

Danish policies on agricultural biogas production and status for their implementation

By Henning Lyngsø Foged, Organe Institute

The official target set out by the Danish Governments Green Growth Plan from 2009 was that 50% of the livestock manure production by 2020 should be used for green energy production, including biogas production. The policy target, which would lead to a Danish biogas production of 16.8 PJ was given up in 2015, where the Danish Government replaced it with more ambitious and broad plans for development of the biogas production, which for all sectors would reach 23 PJ.

The incentives for an increased agricultural biogas production in Denmark comprise a complex of regulations about energy supply, water quality, climate, waste handling and other. The framework conditions include subsidisation of agricultural biogas production, whereas subsidies are conditioned that a maximum of 12% energy crops is co-digested with the manure. Due to a considered over-compensation, the subsidy system is currently being revised.

It is on basis of progression of information and statistical data estimated that there in 2019 is more than 90 agricultural biogas plants in Denmark, digesting around 15% of the Danish livestock manure production. The agricultural biogas production has had double-digit annual growth rates in the last years, and has in 2018 reached 12.2 PJ, including a minor industrial biogas production. Livestock manure make up 87% of the influent amounts at agricultural biogas plants. The production of agricultural and industrial biogas would reach 19.2 PJ by 2020 in case of a similar increase of 57% from 2018 to 2020 as for the period 2016 to 2018. The total Danish biogas production would then exceed 20 PJ by 2020.

Policy targets

Agricultural biogas production has due to its impacts relation to several policy areas, where the most important concerns renewable energy production/climate and water quality. Some policy targets for these areas are mentioned in the following:

- Renewable energy and climate: In Denmark as well as internationally, the recognition of global warming and its harmful effects has led to the determination of measures to reduce the impacts. The United Nations' Kyoto Protocol committed Denmark to a CO₂ reduction of no less than 21% in the period from 1990 to 2012 while the average of EU countries is 8% reduction. Already in 2010, Denmark's CO₂ reduction had reached 23% via efficient measures, such as EU's emission trading scheme that made it more profitable to switch to biomass-based energy production. The Danish Governments Green Growth Plan (Miljøudvalget, 2009) set out the target of using 50% of Danish livestock manure production for green energy by 2020. The policy target, which would lead to a Danish biogas production of 16.8 PJ in 2020 was given up in 2015, where the Danish Government replaced it with more ambitious and broad plans for development of the biogas production that for all sectors would reach 23 PJ (Energistyrelsen, 2018a). The current Danish Climate Policies are listed at the web page of the Danish Energy Agency¹ and comprise among other the goals of being independent from use of fossil fuels by 2050, and a 30% renewable energy share in

¹ <https://ens.dk/en/our-responsibilities/energy-climate-politics/danish-climate-policies>

the entire energy consumption by 2020. The basis for this is the Energy Strategy 2050 (Danish Government, 2011), which also includes decisions about the development of the biogas production and the subsidies that shall provide the necessary incentives. The Energy Strategy is in 2012 followed by an Energy Agreement (Danish Government, 2012) that among other determines to establish a biogas task force to assist municipalities with appointment of suitable locations for new biogas plants and with the administrative procedure for their approval. The frame for Danish climate policies is the climate law (Energi-, Forsynings- og Klimaministeriet, 2014). In accordance with the law, the Danish Parliament, Folketinget, decided on 6 December 2019 on basis of a broad political agreement that the target for greenhouse gas emission reductions by 2030 is 70% compared to the emissions in 1990.

- Water quality: The Danish Governments Green Growth Plan (Miljøudvalget, 2009) determined that the loss of nitrogen to the aquatic environment should be reduced with 19,000 tonnes from 2010 to 2015. Since then, the Food and Agriculture Package (Danish Government, 2015) set the goal to reduce nitrogen emissions to the aquatic environment with approx. 6,000 tons in the period 2016-2021. Also, Denmark is member of the Helsinki Convention, which has an overall goal of a Baltic Sea unaffected by eutrophication, and Denmark has a current obligation within the Convention to reduce the loss of nitrogen to the Baltic Sea with 2,890 tonnes of nitrogen per year (HELCOM, 2015).

Policy instruments employed to reach the targets

Historically, livestock manure-based biogas production has been favoured by agro-environmental legislation introduced since the 80'ies. The regulations have been amended since they were first introduced:

- Currently livestock farms are requested to have nine months storage capacity for their manure production as well as a sufficient cultivated area for use of it as crop fertiliser (Miljø- og Fødevareministeriet, 2019a), meaning a general limit of 170 kg manure N per ha. There is also a flat rate limit of 30 kg P per ha, including P in both mineral fertiliser and livestock manure.
- Livestock manure nutrients in excess can according documented agreements be used as fertiliser at other farms.
- Official standard values for manure applies (Lund et al., 2019) for calculation of the fertilising effect of livestock manure, for calculation of the amount of nitrogen per ha and for ensuring a sufficient livestock manure storage capacity.
- Farms needs to present fertiliser plans before planting, as well as fertiliser accounts after harvest (Miljø- og Fødevareministeriet, 2017).
- Minimum thresholds for the nutrient use efficiency of nitrogen in livestock manure applies, e.g. 75% for pig slurry and 70% for cattle slurry (Miljø- og Fødevareministeriet, 2019b).
- Principally, all Danish livestock farms need to have an environmental approval (Miljø- og Fødevareministeriet, 2019), whereas the complication of the procedure for its obtaining is correlated to the number of animals, and an environmental impact assessment is required from farms above the minimum size threshold given by the Industrial Emissions Directive (2010/75/EU).

The abovementioned regulations were introduced to reduce the environmental load of farming to the benefit of water quality. These regulations are important to mention because they directly favour livestock manure-based biogas production, which

- 1) improves the nutrient use efficiency of manure nitrogen as a larger share of the nitrogen in digestate is mineralised (Birkmose, 2016), and
- 2) via regional biogas production plants that functions as centres for redistribution of livestock manure ease the requirements for manure storage capacity and harmony between land and livestock manure nutrients.

Other important incentives are both in the form of regulations, financial incentives and administrative assistance:

- The Energy Strategy 2050 (Danish Government, 2011) determines the size of subsidies that shall provide the necessary incentives. A limited budget was allocated for supporting investments in biogas plants with up to 30%. The subsidies were conditioned a maximum of 12% energy crops being used for co-digestion. The subsidy system is currently being changed due to a considered over-compensation.
- The Energy Strategy 2050 was in 2012 followed by an Energy Agreement (Danish Government, 2012) that among other determined that a biogas task force should be established to assist municipalities with appointment of suitable locations for new biogas plants and with the administrative procedure for their approval.

Current status for agricultural biogas plants in Denmark

Figure 1 shows the development in the Danish biogas production.

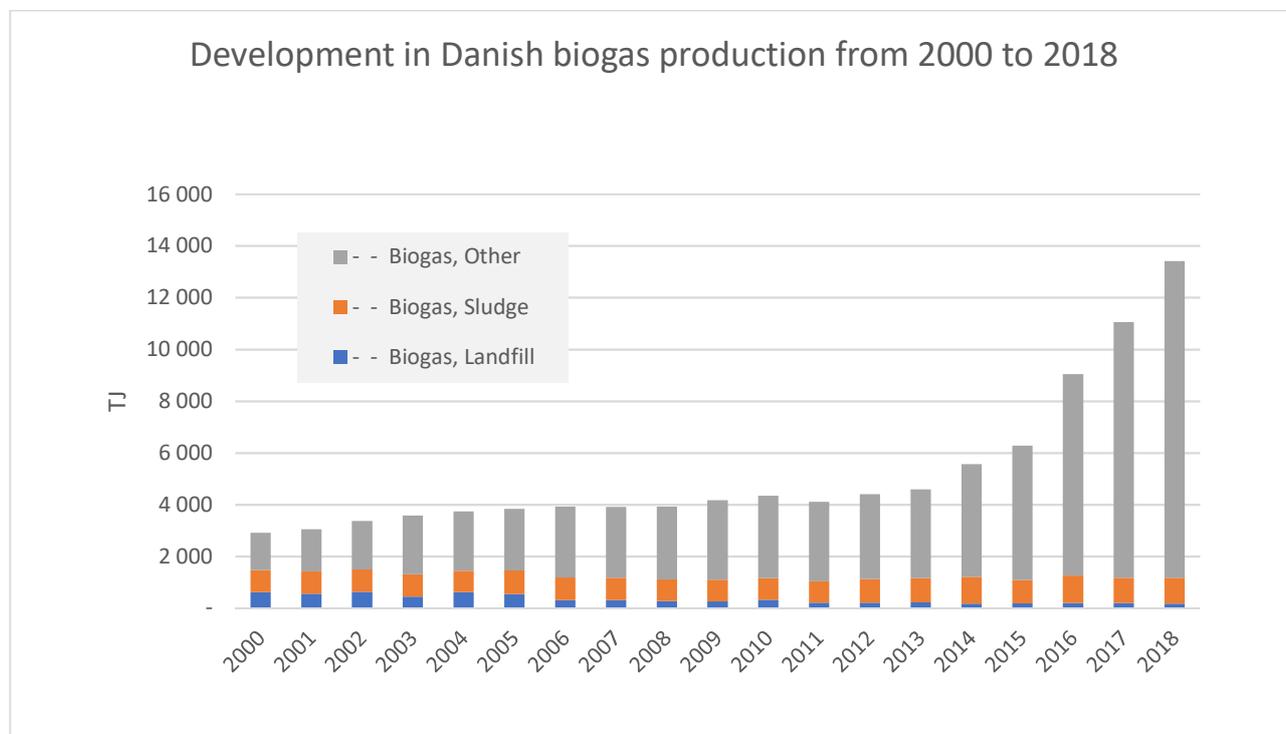


Figure 1: Development of the total Danish biogas production, divided on sectors. "Biogas, other" is dominated by livestock manure-based biogas production but includes also a smaller industrial biogas production. Based on data provided by Energistyrelsen (2018b).

Figure 1 illustrates clearly that the agricultural biogas production was substantially increased as an effect of the 2012 Energy Agreement that implemented the increased subsidisation for biogas production, decided with the Energy Strategy 2050 (Danish Government, 2011). In fact, the “Biogas, other”-production has increased 8.5 times in the period from 2000 to 2018. The production of “Biogas, other” would reach 19.2 PJ by 2020 in case of a similar increase of 57% from 2018 to 2020 as for the period 2016 to 2018. The total Danish biogas production would then exceed 20 PJ by 2020.

Figure 2 shows the location and size of the biogas plants.

Based on a progression of information from the last years, it is estimated that there now are more than 90 livestock manure-based biogas plants in Denmark, whereof at least 54 farm-scale biogas plants. The regional biogas plants are typically digesting 100 - 2,000 tonnes per day, and the farm-scale biogas plants 10 – 100 tonnes per day.

87% of the digested biomass in agricultural biogas plants is livestock manure, and 44% of the biogas is upgraded and injected into the gas grid and 53% is used for electricity production in 2017 (DAKOFA, 2018).

References

- Birkmose, Torkild S. 2016. Markeffekt af kvælstof i afgasset biomasse (In English: Nitrogen use efficiency of digestate). Planteavlsoorientering 1010. Landbrugsinfo.
- DAKOFA. 2018. Biogasproduktionen fordoblet i Danmark på 3 år. (In English: The biogas production is doubled in three years.) <https://dakofa.dk/element/biogasproduktionen-fordoblet-i-danmark-paa-3-aar/>

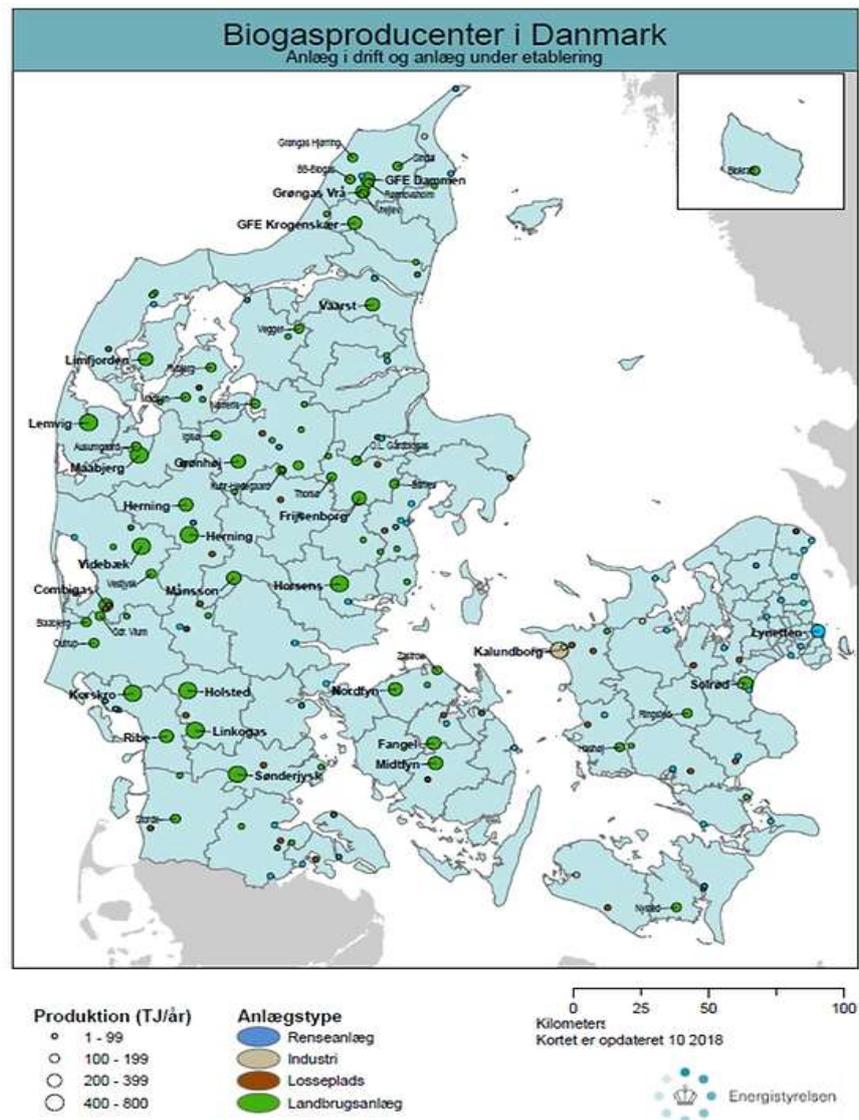


Figure 2: Location of Danish biogas plants. Those shown in green are related to agriculture, blue to wastewater treatment / sludge, red to landfills and grey to industry. (Source: Energistyrelsen)

- Danish Government. 2015. Aftale om Fødevarer- og Landbrugspakke. (In English: The Food and Agriculture Package).
https://mfvm.dk/fileadmin/user_upload/FVM.dk/Dokumenter/Landbrug/Indsatser/Foedevare-og-landbrugspakke/Aftale-om-foedevare-og-landbrugspakken.pdf
- Danish Government. 2012. Energiaftalen. (In English: Energy Agreement).
https://ens.dk/sites/ens.dk/files/EnergiKlimapolitik/aftale_22-03-2012_final_ren.doc.pdf
- Danish Government. 2011. Energy Strategy 2050.
http://www.danishwaterforum.dk/activities/Climate%20change/Dansk_Energistrategi_2050_febr.2011.pdf
- Energistyrelsen. 2018a. Perspektiver for production og anvendelse af biogas i Danmark.
https://ens.dk/sites/ens.dk/files/Bioenergi/perspektiver_for_production_og_anvendelse_af_biogas_i_danmark_november_2018.pdf
- Energistyrelsen. 2018b. Månedlig og årlig energistatistik. (In English: Monthly and annual energy statistics). <https://ens.dk/service/statistik-data-noegletal-og-kort/maanedlig-og-aarlig-energistatistik>
- Energi-, Forsynings- og Klimaministeriet. 2014. LOV nr 716 af 25/06/2014: Lov om Klimarådet, klimapolitisk redegørelse og fastsættelse af nationale klimamålsætninger. (In English: Law on climate council, climate monitoring and determination of climate goals).
<https://www.retsinformation.dk/forms/R0710.aspx?id=163875>
- Foged, Henning Lyngsø. 2012. Livestock Manure to Energy - Status, Technologies and Innovation in Denmark. Inbiom.
<https://inbiom.dk/admin/public/download.aspx?file=/Files/Files/ecom/products/Biogas-Go-Global/Livestock-Manure-to-Energy.pdf>
- HELCOM, 2015. Updated Fifth Baltic Sea pollution load compilation (PLC-5.5). Baltic Sea Environment Proceedings No. 145.
- Lund, Peter et al. 2019. Normtal 2019.
<https://anis.au.dk/forskning/sektioner/husdyrernaering-og-fysiologi/normtal/>.
- Miljø- og Fødevarerministeriet. 2019a. BEK nr. 760 af 30/07/2019: Bekendtgørelse om miljøregulering af dyrehold og om opbevaring og anvendelse af gødning (Husdyrgødningsbekendtgørelsen). (In English: Ordinance on environmental regulation of livestock production, and storage and use of livestock manure.)
<https://www.retsinformation.dk/Forms/R0710.aspx?id=209913>
- Miljø- og Fødevarerministeriet. 2019b. Vejledning om gødsknings- og harmoniregler - Planperioden 1. august 2019 til 31. juli 2020. (In English: Guidelines for fertilising and livestock densities, 2019/2020).
https://lbst.dk/fileadmin/user_upload/NaturErhverv/Filer/Landbrug/Goedningsregnskab/Vejledning_om_goedsknings-og-harmoniregler_i_planperioden_2019_2020_version2.pdf
- Miljø- og Fødevarerministeriet. 2018. BEK nr. 1021 af 06/07/2018: Bekendtgørelse om godkendelse og tilladelse m.v. af husdyrbrug (Husdyrgodkendelsesbekendtgørelsen). (In English: Ordinance on approval of livestock farms etc.)
<https://www.retsinformation.dk/Forms/R0710.aspx?id=202416>

- Miljø- og Fødevareministeriet. 2017. LBK nr 433 af 03/05/2017: Bekendtgørelse af lov om jordbrugets anvendelse af gødning og om plantedække. (In English: Ordinance on farms use of fertilisers and about plant cover etc.)
<https://www.retsinformation.dk/Forms/R0710.aspx?id=188833#idfb66f416-f7f7-4c6d-b27e-fdf8ac931f0e>
- Miljøudvalget. 2009. Aftale om Grøn Vækst. (In English: Agreement on Green Growth).
<http://www.ft.dk/samling/20111/almdele/miu/bilag/21/1030569.pdf>
- Ott, Svend Otto. 2015. Status på biogasanlæg i Danmark. PowerPoint. Biogasrejseholdet. Erhvervsstyrelsen.