomethane (transportation, electricity, heating and cooling), specifically 70% GHG emission reduction compared to fossil fuel comparator (FFC). The FFC value for heating application should correspond to the heating fuel mix, rather than be limited to the GHG emission by natural gas.

Power-to-Methane

A scientifically-based classification of methane produced under different Power-to-Gas pathways (differentiating between the sources of electricity and the sources of carbon dioxide) is to be developed.

THE ROAD AHEAD: EUROPEAN AND NATIONAL RECOMMENDATIONS

Moving Towards Better Utilisation of Biogenic Waste

Source Separated Biowaste

Source separated biowaste collection to be made mandatory in the European Union, preferably together with combination of energetic and material recovery – anaerobic digestion or composting with usage of produced digestate and/or compost as fertilizer). Land-filling of biowaste should be banned (as in a large number of European countries) and combustion of source separated biogenic waste in E2W plants progressively limited.

Moving Towards More Effective Legal and Administrative Measures

Access to the Natural Gas Network

Preferential access to the natural gas grid is to be guaranteed in every EU Member State. The costs of grid injection should be shared between the distribution (transmission) network operator and the biomethane producers on a regulated basis. These costs of TSO's and DSO's to be acknowledged when calculating and approving the grid service fees.

Dedicated Customs I.D. Numbers

Dedicated identification numbers within regulations on the tariff and statistical nomenclature and on the common customs tariffs (2658/87) should be introduced.

GHG Emission Redution

The GHG emission savings that result from avoiding (substituting) the production and use of industrial fertilisers where digestate is applied on cultivated land (according to best practice) is to be recognised when calculating the GHG emission reduction effect of biomethane.

Image Credit : Pexels.com

GHG Emission Default Values

The European Commission should take measures to increase the number of biogas and biomethane pathways with default GHG emission values.

Averaging GHG Emissions (Different Substrates)

The limitation that does not allow for averaging of GHG emission numbers of different substrates processed in an AD plant is to be lifted. Averaging should be allowed based on the share of each substrate in the total energy produced, taking into consideration the specific biogas yields.

Averaging GHG Emissions (Gaseous Fuel Blends)

Averaging of GHG emission numbers of components of gaseous fuel blends (blends of natural gas and biomethane marketed either in compressed or liquefied form) is to be allowed.

Tax Exemptions

As a general rule, the State Aid Guidelines should allow national governments to grant beneficial tax treatment of biomethane used as transportation fuel as compared with natural gas used for the same purpose.

No Retroactive Changes

European Union legislation should not allow national governments to introduce retroactive changes in national support systems, unless adaptations are necessary to comply with EU State Aid rules.

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