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

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(co-chairs TFRN)

WGSR-48, 11 -13 April 2011

## Exciting week about ‘nitrogen’

- Conference on ‘Nitrogen and Global Change’ in Edinburgh, UK
  - 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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**The European  
Nitrogen Assessment**

# The European Nitrogen Assessment

Sources, Effects  
and Policy Perspectives

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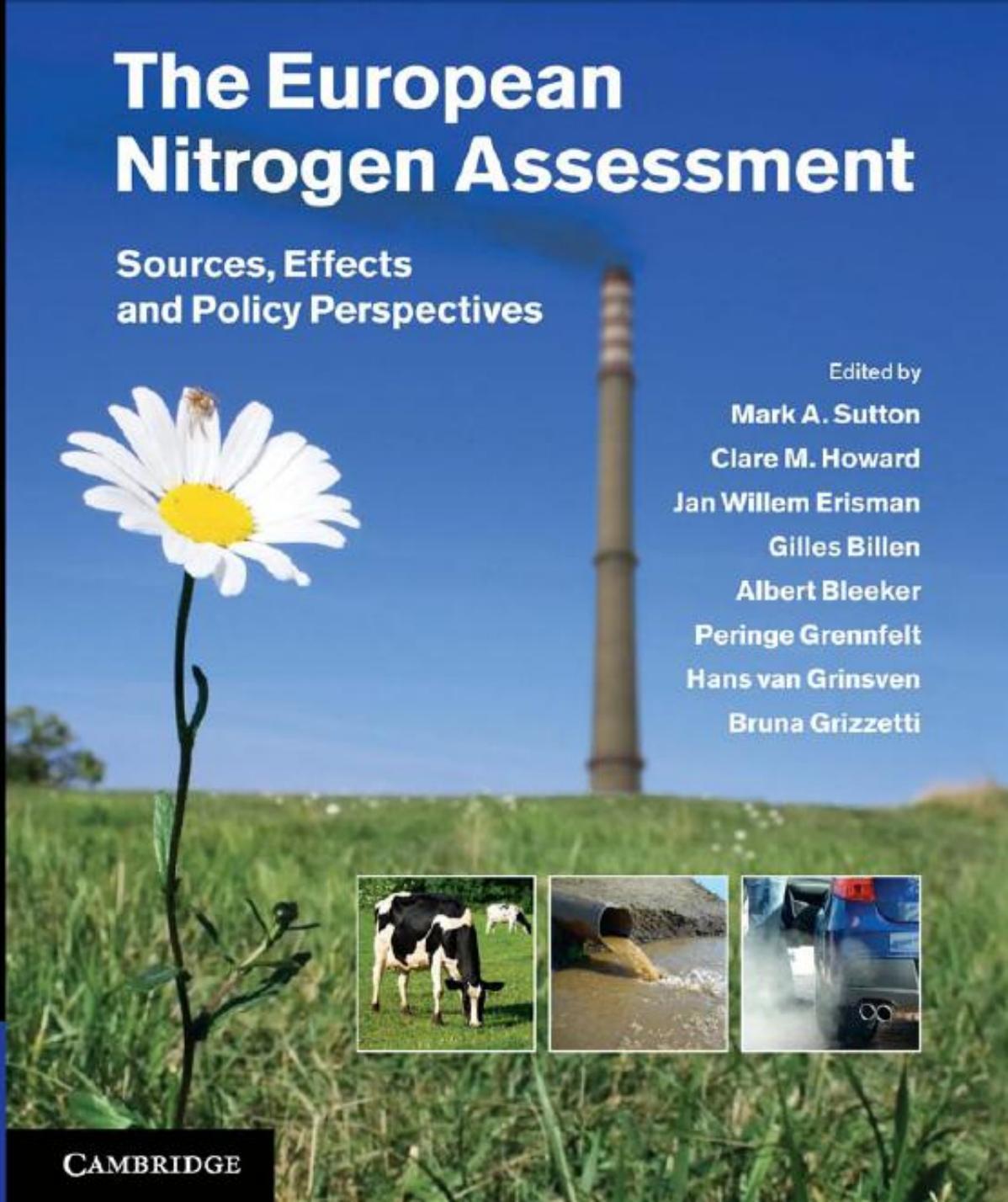
Gilles Billen

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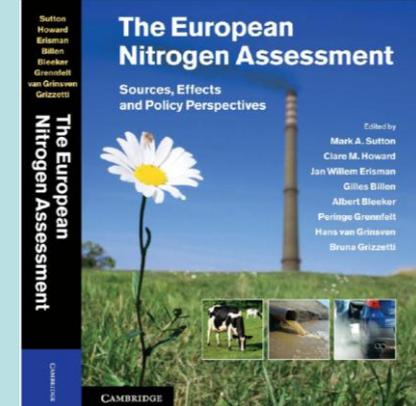
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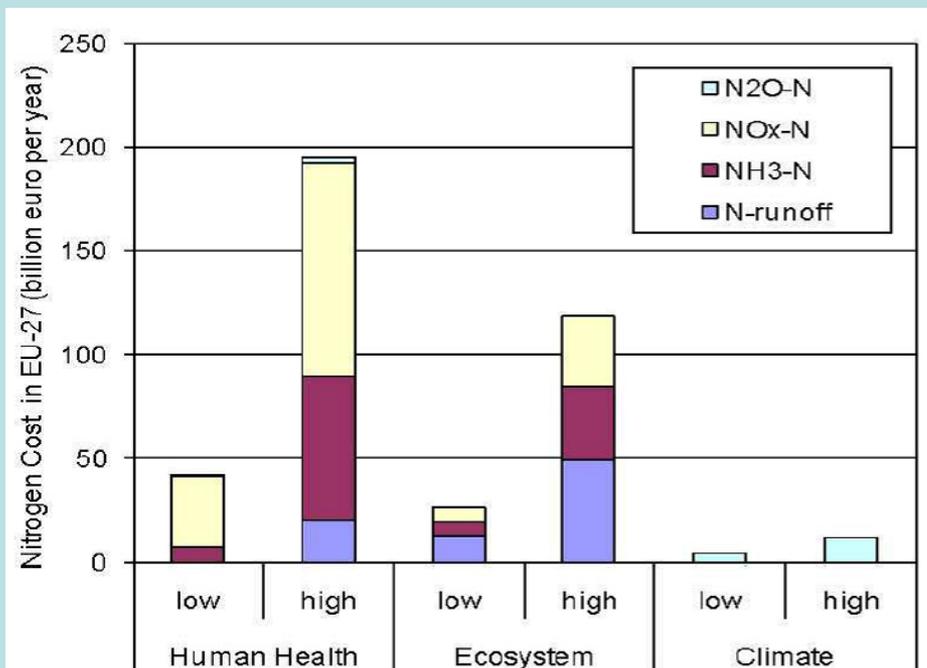
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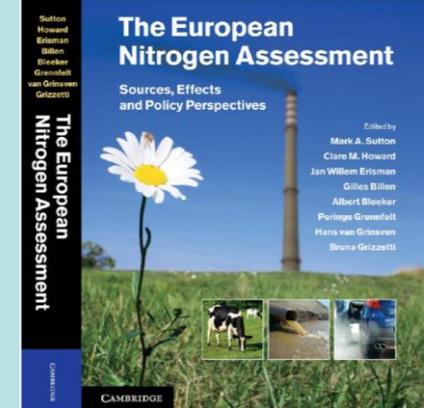
# European Nitrogen Assessment

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



Damage by nitrogen estimated at 70-320 billion euro per year

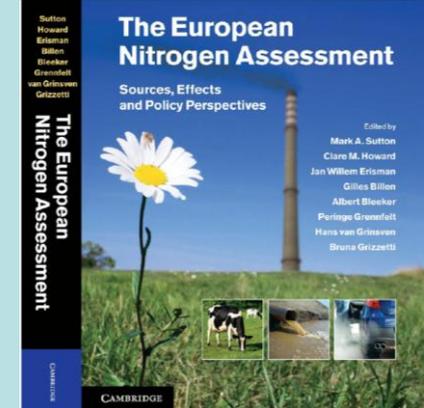




# European Nitrogen Assessment

## 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 NH<sub>3</sub> 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:

- Cost of abatement measures are less than previously reported;
- Some side-effects of abatement measures provide benefits to farmers
  - e.g. less smothering of herbage, increase animal health
- Climate co-benefits can be significant
  - e.g. CO<sub>2</sub> and N<sub>2</sub>O 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 € 0-2 per kg NH<sub>3</sub>-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

<b>Measures</b>	<b>Cost, €/kg NH<sub>3</sub>-N saved</b>
Nitrogen management	-1.0 to 1.0
Feeding strategies	-0.5 to 0.5
Animal housing	0.0 to 10
Slurry storages	0.1 to 4.0
Slurry application	0.1 to 5.0
Urea application	0.0 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.

# Costs of ammonia abatement

- Results of the workshop on “Cost of ammonia abatement measures” in Paris will be published in a book published on line by Springer Verlag.
- Planning: second half 2011

# Current Annex IX of Gothenburg Protocol addresses a fraction of the total emissions of $\text{NH}_3$ 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.

## 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. Reflect a high level of ambition in reducing  $\text{NH}_3$  emissions, while remaining cost effective
- B. Reflect a moderate level of ambition, as well as being cost effective;
- C. Reflect a 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:**

- Various dates

# Selecting farm size thresholds

- **Thresholds for cattle farming (~50% agric NH<sub>3</sub>)**
  - > 50 livestock units (covering 13% of farms in EU; 72% of cattle)
  - > All new or largely rebuild farms with >5 livestock units
  
- **Thresholds for pig farming (~20% agric NH<sub>3</sub>)**
  - > 750 sows & > 2000 fattener pigs (covering ~20% of EU poultry)
  - > 200 livestock units (covering ~70% of pigs in EU)
  - > All new or largely rebuild farms with >5 livestock units
  
- **Thresholds for poultry farming (~15% NH<sub>3</sub>)**
  - > 40,000 chickens (covering ~70% of EU poultry)
  - > All new or largely rebuild farms with >5 livestock units

## Selecting farm size thresholds

- 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. Makes it more flexible and detailed.

## B. Nitrogen management at whole-farm

- Nitrogen Use Efficiency (NUE) and Nitrogen Input-Output Balances (NIOB) proposed as indicators
- First 5-10 years establishing baseline values on 'demonstration'/'pilot' farms; thereafter on
  - 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%

## C. Livestock feeding strategies

- Animal feed composition ( $\text{NH}_3$  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%

## D. Animal housing

- **Existing large pig & poultry farms:** >20% reduction as now;
- **New pig houses with >5 LU;** reduction targets:
  - 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 with >5 LU:** >20% reduction;
- **New laying hen houses with >5 LU;** reduction targets:
  - 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 with >5 LU:** >25% reduction target, when feasible
- **Other livestock with >5 LU;** reduce NH<sub>3</sub> emissions when feasible

## E. Manure Storage

- **New slurry stores; reduction targets:**
  - A: 80%;
  - B: 60%;
  - C: 40%;
  
- **For existing slurry stores: reduction target >40%**
  
- **Solid manure: reduce NH<sub>3</sub> emissions when feasible :**

## F. Manure application

### Targets and Options

- Targets depend on soil, crop, slope, farm size, tanker size (see Tables for levels A, B and C):
  - A: > 60%, with relaxation to 30% for small farms
  - B: > 30% for all farms, with exemptions
  - C: > 30%, with full exemption for small farms
  
- No requirements for smallest farms (<5 LU)

## G. Urea and ammonia-based fertilizers

- Ban on ammonium carbonate fertilizers
- Urea-based fertilizers: emission reduction targets:
  - A: >80%
  - B: >50%
  - C: >30%
- Ammonium sulphate and phosphate based 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
- Categories 2 and 3 may be used, but suitable verification should be provided by the Party.

## 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