Narratives and identity of biogas solutions on the way to 350 TWh in Europe

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Abstract

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During 2022, a goal for production and use of 35 bcm (approx. 350 TWh) biomethane by 2030 was launched as a part of the REPowerEU Plan by the European Commission. The improved self-reliance on energy for Europe was an important reason behind this new goal. This has fueled the expansion of the sector; new digestion plants are being built and upgrading plants are added to existing digesters around Europe. Data from European Biogas Association suggest a rapid growth, however unclear if the goal will be reached.

Under the umbrella of the term biogas solutions, any system that generates methane through anaerobic digestion of renewable organic sources can be included. Advocates for biogas solutions have historically often highlighted their versatility as an asset. Any organic feedstock can be used as input and the energy output could be used for heat, electricity generation, grid injection, transport fuel, energy use in industry and as raw material to produce chemicals. Even the digestate has been suggested to be used for many different purposes, especially after fractionation. However, the use as biofertilizer is the most common option. This versatility of biogas solutions is an asset; however, it may also bring difficulty in communicating about their societal role and creating an unclear identity for policy makers on different levels.

In the Nordic countries, biogas solutions mainly evolved in the waste and sewage sectors where the actual gas was a by-product to the waste treatment. During the 1990s, the importance of gas production grew, and more often, the raw biogas became upgraded to biomethane to the transport sector where the willingness to pay for renewable fuel was high1. Researchers in the Biogas Solutions Research Center (BSRC) found it useful to term this a "Nordic biogas model" (NBM) to denote the different characteristics, for instance in relation to, the most well-spread biogas solution in Europe which was crops to electricity in the German case 2.

NBM is starting from extremely low-value, even difficult, inputs like waste from slaughterhouses, dairies, sewage treatment and source-separated food waste and, on top of the waste treatment, generate two renewable products substituting those of fossil origin, biomethane mainly used for transport and biofertilizer. The quest to raise value the most is the underlying principle behind NBM. Newer additions to the model include carbon capture and utilization (CCU) and fractionation of digestate into several nutrient fertilizer products. There is thus

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an inherent and sometimes expanding multi-functionality in the NBM.

NBM has been suggested to be of global relevance and could be implemented in any city and region 3. There are three main prerequisites for its realization: (i) significant amount of organic matter of low value, (ii) a need for transport of goods and people, or in a broader sense, any other applications where a versatile energy carrier such as methane is required and (iii) a surrounding area with a need for nutrients. Obviously, these conditions can be found in many cities around the world and often to a much larger extent than in the Nordic countries.

However, when you want to realize the full potential of sustainability contribution of biogas solutions, NBM is merely one component out of several needed. In a Swedish governmental inquiry about biogas solutions completed in 2019, it was obvious that most of the potential for expansion was to be found in the agricultural sector 4. Manure, by-products from crops like straw, intercropping and ley grass crops are useful feedstocks for biogas production from the agricultural sector. Agricultural biogas solutions can range from questionable in a sustainability assessment to very good. Concepts like Biogasdoneright and carbon farming are concepts that denote crop-based biogas systems that do not compete with food or feed production but instead make agricultural practices more sustainable 5. Intercropping, digestion of manure and soil carbon buildup, partly through addition of biofertilizer, are components making it possible to simultaneously deliver energy and nutrients while mitigating climate change. There is a lot of support for the idea that most of the untapped potential for expanding biogas solutions is to be found within the farming sector.

So, how could the agricultural biogas solutions and the NBM together make it possible to reach the EU goal of 350 TWh biomethane? Small-scale biogas production in farms will typically not generate upgraded biomethane, rather electricity and heat, due to high investment necessary for up-grading. Building large-scale production, supplied with feedstock from many farms, enables a higher value creation. However, with a large share of manure in the feedstock mix, gas production will be low and being able to add industrial and domestic food waste (NBM) to such a production system build scale and makes better use of the investment. Furthermore, low-grade organic feedstocks typically have higher nutrient concentration per biomethane produced compared with primary biomass making the resulting biofertilizer more valuable for use in agriculture 6.

A production system that combines the waste sector (NBM) and the agriculture sector (Biogasdoneright) is a promising concept for Europe and could be crucial in reaching the quantitative goal. Considering spatial aspects, it makes sense to direct the waste-based feedstocks to large-scale plants situated in agricultural areas to minimize transport and close nutrient cycles between cities and their surroundings.

The identity of biogas solutions should not be defined only by their versatility, probably neither through their capacity to deliver significant amounts of renewable energy. The latter being something that can be achieved in many ways. It is instead the multifunctional aspects of a wide and dynamic value creation including nutrient circulation that cannot be replaced by other technologies or approaches.

Humanity needs its bioeconomy, and the bioeconomy needs a long-term sustainable nutrient supply, indicating that all cities and regions need to include a biogas solution in their infrastructure portfolio. Employing the NBM and the Biogasdoneright concept would create a European narrative to be widely communicated fueling the processes towards the 350 TWh biomethane and beyond.

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