EPG
ENERGY POLICY GROUP

Biogas:

A high-potential, sustainable, yet untapped fuel in Romania

by Dragoş Tâlvescu

Oslo, 5 March 2015

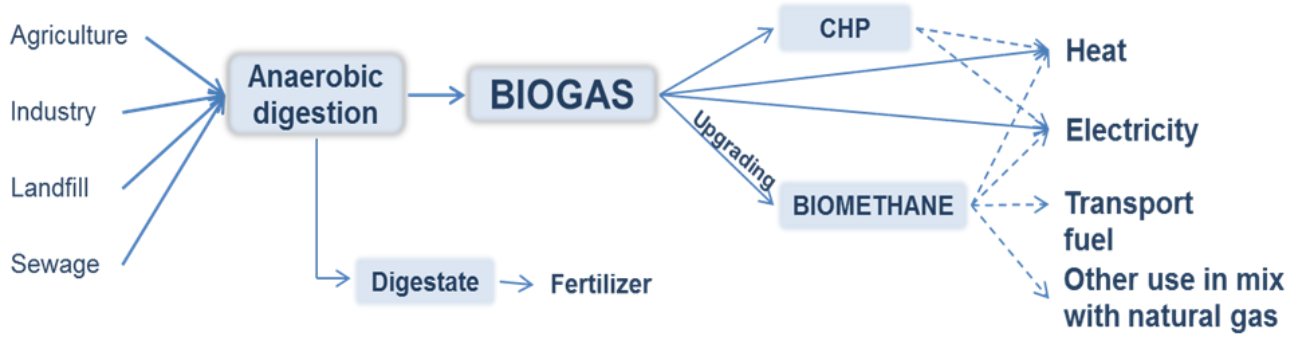
Portrayed as a key element to Romania's sustainable energy future, biomass should be the object of intense debate in connection with the future national energy strategy. Solid (wood, charcoal) and liquid (biodiesel, bioethanol) forms of biomass are rather well known, but it is also possible to derive significant amounts of valuable, clean energy by burning (upgraded) biogas. This article briefly discusses the prospects of biogas production and use in Romania, in a European context.

The biogas value chain – a versatile, renewable fuel

Biogas is a valuable methane-based, gaseous fuel, derived from various biogenic sources. While conventional (fossil) natural gas forms from the decomposition of organic matter at high temperature and pressure in the lithosphere over millions of years, biogas forms close to ground surface or in special plants, within weeks or months, in a four-stage process called *anaerobic digestion*. Due to the speed of biogas synthesis by anaerobic digestion, its methane content is lower (35-70%) than for natural gas (80-96%) and its CO_2 content rather high (15-50%). The solid residue of anaerobic digestion, called *digestate*, can partly become fertiliser.

The three main sources of biogas are agricultural waste (plant residues, manures) or dedicated energy crops (maize, grasses etc.), wastewater (sewage sludge), and biogenic landfill waste. Industrial organic residues, particularly in the food-processing sector, can also be an attractive biogas feedstock.

Figure 1: Schematic representation of the biogas value chain



Source: Sund Energy, 2010

Similar to natural gas, biogas can be used directly to generate heat, electricity or in the co-generation of both. It is also possible to increase the calorific value of biogas by removing CO_2 and upgrading it

(close) to natural gas characteristics. The higher-value product, *biomethane*, can be injected into the natural gas grid for easier distribution over long distances. Biomethane can have any use as natural gas, including feedstock in fertilizer or methanol production, as well as transportation fuel (see earlier ENPG articles on small-scale LNG).

The high CO_2 content of biogas is usually released in the atmosphere (it is technically possible to capture and store (CCS) it in the process of upgrading to biomethane, but this is expensive) and burning the methane content of biogas releases CO_2 as well. Nevertheless, in a full-picture perspective, biogas is almost climate neutral, since the alternative would be to let the methane in the feedstocks dissipate into the atmosphere. Methane is a much more potent greenhouse gas than CO_2, so avoiding its release is very valuable for climate mitigation. In addition to avoiding methane emissions, using locally produced biogas/biomethane often replaces imported fossil fuels and provides an additional income stream to farmers. Therefore, several EU member states now provide strong incentives for biogas production.

Short overview of European biogas

Biogas production in the EU in 2013 was 566 PJ (157 TWh), accounting for almost 7% of total renewable energy use, but only 0.8% of total primary energy demand and 3.5% of natural gas demand. The situation varies considerably between countries. Half of all EU biogas production takes place in Germany (287 PJ) and another 27% is equally split between the UK and Italy (76 PJ each). Other important biogas producers are the Czech Republic, France, Spain and the Netherlands, totalling 66 PJ (*Eurostat, nrg_110a, 2014*). Italy, Germany and the Czech Republic have registered the highest growth rates over the past 5 years, but they are all currently slowing down, with changes to their biogas incentive schemes. (*EurObserver*, 2014)

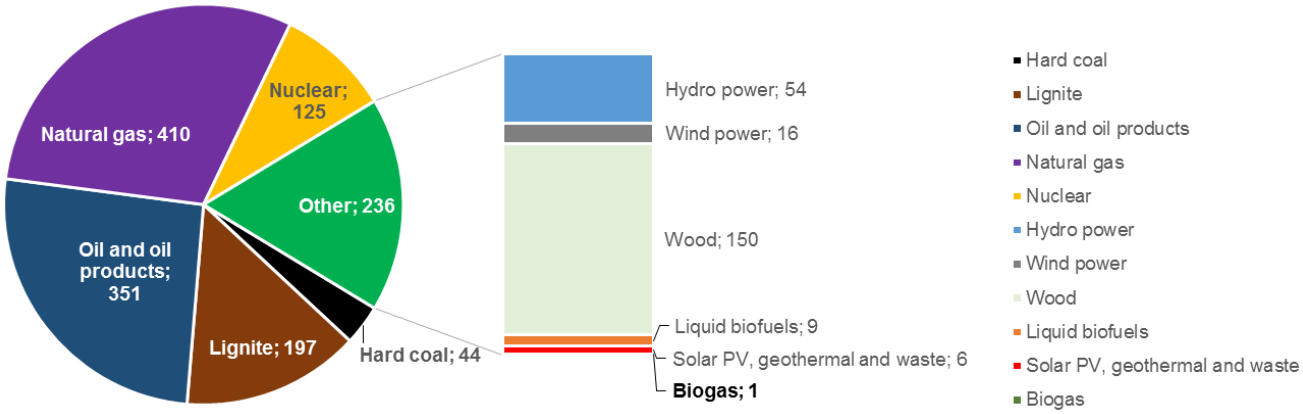
The feedstock distribution is 70% agricultural waste and energy crops (particularly in Germany, Italy, the Czech Republic and Austria), 20% landfill biogas (especially the UK, Spain, Portugal and Ireland) and 10% wastewater biogas (especially Sweden and Poland), illustrating different support policies in each member state. Biogas is usually monetised in co-generation plants and the main usable outputs are electricity (53 TWh) and heat (about 30 TWh – 80% used locally by the producer). In addition, at the end of June 2014, there were 258 upgrading plants producing 1.3 bcm biomethane, with Germany (151) and Sweden (53) taking the lion's share (*EurObserver*, 2014).

Energy crops for biogas production is competing with food production, so it is less sustainable than biogas derived from organic waste, and the EU is discouraging their expansion. However, there is considerable untapped biogas potential in all member states, and the member states' national action plans for renewable energy indicate a 40% increase in electricity generation (to 70 TWh) and 70% increase in heat use (to 50 TWh) by 2020.

Biogas in the Romanian energy mix

In 2013, Romania had a primary energy demand of 1354 PJ (374 TWh; 32.2 mtoe), of which 30% natural gas i.e. 410 PJ (114 TWh). Renewable energy covered only 17% of primary energy demand, i.e. 232 PJ (64 TWh), and 2/3 of this (150 PJ; 42 TWh) was wood burnt for heating and cooking in inefficient stoves and ovens. To compare, hydropower stood for 54 PJ (15 TWh), liquid biomass use was nine PJ and biogas less than 1 PJ (*Eurostat, nrg_110a, 2014*).

Figure 2: Biogas in the primary energy mix of Romania (2013; measured in PJ; total: 1347 PJ)



Data: Eurostat, nrg110a

Biogas production in Romania started in the 1960s, mainly at municipal wastewater treatment plants and with sludge from pig farms. By 1989, 400 facilities were producing approximately 180 GWh (650 TJ) of energy. However, the lack of investments after 1990, privatisations and liquidations led to a rapid fall in biogas production.

According to Eurostat, Romania only reports biogas production since 2007, but the pace of growth was slow until 2010, when the green certificates incentive system started (*Eurostat, nrg_110a, 2014*). Biogas receives up to four green certificates per MWh, depending on the type of feedstock (energy crops are for now incentivised) and utilisation (CHP is incentivised). Romania does not support heat production from biogas other than as by-product of electricity generation in CHP plants, and there is no incentive or legal framework for upgrading to biomethane and for the injection of biomethane in the national gas grid (*www.res-legal.eu, Romanian NREAP*).

In 2013, total biogas production in Romania was 822 TJ, of which the marketed biogas-derived heat was 138 TJ (100 TJ from CHP plants). Some heat was used locally at the production site. Gross electricity generation from biogas was about 102 TJ (26 GWh), considerably below the 440 GWh expected for 2013 in the national renewable energy action plan, and far from the planned 950 GWh for 2020 (*Romanian NREAP*). The total theoretical biogas production potential is estimated at 110 TWh, with most feedstock from crops residues and livestock manure (Vintila and Neo, 2011). If about 10% of the potential were to be realised, it would amount to a 50-fold increase from the 2013 production level and a tremendous increase even compared to the 2020 target. In order to realise this potential, concentrated effort is required in order to make it easier for interested investors to take a final investment decision.

Realising Romania's biogas potential

For Romania to increase its biogas production 50-fold, a step change is necessary, even if the level of support is sufficient to make most investments profitable. To begin with, the permitting procedures for biogas projects must be simplified, for instance by setting up a "one-stop shop" for all the

necessary approvals, including environmental impact assessments, grid connection etc. Another key condition in order to attract investment capital is to build trust on the stability of the green certificates scheme (or, if relevant, the upcoming feed-in tariffs system), since the sudden adjustment in 2014 has made it difficult for investors to commit capital for renewable energy projects.

On a more general level, modern farms are a prerequisite for setting up an efficient value chain for biogas, from collecting the crop residues, to the anaerobic digester, to maximising the value of the produced biogas, locally or by selling heat/electricity to the grid. Only pooling the arable land into medium- and large-scale farms or cooperatives and a high degree of mechanisation can make the investment in biogas from crop residues and livestock worthwhile. The ongoing, gradual modernisation of Romanian agriculture, which takes place independently from biogas incentives, will lay the foundation for increased biogas production over the next years. As farmers come into a position to invest in biogas, regional and local authorities should support them with the basic expertise needed to embark on biogas projects.

Finally, there is considerable potential for biogas production from landfill waste and wastewater treatment plants. Romania sends most of its waste to landfills, but this should change towards more rewarding waste handling, including recycling and incineration. However, there will remain considerable potential in landfill gas. Many Romanian municipalities lack modern wastewater treatment facilities, but there is considerable funding from the EU to catch up in this respect. With proper regulation and stable incentives in place, it should be possible to trigger investments in biogas production from both landfill and wastewater treatment plants in most of Romania's municipalities. This would be a welcome renewable addition to local energy supplies, at the same time improving the environment and combating climate change.

Biogas production in Romania will probably not overtake liquid biofuels, solar or wind power generation in the energy mix, remaining a marginal domestic source of energy supply. Nevertheless, it is essential to pursue its large-scale development, as it improves local environments and the livelihood of farmers; it mitigates climate change and overall contributes to a long-term sustainable energy mix.

Dragoş Tâlvescu is an EPG affiliated expert

Str. Buzeşti 75-77, 011013

Bucureşti, Romania

www.enpg.ro

office@enpg.ro