IEA Bioenergy

Integrated biogas systems

Local applications of anaerobic digestion towards integrated sustainable solutions

Summary Series

IEA Bioenergy: Task 37: 5 2018

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Introduction

In 2015, the United Nations adopted 17 sustainable development goals (SDGs) and 169 targets as part of a global partnership. Biogas and anaerobic digestion can positively contribute to several of the SDGs. For the biogas industry, these SDG's specifically relate to food and energy security, well-being, gender equality, sustainable water management and sanitation, resilient regions and cities, sustainable industrialisation and combating the effects of climate change. To ensure that the biogas industry is on track to meet these SDGs it is imperative that the biogas sector is both economically and environmentally sustainable. Experiences from traditional biogas approaches have shown that significant government support is still required to make this market competitive and some of these systems are lacking sustainability in terms of high costs and environmental impact. Innovation, optimisation and implementation strategies are necessary to transform conventional digesters into more sustainable anaerobic digestion systems.

This report produced by IEA Bioenergy Task 37, addresses local applications of integrated biogas concepts. Through case studies, examples of technical solutions, concepts, and strategies, which pertain to sustainable biogas production, are provided. Data has been gathered on anaerobic digestion facilities from seven countries with a focus on developing countries or countries with an emerging biogas sector which are not dependent or have little reliance on, or recourse to, financial support. The case stories demonstrate that there is no 'ideal' integrated solution, as each anaerobic digestion application has different feedstocks available, constraints and end products. What needs to be considered and encouraged is adaption of exemplar systems, which suit individual situations. The following sections summarise the key findings, firstly in terms of the economic and environmental diversity of biogas plants across the globe. The report then addresses the challenges that are faced when implementing anaerobic digestion systems, leading to the local benefits that are realised when sustainable solutions are adhered to. The full report can be downloaded from http://task37.ieabioenergy.com/technical-brochures.html.

Economic and environmental diversity of biogas plants

Anaerobic digestion is a very versatile technology producing biogas, which can be used for cooking, heating, cooling and electricity production or upgraded and used for vehicle fuel or gas-grid injection. Biogas facilities range from micro-scale household digesters in developing countries,

small-scale digesters used on farms and communities to large sale digesters encompassing centralised systems found in regions and cities. The feedstock is sourced from a range of organic waste, from landfill and municipal waste, agro-industrial and livestock waste to purpose grown crops. Similarly, there is a wide range of different technologies used - from simple household digesters and covered lagoons to highly mechanized continuous stirred tanks reactors with modern sensors for process monitoring and control. Economic drivers including the cost of energy, waste disposal and fertiliser plus the level of financial support vary across the globe; these economic drivers heavily influence the size of plant, feedstocks and technology used.

Challenges of sustainable anaerobic digestion

Some of the main challenges faced when implementing the use of anaerobic digestion systems include appropriate feedstock, operation and maintenance. Correct training and quality control, together with a consistent supply of feedstock and use of all anaerobic digestion end- and by-products are essential criteria for sustainable biogas systems, which must be an appropriate fit for the community and climate. The choice of technology is also a crucial component. As methane is a strong greenhouse gas (GHG), methane emissions from the biogas process should be minimised to reduce environmental impact. Nevertheless, even with industrial biogas technology and strict regulations, emissions from digestate storage, combined heat and power (CHP), pressure valves, or leakages in the cover membrane can occur. It is assumed that GHG emissions from low cost systems, such as lagoons and small scale biogas plants, are higher, but often they are the only economic feasible solution, especially in developing countries, where energy prices are lower than in industrialised countries and where there is less or no financial support for biogas plant operators. Therefore, it is important to improve such technologies to ensure decarbonisation, sustainability and improvement in the environment, without a disproportionate increase in costs and loss of economic viability.

Regional applications to provide sustainable solutions

The purpose of using anaerobic digestion is usually related to waste management (agricultural and food waste, animal or human excreta and other organic waste) and energy production. The remaining digestate is an added benefit, which creates additional value. Thus, the use of anaerobic digestion systems can ensure proper waste management, displacement of fossil fuels, production of biofertiliser and overall decarbonisation and improved environmental impact and sustainability. Other benefits in addition to energy generation and by products particularly in regional areas include:

• Increases in local added value;

• Support for the agricultural and industrial sector in the region;

• Generation of high skill jobs in planning, engineering, operating and maintaining of biogas and biomethane plants;

• Increases in tax revenues in municipalities.