# IEA Bioenergy

# **Summary Series**

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Governance of environmental sustainability of manurebased centralised biogas production in Denmark

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#### Introduction

Manure-based centralised co-digestion is a Danish biogas production concept that developed in the late 1980s. Manure and slurries are supplied from several farms to a centrally located biogas plant for co-digestion with up to 25% digestible wastes. From its early stages of development, centralised co-digestion of manure was recognised by the Danish society as a multifunctional, environmentally sustainable concept, able to deliver a number of benefits for the agriculture, environment, and energy sectors, and society as a whole. In 2016, the annual production of biogas surpassed 9 PJ, with 75-85% of the produced biogas originating from manure-based plants. The goal is to increase annual production to 16 PJ by 2020.

## Phases of the Danish Biogas Sector

Development of the Danish biogas sector has gone through several different phases (Fig. 1).

- The **first phase** was characterized by entrepreneurship, a high level of flexibility and a low level of government control.
- The second phase was characterised by build-up and innovation through governmental financial incentives, and support for research, education and information sharing. Farmers were motivated by new restrictions to reduce nitrogen pollution from farming, which biogas production could help to achieve without major costs. During this phase, a common understanding developed that manure-based centralised biogas production is a multifunctional, environmentally sustainable concept; one that is able to deliver a number of intertwined benefits for the agriculture, environment, and energy sectors, and for society as a whole.
- During the **third phase**, government commitment to biogas development waned as a result of a shift in policy focus away from the environment and climate and more towards market liberalization, resulting in stagnation.
- The **fourth phase** began with the energy agreement of 2012, which reintroduced political commitment to the development of the biogas sector, and a goal that 50% of the manure produced in Denmark should be used for biogas production by 2030.

It is expected that the next phase will involve improved integration of biogas with the energy sector as a whole, for example as support for intermittent renewable electricity from wind and solar energy. It is also expected that a narrative will develop of biogas developments as part of the circular bioeconomy. The biogas sector is seen as a solution to several environmental

challenges that occur in connection with intensive agriculture. Financial incentives can thus be seen as part of sustainability governance. These incentives have been in place in periods of time during the development of this sector and absent in other periods. A new energy agreement is expected very soon (Fig. 1). This is expected to dictate the next phase, either leading to the sector becoming more vibrant or to a loss in momentum, depending on the outcome of negotiations.

## Sustainability Governance

The most significant sustainability concern associated with biogas deployment has been the use of agricultural land (which can be linked with undesirable indirect land use changes) and competition with fodder and food production, since co-digestion of manure with various crops significantly increases biogas production efficiency in the biogas plant. This concern led to restrictions on the use of energy crops as feedstock, and a political decision to phase out their use in Danish biogas production. Biogas sustainability is first of all about following best practice to ensure safety and sustainability improvements, throughout the closed loop supply chain. This involves the use of good practice in: crop production; handling and management of the feedstock; appropriate digestion to avoid sanitary problems of the digestate; reduction of fugitive emissions and leakages from the plant; and safe and sound application of the digestate as a biofertiliser in the field. A mix of laws, statutory orders, voluntary monitoring systems and good practice guidelines govern these issues.



Figure 1. Comparison of Danish biogas production levels with selected relevant national energy, agricultural and environmental policy strategies and agreements during the period 1986-2016. A new energy agreement is expected in 2018.

