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## Decline in Danish agricultural greenhouse gasses

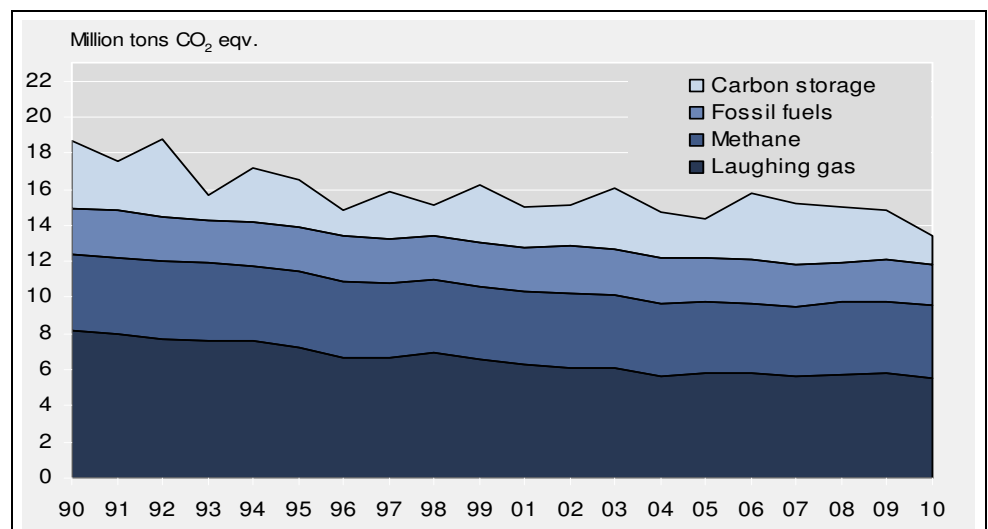
Highlights.

- Danish agricultural emissions of greenhouse gasses declined 10 pct. from 2008 to 2009. This decrease continues many years of steady decline in the Danish agricultural greenhouse gas emissions. From 1990 to 2009 greenhouse gas emissions were reduced by 28 pct., i.e. from 18.7 million tons to 13.4 tons CO<sub>2</sub> equivalents.
- The driving forces behind this development are combined agricultural approaches, which have led to improved efficiency in production as well as environmental gains. Optimization of breeding and feeding, improved utilization of nitrogen in manure, reduced use of fertilizer and changes in tillage are among the main factors.
- Further improvements are expected in the future due to e.g. enhanced use of manure for biogas, as well as catch crops, conversion of cultivated soils into non-cultivated areas, extensification of environmentally sensitive lowland soils and establishment of wetlands.

*Ten pct. decline in greenhouse gas emissions from 2008 to 2009*

Danish agricultural emissions of greenhouse gasses continue to decline. From 2008 to 2009, total emissions of agricultural greenhouse gasses measured in CO<sub>2</sub>-equivalents declined 10 pct., corresponding to a decline from 14.8 million tons in 2008 to 13.4 million tons in 2009.

### Emissions of Danish agricultural greenhouse gasses. 1990-2009



Source: "Central Data Repository Submission March 15 2011, for years 1990-2009. Reporting obligation for: Greenhouse gas inventories (EU)". Eionet.

The emissions of laughing gas (N<sub>2</sub>O) were reduced 4.6 pct., from 5.8 million tons in 2008 to 5.5 million tons in 2009. The emissions of methane (CH<sub>4</sub>) were almost stable, but showed a small increase of 1.8 pct., from 4.0 million tons to 4.1 million tons. Emissions of laughing gas and methane together decreased 2 pct.

Emissions of fossil fuels were reduced by 3.7 pct., from 2.3 million tons to 2.2 million tons, and emissions from carbon storage, which varies somewhat over time, were reduced by 42 pct., from 2.7 million tons to 1.6 million tons.

*Reduction in greenhouse gasses of 28 pct. from 1990 to 2009*

The recent development continues many years of decrease in the agricultural greenhouse gas emissions in Denmark. Thus, from 1990 to 2009 the emissions of greenhouse gas emissions were reduced by 28 pct., i.e. from 18.7 million tons to 13.4 tons CO<sub>2</sub> equivalents.

Emissions of laughing gas, methane and fossil fuels display a steady decrease from 1990 to 2009, with decreases of 32 pct., 3 pct. and 13 pct., respectively. Emissions from carbon storage show a reduction of 59 pct. from 1990 to 2009 with some fluctuations.

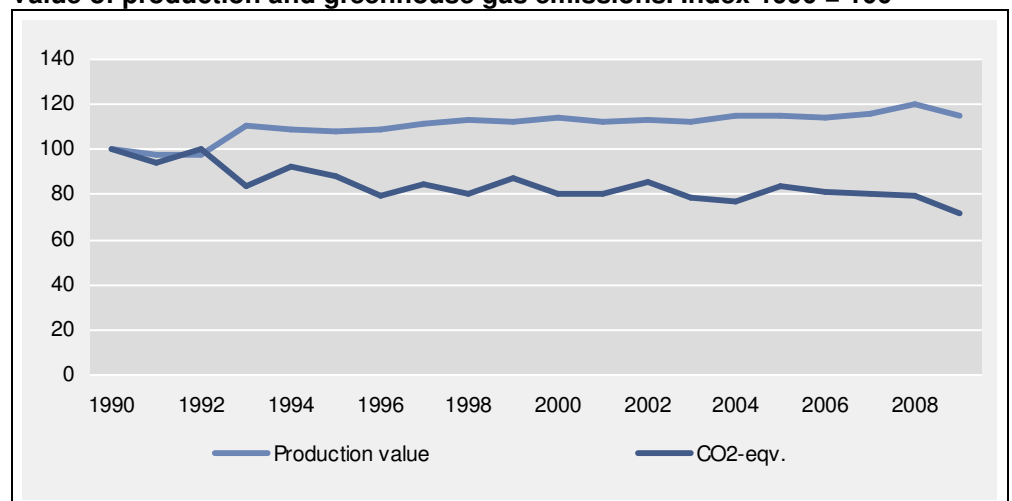
*Methane comes from cows' digestion and laughing gas from the use of manure and fertilizers*

Agricultural emissions of methane are primarily due to cows' digestion, but also from manure handling and storage. Emissions of laughing gas are related to transformation of nitrogen when using manure and fertilizers in the field. Emissions from the use of fossil fuels derive from the use of fuels and electricity for vehicles and machines. Emissions related to carbon storage occur in connection with tillage. Reduced tillage leads to reduced emissions.

*Parallel increase in production of 15 pct.*

The 28 pct. reduction in greenhouse gas emissions have been achieved in parallel with an increase in agricultural production of 15 pct. from 1990 to 2009 (output value in constant prices).

**Value of production and greenhouse gas emissions. Index 1990 = 100**



Sources: "Central Data Repository Submission March 15 2011, for years 1990-2009", op.cit. and the Danish National Accounts.

*Decoupling*

What are the driving forces behind this successful decoupling of production increase from reductions in emissions?

*Optimization of breeding and feeding among main explanatory factors*

Danish farmers have combined various approaches, which have led to improved efficiency in production as well as environmental gains. Optimization of breeding and feeding, improved utilization of the nitrogen contents in ma-



nure, reduced use of fertilizer and changes in tillage are among the main factors.

Research and development concerning further improvements of the environmental performance is still being carried out in the Danish agricultural sector and related institutions and is expected to enable further reductions in greenhouse gas emissions as well as in other environmental impacts.

*Future improvement expected as a result of increased use of manure for biogas...*

As an example, enhanced use of manure for production of biogas can reduce climate impacts. The Danish agricultural sector aims at a target of 50 pct. of the production of manure to be used for biogas in 2020. This will provide improvements in the both climate performance and environmental performance of the sector.

*... as well as catch crops, extensification and wetlands*

Other examples of approaches, which can be applied further in the future, are catch crops, conversion into non-cultivated areas, extensification of environmentally sensitive lowland soils and establishment of wetlands.

**Data Agricultural emissions of greenhouse gasses. 1990, 2008 and 2009**

	Million tons CO <sub>2</sub> equivalents			Pct.	
	1990	2008	2009	1990-2009	2008-2009
Laughing gas	8,16	5,78	5,52	-32	-5
Methane	4,23	4,02	4,09	-3	2
Sum	12,38	9,80	9,61	-22	-2
Fossil fuels	2,54	2,31	2,23	-13	-4
Carbon storage	3,76	2,69	1,55	-59	-42
<b>Total</b>	<b>18,69</b>	<b>14,80</b>	<b>13,38</b>	<b>-28</b>	<b>-10</b>

Source: "Central Data Repository Submission March 15 2011, for years 1990-2009", op.cit.

*Literature* The European Environmental Agency (EEA): "Central Data Repository Submission March 15 2011, for years 1990-2009. Reporting obligation for Greenhouse gas inventories (EU)". Eionet, Reporting Obligations Database. <http://rod.eionet.europa.eu/>.

National Environmental Research Institute: "Danish Emission Inventory for Agriculture. Inventories 1985-2009". NERI Technical Report no. 810. 2011.



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