Potential in Eastern Europe

Case study for the Russian Federation, Ukraine and Belarus

Russia is firmly established as a natural gas supplier in the European energy landscape. Belarus and the Ukraine are transit countries, through which the natural gas pipelines pass. This infrastructure could be used if biogenic gases are produced and fed in along the natural gas network.

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The biomass resources here in Germany are limited. Belarus, Russia and the Ukraine are countries with a large potential of biomass that can be used to produce energy, which could then be used to produce biogas and biomethane. However, the bioenergy sector in all three countries is still in its infancy. The first biogas plants have been built, but there are not yet any biomethane plants. The political framework is also an obstacle to rapid development. The question of the conditions, under which the potential could be tapped, was examined by the research project "sustainable European biomethane strategy". The research results were used as the basis for development of a strategy with which impetus could be provided for a functioning biomethane industry in the different countries. It also examines the possibilities of exporting biomethane to Western Europe, with the focus on Germany.

Biomass potential

The country studies come to the conclusion that significant and to date unused potential exists in all three countries for the cultivation of biomass and the use of residual materials for the production of bioenergy (see tab. 1). On the one hand, potential exists for the cultivation of energy crops on fallow land and yield potential by increasing productivity; on the other in developing the unused forest and residual material potential. In addition, it can be assumed that large potential exists for animal residues and municipal wastes, which were not examined any closer. Based on this, if the unused biomass potential were to be fully developed, 174 billion m^3 biomethane per year could be produced. By comparison, the Germany-wide natural gas consumption in 2010 was 3,700 PJ or 105 billion m^3, which equals 22 % of the total primary energy consumption. Therefore, the theoretical biomethane potential of Russia, the Ukraine and Belarus would exceed current natural gas consumption in Germany by 65 %.

Plant concepts and production costs

Biomethane can be produced not only through biochemical conversion to biogas but also through thermo-chemical conversion to bio-SNG. Different plant concepts (see fig. 1) are considered for the supply paths for biomethane from biogas and bio-SNG for each country. These differ in plant capacity, plant technology, raw materials and with regard to the timescale.

Two plant sizes, with 11 and 34 $MW_{Biomethane}$ were examined for the biochemical process (fermentation). The raw material is based on clover/grass growth on fallow land and, depending on the concept, this is fermented with or without slurry. By comparison, for the thermo-chemical supply paths, solid biomass in the form of wood chippings is allothermically gasified, i.e. at high temperatures and with the exclusion of oxygen, is converted into a gas mixture of CO, H_2, CO_2 and CH_4. Following upgrading, catalysts are used to produce a

	Russia	Ukraine	Belarus
Fallow land 2030 (70% recultivation)	26,6 Mio. ha	7,9 Mio. ha	0.9 Mio. ha
Theoretical biomethane yield (fallow land)	60,0 Mrd. m^3/a	17,8 Mrd. m^3/a	2,0 Mrd. m^3/a
Forest 2030 (available wood potential)	51,8 Mio. t/a	12,9 Mio. t/a	9,6 Mio. t/a
Theoretical biomethane yield (forest)	10,0 Mrd. m^3/a	2,5 Mrd. m^3/a	1,9 Mrd. m^3/a
Theoretical overall biomethane yield	70,0 Mrd. m^3/a	20,3 Mrd. m^3/a	3,9 Mrd. m^3/a

Table 1: Areas, wood and biomethane potential in 2030

methane-rich gas and any CO_2 is removed. The resulting bio-SNG therefore has the same product properties as biomethane. Plant concepts with a bio-SNG output of 18 MW and 65 MW were considered for the calculations.
The production costs calculated for biomethane in 2030, for all plant concepts and sizes, are on average 50% higher than the natural gas price forecast for 2030 (see fig. 1).

GHG balance

Significant greenhouse gas reductions, not only with the biogas concepts but also with the bio-SNG concepts can be achieved in all three countries compared to the Russian natural gas references. The results for the Russian Federation show that the supply of biomethane could reduce greenhouse gas emissions by up to 65 % compared to the fossil reference (natural gas from pipeline in Russia) in the long-term concept (2030).
The complex and innovative plant engineering of the bio-SNG plants leads to considerably higher production costs compared to the biochemical concepts. However, at the same time, even without credits for heat use, lower GHG emissions can be achieved for the supply of biomethane. Compared to fossil natural gas, all concepts have higher production costs for the forecast year 2030, but also a significant GHG reduction potential.

Strategy

The country studies not only identified the potential, but also the obstacles to the establishment of the biomethane industry in Eastern Europe. Firstly, on the one hand, it is necessary to aim to achieve sustained development of biogas and small-scale biomass gasification plants with CHP, on the other hand, local skilled personnel must be trained. Without training local specialists, it is not possible to guarantee economic efficiency and proper operation of the plants. In addition, suitable financial instruments will be required to support the investment activity. In all three countries, access to loans, especially for small investors, is difficult and the high interest rates reduce the willingness to invest. The legal and political frameworks are also not yet optimal. There are no laws for regulating grid access and the remuneration of electrical power produced from bioenergy or if they do exist they have a very limited effect, as is the case in the Ukraine. Bioenergy as a possible renewable power supply, is currently not attributed much importance at the political levels. The following strategy was suggested in order to nevertheless expand sustainable use of the biomass potential.
In the short-term, local plants without biomethane processing, which require a smaller investment, could be installed in order to initially use the favourable residual material potential for the regional power supply. It would then be possible to train local people to operate the plants and to largely generate the added value in the region itself. With the establishment of regional use of biomass for energy production, the advantages (reduction of energy imports, creation of jobs, and reduction of waste products/residual materials) will be significant and the political will to support bioenergy will probably be strengthened. In the short-term, the strategy is aimed at setting up use of biomass as an energy source and pushing ahead rural development. At the same time, within the scope of technology partnerships, it will be necessary to work on optimising the plant engineering and configuration, in order to achieve a higher GHG reduction in the medium to long-term.
In the long-term a changeover to larger plants based on bio and thermo-chemical concepts is feasible. The previously developed local know-how for the production of biogas and / or bio-SNG enables the operation of large plants, which can also cover the national supply with biomethane. Furthermore, the legal framework should be set up to enable problem-free feed-in of biomethane into existing networks and to enable transport to Germany/Europe. The experience acquired during the first phase will enable the local skilled staff to achieve the necessary quality assurance. In the long-term, the strategy is aimed at integrating the regional production of biomethane and/or Bio-SNG into the European supply structures and for both sides to achieve synergy effects from the international trade.

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Biomass
energy use

Partners: Deutsches BiomasseForschungsZentrum gGmbH
Wuppertal Institute for Climate, Environment and Energy GmbH
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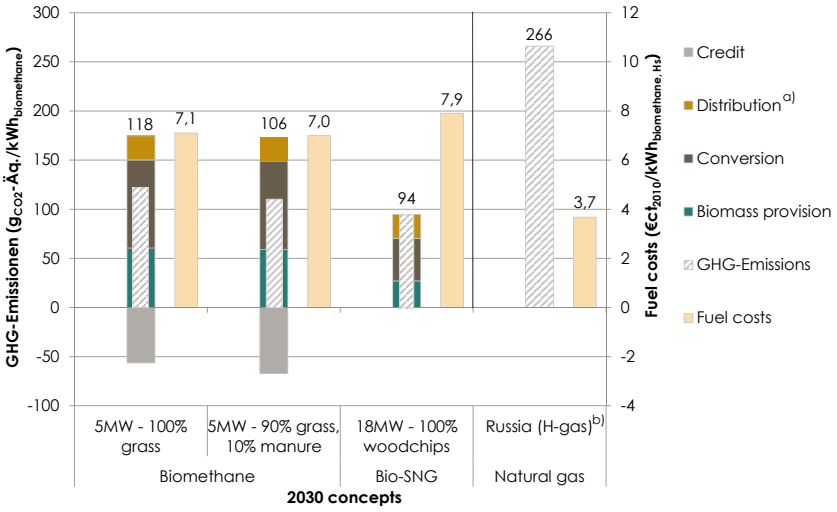
Technical University of Dresden, Chair of Forestry and the Timber Industry in Eastern Europe



a) Average haul distance: 3.000 km
b) Source: BfA, World Energy Outlook 2010 (real price increase of natural gas between 2009 and 2030 by 75%)

Figure 1: GHG balance, comparison of production costs (excerpt for the Russian Federation)