IEA Bioenergy

# THE ROLE OF ANAEROBIC DIGESTION AND BIOGAS IN THE CIRCULAR ECONOMY

Local applications of anaerobic digestion towards integrated sustainable solutions

## Summary Series

IEA Bioenergy: Task 37: 8 2018

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## Executive Summary

This technical report has been written to highlight the diversity of benefits from anaerobic digestion and biogas systems. Biogas from anaerobic digestion is not merely a concept of production of renewable energy; it cannot be compared to a wind turbine or a photovoltaic array. Nor can anaerobic digestion be bracketed as just a means of waste treatment or as a tool to reduce greenhouse gases in agriculture and in energy. It cannot be pigeonholed as a means of producing biofertilizer through mineralisation of the nutrients in slurry to optimise availability, or as a means of protecting water quality in streams and aquifers. It is all these and more. The multifunctionality of this concept is its clearest strength. Sustainable biogas systems include processes for treatment of waste, for protection of environment, for conversion of low-value material to higher-value material, for the production of electricity, heat and of advanced gaseous biofuel. Biogas and anaerobic digestion systems are dispatchable and as such can facilitate intermittent renewable electricity.

The target group for the report is represented by biogas stakeholders in general, and by decision makers and the biogas business actors. The reader should have a conceptual understanding of biogas, anaerobic digestion, the energy and fuel system and the circular economy. The reader should be interested in how the pieces fit together and how the multifunctionality interlinks all these aspects. The scope of the report has thus been to create a narrative, on the topic of how anaerobic digestion and biogas fit into the concept of the circular economy.

The biogas plant and its basic functions are described, as are the concept of biorefineries and how they interlink to biogas production. The multiple functions of biogas in the circular economy are discussed under the following headings: i) Biogas as an energy carrier; ii) Reduction of GHG emissions; iii) Energy security; iv) Biogas as raw material – further use of carbon dioxide and methane; v) Biogas from AD as a scavenger for organic waste streams; vi) Biogas treatment for better water quality; vii) Awareness tool on circular thinking; viii) Biogas in agriculture; ix) Balancing income for rural areas; and x) Challenges in using waste as raw-material.

To show how closely related anaerobic digestion and biogas are to the concept of circular economy, the intimate relation is exemplified through four case-studies: i) Vera Park, Sweden; ii) BioKymppi, Finland; iii) Sønderjysk Biogas Bevtoft, Denmark; and iv) The Magic Factory, Norway (figure 1).


*Figure 1. The circularity of the biogas plant – "The Magic Factory".*

These examples are just a few of the many more currently active and in the planning stage. They show how simple it can be to take a significant step towards circular economy concepts with the aid of biogas and anaerobic digestion.

We are still in the advent of the circular economy. Products from bio-based resources will grow in both absolute and relative terms in the coming years. In the future bioeconomy, wastes will be transformed to high-value products and chemical building blocks, fuels, power and heating; biogas facilities will play a vital role in this development, and in the implementation of the novel production paths that arise in the transition to a bio-economy. The future of the biogas facility is a factory where value is created from previously wasted materials; this ensures sustainability of the environment and potential for financial gain for the local community. The flexibility of the anaerobic digestion system and its ability to digest a multitude of organic feedstocks, while producing a significant range of products ensures the role of anaerobic digestion and biogas in the circular economy.