Ammonia abatement in Denmark

Geneva 2017

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## Danish Agriculture

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<table>
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<tbody>
<tr>
<td>National territory</td>
<td>4.3 mill. hectares</td>
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<tr>
<td>Agricultural area</td>
<td>2.6 mill hectares (6 pct. permanent grass)</td>
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<tr>
<td>Number of agricultural holdings</td>
<td>55,000 holdings</td>
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<tr>
<td>Number of livestock holdings</td>
<td>30,000 holdings</td>
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<tr>
<td>Annual production of pigs for slaughter</td>
<td>23 mill. pigs for slaughter</td>
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<tr>
<td>Annual milk production</td>
<td>4.5 bn. kg milk</td>
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Livestock density
Focus for the media and politicians

Before 2001-2003

- Nitrate pollution of the ground water (health)
- Dead fish and lobsters in response to periods of oxygen deficit in fjords and coastal waters (1986 had big incident)

Now - also

- A growing concern for biodiversity and vulnerable nature
  - More focus on ammonia emission
  - More focus on phosphorous
  - Local ‘response’ to increase in livestock production (nobody like to have a major pig farm as close neighbour)
  - Focus on odour from pigs and slurry
  - Health effect of secondary PM-pollution
# Overview, Action Plans

<table>
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<tr>
<th>Year</th>
<th>Description</th>
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<tr>
<td>1985</td>
<td>NPo Action Plan</td>
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| 1987 | Action Plan I on the Aquatic Environment  
  (objective 49% reduction of nitrate leaching) |
| 1991 | Action Plan for Sustainable Agriculture |
| 1998 | Action Plan II |
| 2000 | AP II Midterm evaluation |
| 2001 | Ammonia Action Plan (as set out in Action Plan II) |
| 2004 | Action Plan III |
| 2009 | Green Growth |
| 2015 | Foodstuff and agriculture action plan (growth) |
Regulatory measures on use of fertilizers and winter plant cover. Control and inspection by state authorities

• Mandatory fertilizer plans

• Mandatory demands for late crops (grass, beets, catch crops)

• Standards on utilization of animal manure N (70-75 % slurry) can result in a reduction in the allowed amount of commercial fertilizer

• Maximum limits for plant-available N applied to different crops nitrogen standards which were 18 %, now 0 %, below economic optimum

• Max. 140 kg N/ha from animal manure. Rest from commercial fertilizer. 170 kg N/ha from cattle holdings - 230 kg N/ha under certain conditions on crops – special exception in Nitrate Directive
**Housing - Best Available Technology**

- From 2007 a 15% reduction of NH3 was required compared to "best standard housing system"

- Gradually increased to 30% in 2010

- Reduction measures of own choice – incl. feeding, housing, add-on technologies and storage.

- In 2010 the guideline in the 2003 BREF (pigs and poultry) was transformed into national guiding emission limit values for all animal types. From 2017 these limit values are binding.

- Major revision in 2017. Regulation is based on emission per floor area (emitting surface) rather than animal units.

Definition of BAT: single technique < 100 Dkr. (~ €13)/ kg reduced N and a combination of techniques < 1-2% of cost of production (~ € 5)
Regulatory measures encompassed all livestock production

Demands to animal housing (Floors etc.)

Storage capacity

• 7-9 month – preferably a full year

Cover on storage container, compost and manure yards

Control and inspection by local authorities every 3rd year by local authorities
Regulation regarding spreading of livestock manure

• Purpose: to reduce ammonia emissions and nitrate leaching

• Periods of spreading: Not allowed to use livestock manure after harvest to 1. February. Exception: allowed in the autumn on grass and winter rapeseed

• only band spreading and injection of slurry is allowed (no overall / broad spreading)

• It is mandatory to inject slurry used on grass and on “bare soil”

• Solid manure shall be incorporated into the soil within 6 hours when spreading on bare soil

• These measures (2 slides) decreased the Danish ammonia emissions to air by 30% from end of 1990’es to 2003.
Voluntary measures

• 16,000 hectare wetlands

• 170,000 hectare organic farming mostly dairyfarms
New local actions plans for the aquatic environment

- 10 meter buffer zones along streams and lakes
  - Introduced 2012
  - Abandoned 2015
- Additionally 140,000 ha late crops
- More wetlands
  - Implementation still pending
- Restrictions in soil management in the autumn
Environmental achievements

Nitrate:

- 1985-2003: Nitrate leaching reduced with 48% (Chemical fertilizer (N) 49%)

Phosphorous:

- 1985-2003: Surplus reduced with app. 50% (25 kg P/ha => 13 kg P/ha)
- 2004 (AAE III): Surplus reduced with 50% (2015) => 7 kg P/ha

Ammonia:

- 1990-2007: Reduced with app. 30%.
- Green Growth (2009): New standards (30% reduction compared to best practice 2005/2006) and demands for max. deposition on nature (vulnerable nature compassed by Habitat Directive (0.2-0.7 kg N per hectare))
Whats on its way for animal manure?

**Biogas:**

- 6% of the slurry is today treated in biogasplants
- Utilization of N is increased from 75 to 85% in residue, energy is produced and the methane emission is reduced.

**Slurry separation:**

- 10% of the slurry is separated and dry matter is exported to other farms.
- Dry matter compressed to pills and exported (high dry matter and P)
- Dry matter could be used for burning (energyproduction)

**Acidification:**

- Reduced ammonia emission and improved utilization of nitrogen
- 19% of total amount is acidified – most from cattle, as acidification can act as a substitution for injection on grasslands
Surveillance of surface water quality