

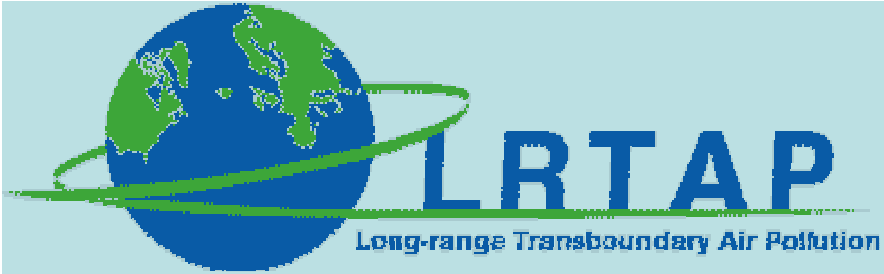


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Update on Revision of Annex IX & the Economic Costs of its Provisions

Oene Oenema and Mark Sutton
(co-chairs TFRN)

WGSR-48, 11 -13 April 2011



Exciting week about 'nitrogen'

- Conference on 'Nitrogen and Global Change' in Edinburgh, UK, 12-14 April 2011
 - Presenting final results of IP NitroEurope
- Launch of the European Nitrogen Assessment (ENA)
 - Article in Nature about "Too much of a good thing"
 - Press releases
- Meeting WGSR-48:
 - Revision of the Gothenburg Protocol



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Grennfelt
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Grizzetti

**The European
Nitrogen Assessment**

The European Nitrogen Assessment

Sources, Effects
and Policy Perspectives

Edited by

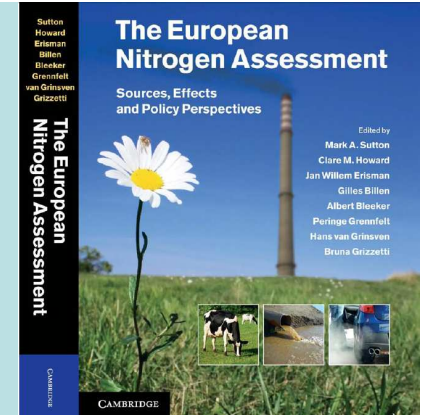
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CAMBRIDGE

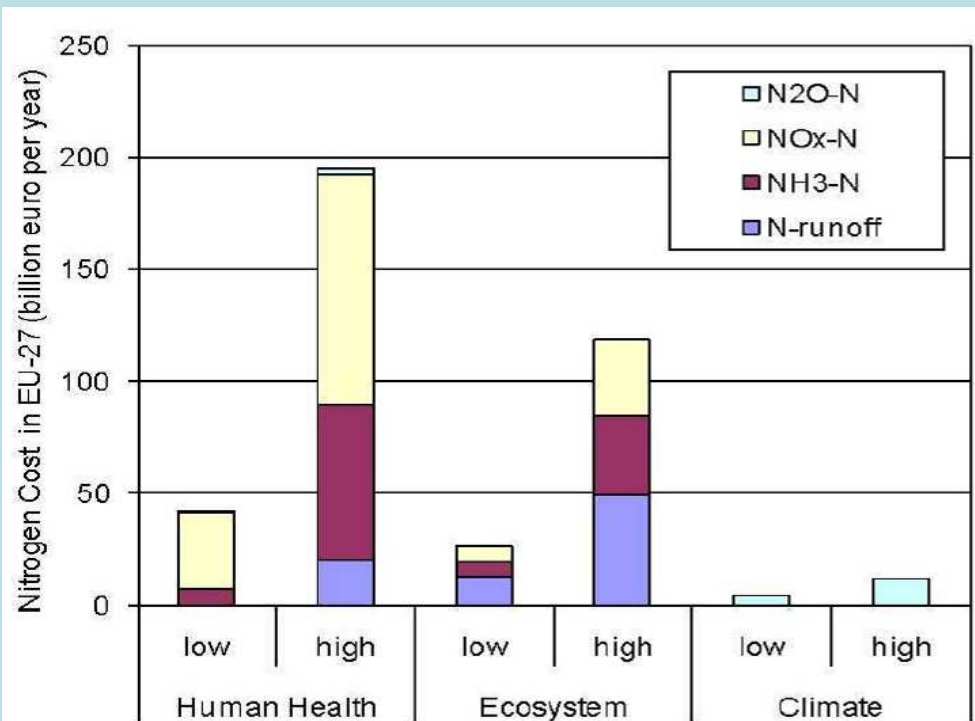


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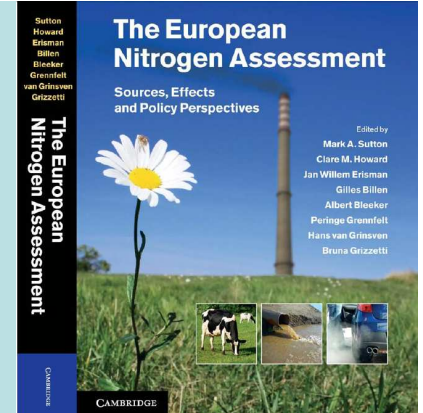
European Nitrogen Assessment

First integrated nitrogen assessment, with contributions from 200 experts from 21 countries and 89 organisations in Europe



Damage by nitrogen emissions estimated at 70 to 320 billion euro per yr

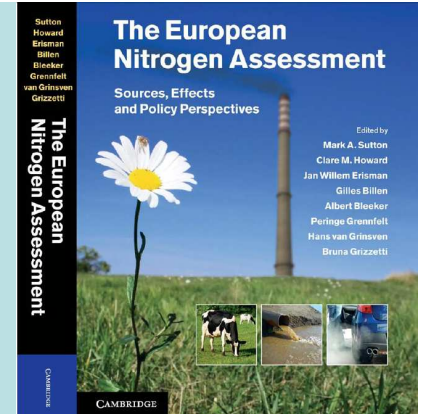




European Nitrogen Assessment

Proposes a package of 7 key actions:

- Improving nitrogen use efficiency in crop production
- Improving nitrogen use efficiency in animal production
- Increasing the fertilizer N equivalence value of animal manure
- Low-emission combustion and energy-efficient systems
- Recycling nitrogen (& phosphorus) from waste water systems
- Energy and transport savings
- Lowering human consumption of animal protein



European Nitrogen Assessment

Summary for Policy Makers

- We suggest to submit this summary to
 - WGSR-49 in August 2011, as (in)formal document
 - Executive Body meeting in December 2011, as formal document



**Options for revising
Annex IX of
the Gothenburg Protocol**



TFRN documents to WGSR-48

- 1. Report of TFRN-5 in Paris,
(ECE/EB.AIR/WG.5/2011/6)**
- 2. Draft revised technical Annex IX of GP
(ECE/EB.AIR/WG.5/2011/3)**
- 3. Revised Draft Guidance Document for preventing
and abating NH₃ emissions (Informal Document)**
- 4. Nature comment on 'Too much of good thing'
(Informal Document)**



Report TFRN-5

27 October 2010, Paris

TFRN-5 discussed:

- Feedback from WGSR-47
- Results of workshop on “Costs of ammonia abatement and the climate co-benefits”, Paris, 25 - 26 October 2010.
- Proposal for revision of Annex IX
- Draft Guidance Document
- Work of Expert Panels
- TFRN-6 in Rome, 10-12 May 2011

Costs of ammonia abatement

Main results of the workshop (to be published in a book):

- Cost of abatement measures are less than previously reported;
- Some side-effects of abatement measures provide benefits to farmers
 - e.g. , fertilizer savings, less smothering of herbage, increase animal health
- Climate co-benefits can be significant
 - e.g. CO₂ and N₂O emissions associated with fertilizer production

Costs of ammonia abatement

Main results of the workshop:

- Cost of abatement measures depend on farm size and structure (farm-specific);
- Most measures costs roughly € -0.5 to 2 per kg NH₃-N saved, but some more expensive
- Measures have to be considered from a 'whole-farm' perspective, as a strategic package of measures (which then may lead to innovation and technical change).
- Farmers need time to adjust and learn (also from each other)

Overview of mean costs of ammonia abatement measures

| Measures | Cost, €/kg NH₃-N saved |
|---------------------|--|
| Nitrogen management | -1.0 to 1.0 |
| Feeding strategies | -0.5 to 1.0 |
| Animal housing | 0.0 to 10 |
| Slurry storages | 0.1 to 4.0 |
| Slurry application | -0.5 to 5.0 |
| Urea application | -0.1 to 1.5 |

Costs of ammonia abatement

- Relatively cheap measures are
 - Nitrogen management
 - Feeding strategies
 - Covers on slurry storages
 - Slurry application (esp. via contractors)

- Expensive measures are:
 - Rebuilding existing housing systems
 - New housing systems when reduction targets are high
 - Solid manure application
 - Go beyond 'minimum thresholds for animal feeding'

Costs of ammonia abatement

Experiences from practice:

- DK and NL have reduced ammonia emissions by ~50%, yet have competitive animal agriculture
- Overall mean costs of housing and slurry storage measures in pig houses in NL are estimated at 3 euro per kg N saved.



Proposals for Updated and **New** measures in Annex IX

- **Nitrogen management, considering the whole N cycle**
- **Livestock feeding strategies**
- Animal housing, **including cattle housing**
- Manure storage, **including those for cattle manure**
- Manure spreading
- Mineral fertilizer use, including urea, **ammonium phosphate and ammonium sulphate**



Three ambition levels; all technical feasible

- A. High level of ambition in reducing NH_3 emissions,
- B. Moderate level of ambition, as well as being cost effective;
- C. Modest level of ambition, as well as being cost effective;



Ambition levels (A, B, C) vary in targets, thresholds and implementation dates

➤ **Targets:**

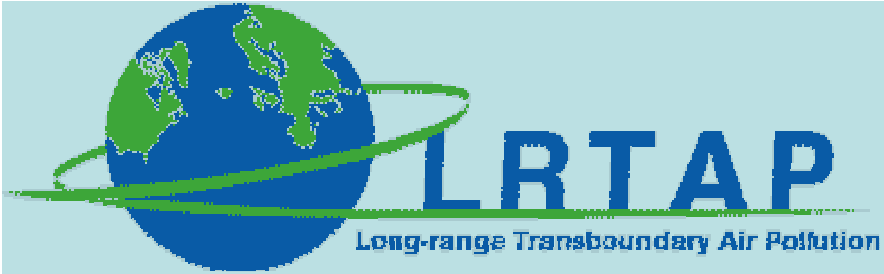
- Emissions reduction targets

➤ **Thresholds**

- Farm size, size of tankers for manure spreading

➤ **Implementation dates:**

- Delayed implementation for countries in transition



Options & thresholds & targets

- Current proposals have for each option (A,B,C) one threshold and one emission reduction target.
- However, it is possible to have various farm size thresholds with different reduction targets within one option. Provides flexible.



Selecting farm size thresholds

- **Thresholds for cattle farming (~50% agric NH₃)**
 - A. > 5 livestock units, for new farms
 - B. > 50 livestock units, covering 13% of farms in EU; 72% of cattle
 - C. > 50 livestock units, covering 13% of farms in EU; 72% of cattle

- **Thresholds for pig farming (~20% agric NH₃)**
 - A. > 5 livestock units, for new farms
 - B. > 200 livestock units, covering ~70% of pigs in EU)
 - C. > 750 sows & > 2000 fattener pigs (covering ~20% of EU pigs)

- **Thresholds for poultry farming (~15% NH₃)**
 - A. > 5 livestock units, for new farms
 - B. > 40,000 chickens, covering ~70% of EU poultry)
 - C. > 40,000 chickens, covering ~70% of EU poultry)



A. Advisory Code of Good Agricultural Practice

- No quantitative ammonia reduction targets
- Still has to be updated.



B. Nitrogen management at whole-farm

C. Livestock feeding strategies

- **Indicators:**
 - Nitrogen Use Efficiency (NUE) and Nitrogen Input-Output Balances (NIOB)
 - Contents of protein, non-starch polysaccharides, & cation-anions

- First 5-10 years establishing baseline values

- **Improvement targets:** relative change of 5 yrs means
 - A: 30%
 - B: 20%
 - C: 10%



D. Animal housing

- **Existing large pig & poultry farms:** >20% (as now)
- **New pig houses:**
 - A: >35% when T in summer >20 C; else >60%
 - B: >25% when T in summer >20 C; else >35%.
 - C: >25%
- **New broiler farms:** >20% ;
- **New laying hen houses**
 - A: >60%
 - B: >60% for non-caged hens and 50% for hens in cages
 - C: >60% for non-caged hens and 30% for hens in cages
- **New cattle farms** >25%, when feasible
- **Other livestock;** reduce NH₃ emissions when feasible



E. Manure Storage

- **New slurry stores:**
 - A: 80%;
 - B: 60%;
 - C: 40%;

- **For existing slurry stores: >40%**

- **Solid manure: when feasible :**



F. Manure application

- Reduction targets depend on soil, crop, slope, farm size, tanker size:
 - A: > 60% (with specific exemptions)
 - B: > 30% (with specific exemptions)
 - C: > 30% (with specific exemptions)



G. Urea and ammonia-based fertilizers

- Ban on ammonium carbonate fertilizers
- Urea and ammonium sulphate and phosphate fertilizers: emission reduction targets:
 - A: >80%
 - B: >50%
 - C: >30%



Guidance Document

- Revised draft version available, which include now information on economic costs;
- The Guidance Document lists 3 categories of techniques/approaches:
 - Category 1: well proven
 - Category 2: sound, but some uncertainties
 - Category 3: with problems and not recommended



Concluding remarks

- Total societal costs of excess nitrogen in the environment are large;
- Various options are available for decreasing ammonia emissions, at relatively low cost.
- The various options and emission abatement techniques have been described in detail in the draft Annex IX and the draft Guidance Document



Current Annex IX of Gothenburg Protocol addresses a fraction of the total emissions of NH_3 from agricultural sources

- A. Advisory code of good agricultural practice;
- B. Ban on ammonium carbonate fertilizers; limit emissions from urea fertilizers, when feasible;
- C. Manure application: target of >30% emission reduction, when feasible;
- D. Manure storage: large pig & poultry farms: target of >40% emission reduction for new stores; and 40% for existing stores when feasible; and
- E. Animal housing: target > 20% emission reduction for new housing of large pig & poultry farms.



C. Livestock feeding strategies

- Animal feed composition (NH_3 emission potential) as indicator:
 - Protein content;
 - Non-starch polysaccharides content
 - Cation-anion balance

- First 5 years establishing baseline values
 - A: farms > 5 LU
 - B; farms > 50 LU for cattle; >200 LU of pigs; >40000 chickens
 - C: farms > 50 LU for cattle; current thresholds for pigs and poultry

- Improvement targets: relative change of 5 yrs averages
 - A: 30%
 - B: 20%
 - C: 10%