



Why has nitrogen control failed within various policies

Peringe Grennfelt

Outline

- Has Nitrogen abatement policies failed?
- If so, can we understand the reason?
- What can we do to improve policy?

- European perspective

Environmental problems and policy processes of relevance for Nitrogen

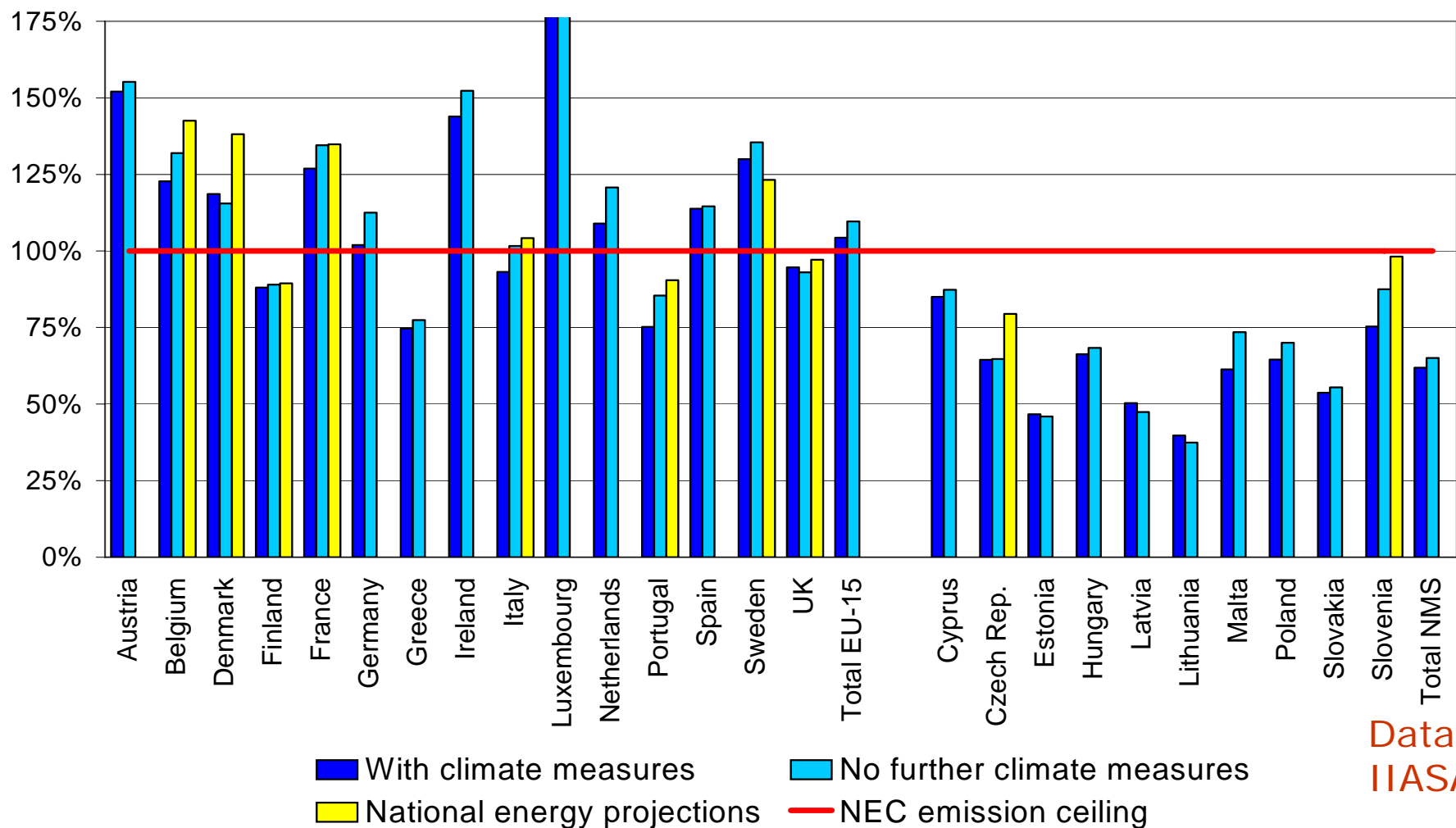
- Local air pollution NO₂ (EU CAFE)
- Regional air pollution – N deposition, ozone, particles (EU CAFE - CLRTAP)
- Groundwater nitrate (Nitrate directive, WFD)
- Biodiversity (Habitat directive, Natura 2000)
- Marine eutrophication (Marine conventions - OSPAR, HELCOM, MARPOL, WFD)
- Hemispheric ozone (TFHTAP, CLRTAP)
- Climate change N₂O, ozone, aerosols (Kyoto protocol)
- Sector policies (CAP, Autooil, energy policies)

Air pollution

- In general land based NO_x and NH₃ emissions in Europe have been reduced in the order of 20-40% since 1980
- The CAFE baseline scenario for European emissions indicates that NO_x emissions will be further reduced with about 40% by 2020
- The CAFE baseline scenario indicates **no** reductions of ammonia emissions for the period 2000 – 2020
- This will lead to a substantial increase in the ratio $N_{\text{red}}/N_{\text{ox}}$ in Europe.
- Commitments made in the Gothenburg Protocol and the NEC Directive will be difficult to achieve

NO_x emissions projected for 2010

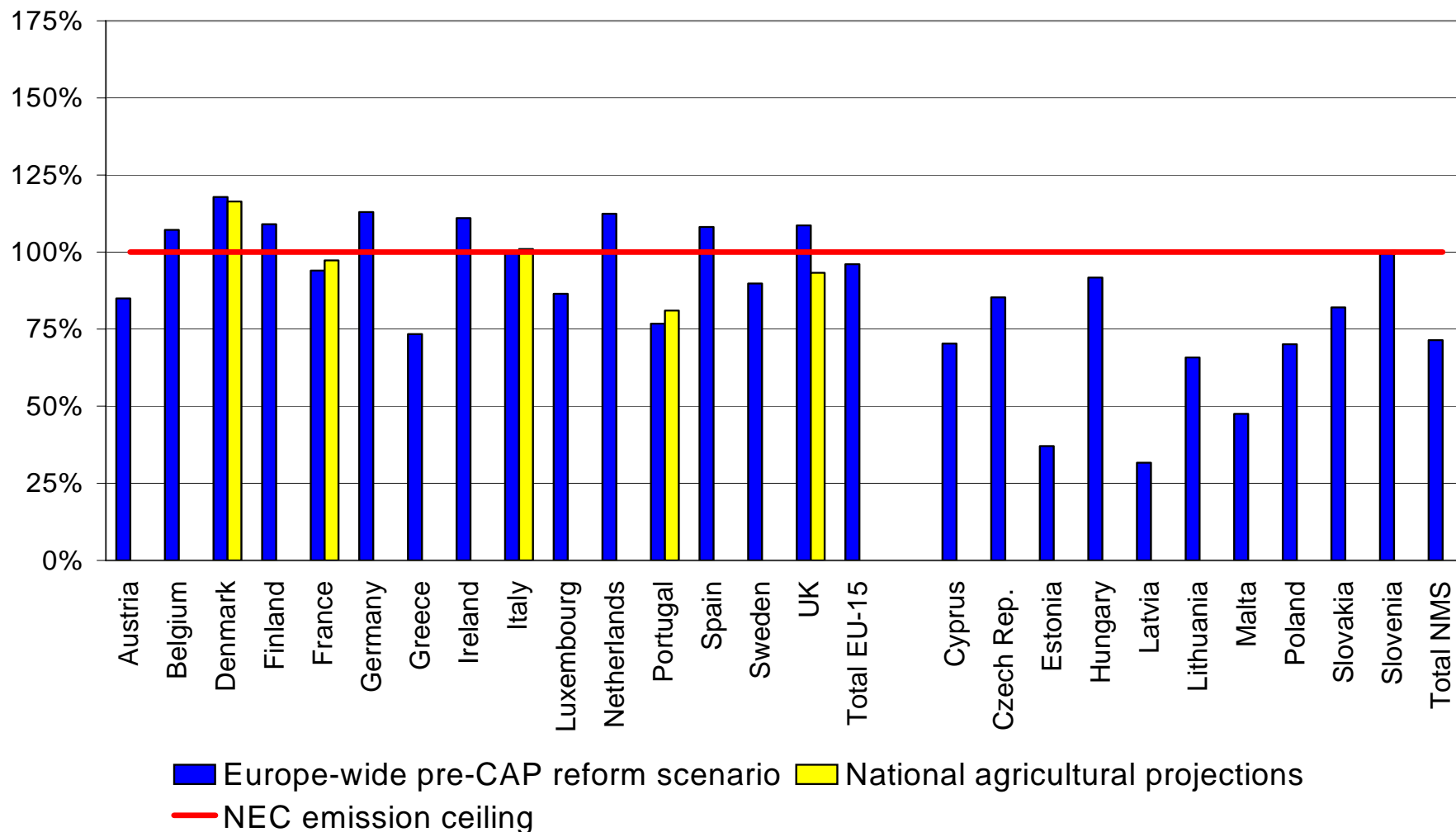
compared to NEC emission ceilings



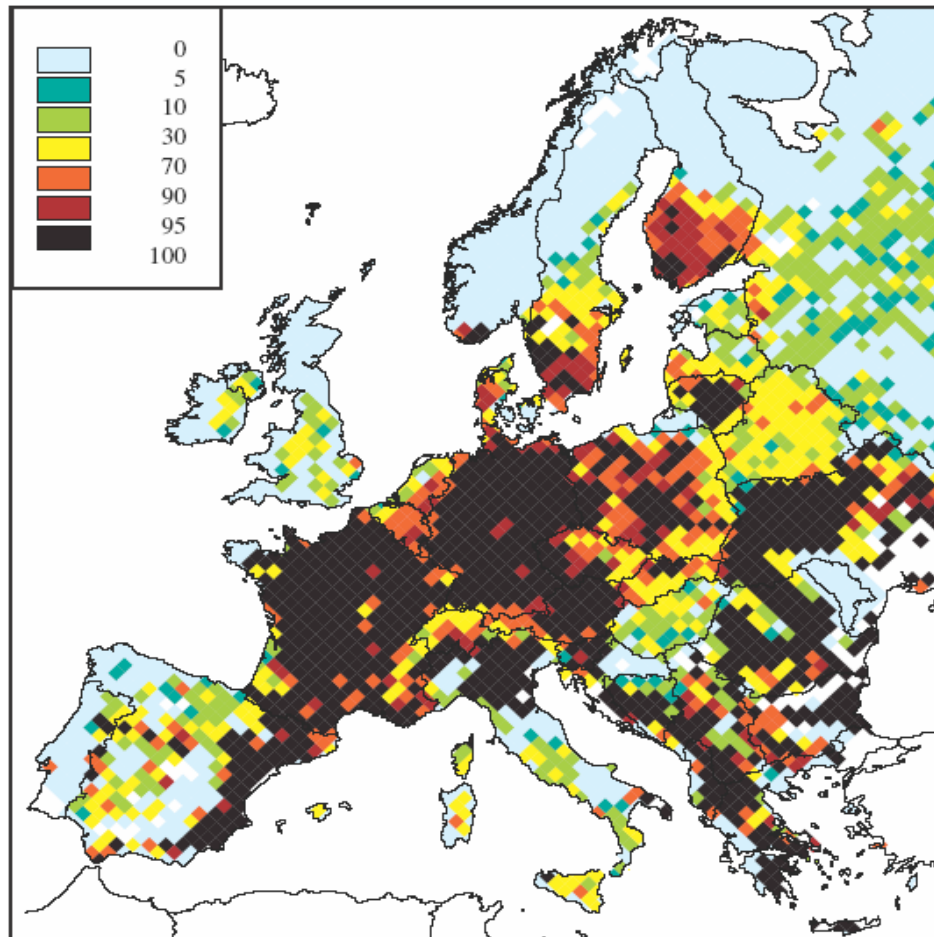
Data from
IIASA

NH₃ emissions projected for 2010

compared to NEC emission ceilings (IIASA)



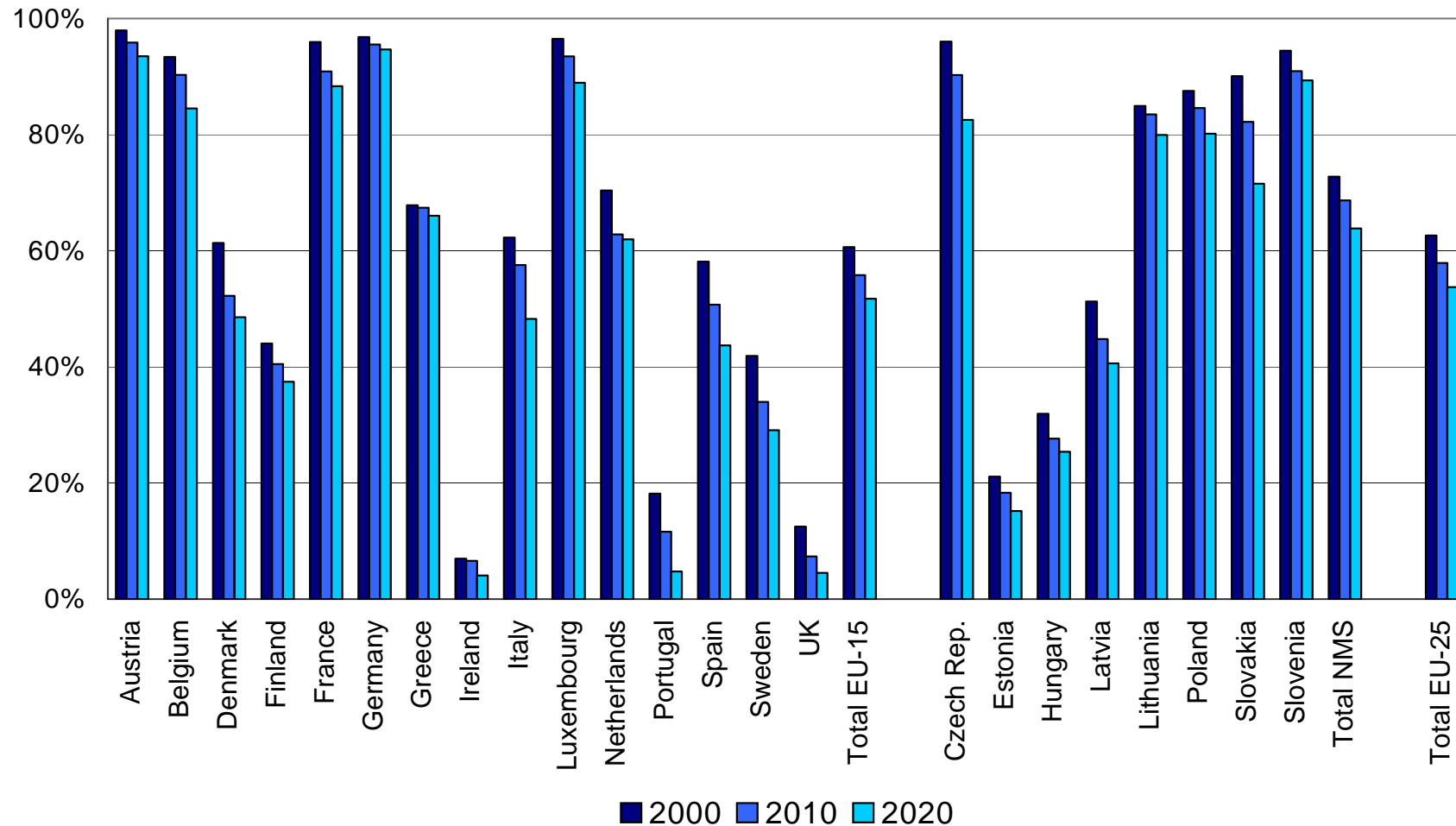
Excess of critical loads for eutrophication 2020



Percentage of ecosystems
area
with nitrogen deposition
above critical loads,
using grid-average
deposition.
Average of calculations for
1997, 1999, 2000 & 2003
meteorologies

Percent of ecosystems area

with nitrogen deposition above critical loads for eutrophication (Data from IIASA)





Marine conventions

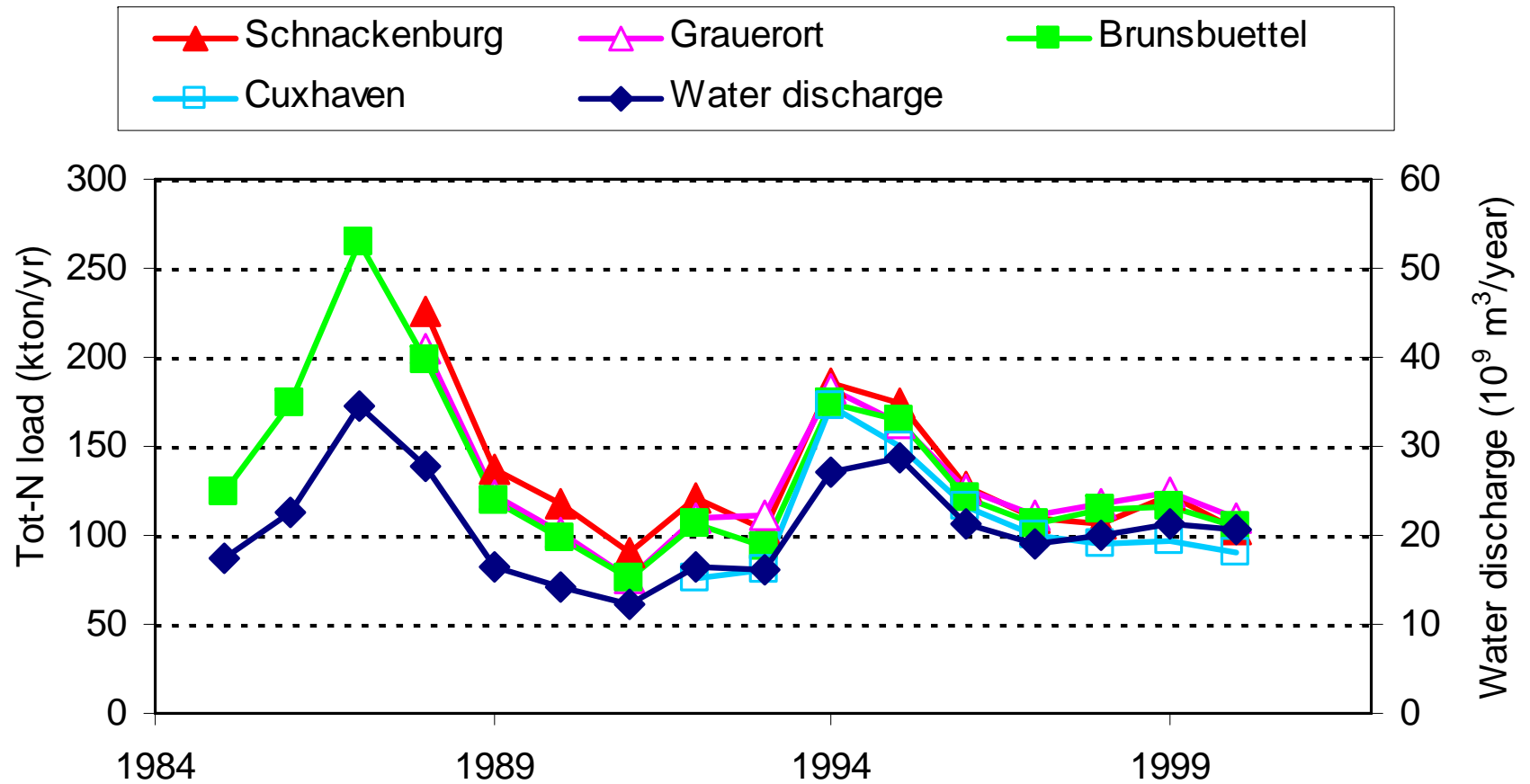
- HELCOM and OSPAR: Objective 50% reduction in nutrient load (1988)
- What are the results?
- Example from the river Elbe. (Grimvall et al)



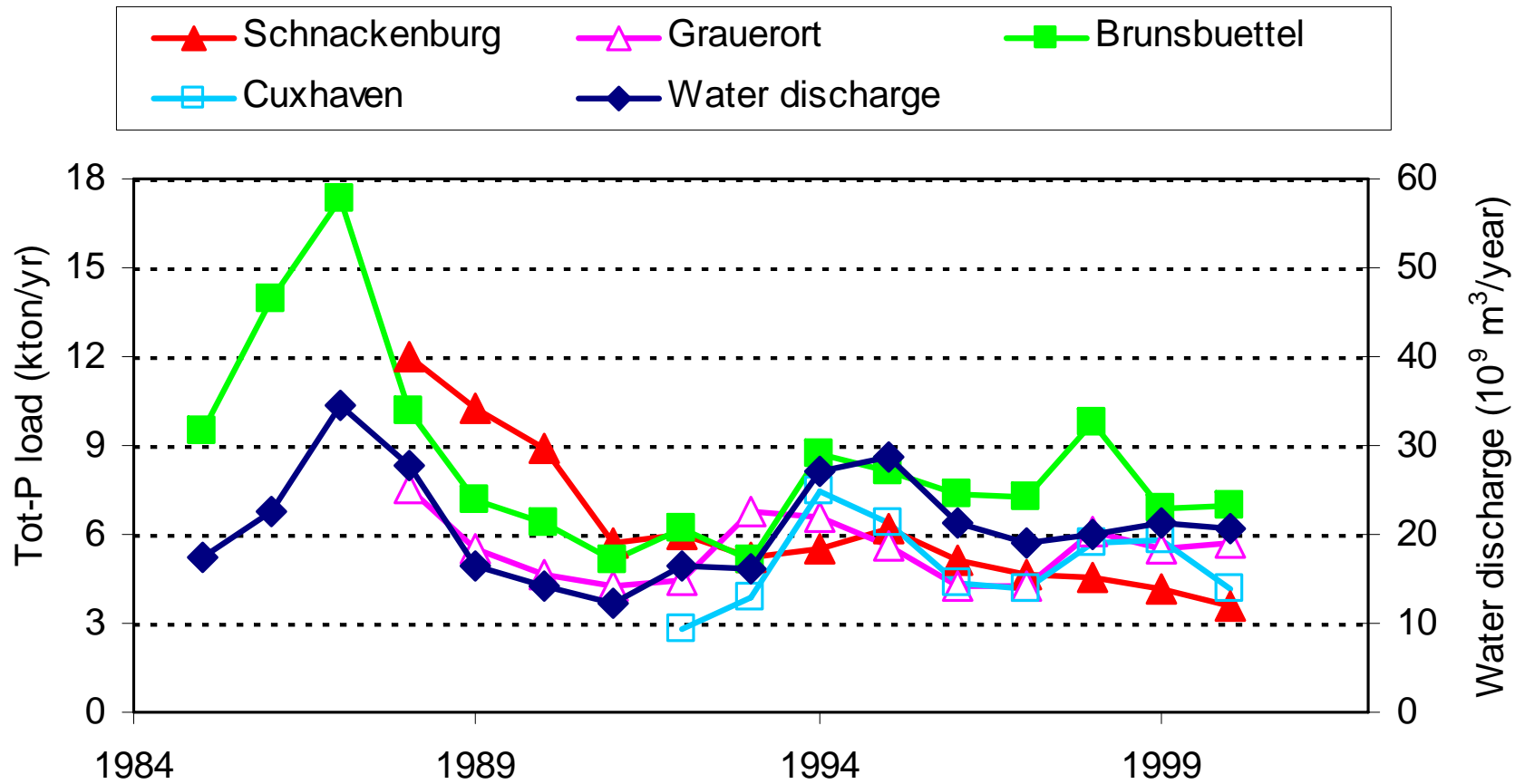
Phosphorus or Nitrogen?

- An intense debate over many years
- Although reductions in input, the situation in the Baltic has become worse
- A recent evaluation indicate that P is more important to reduce in the Baltic than N.
- For normal marine areas N is still most important
- The last word is not said yet

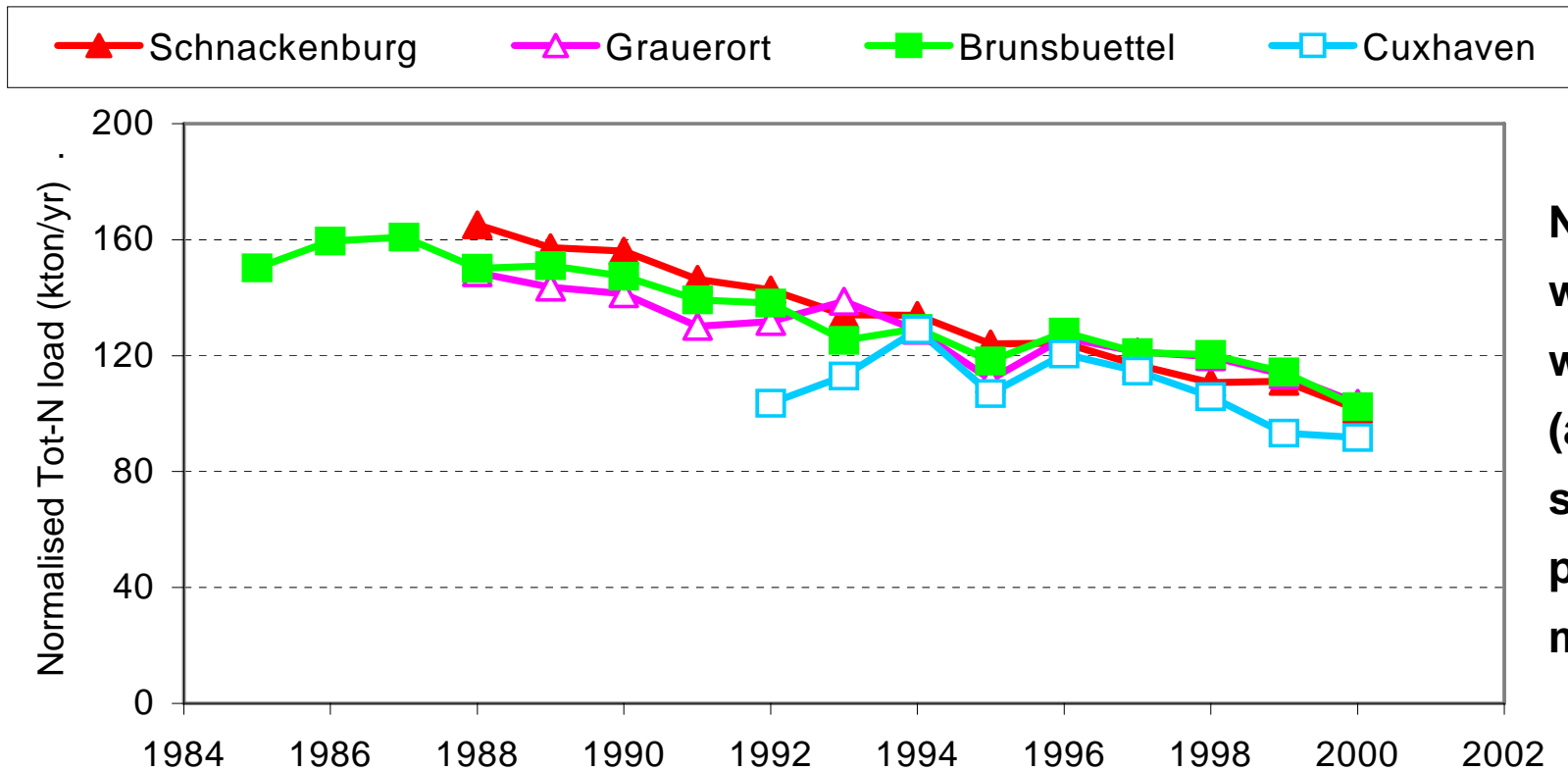
Total nitrogen load carried by the Elbe River



Total phosphorus load carried by the Elbe River



Normalised load of total nitrogen carried by the Elbe River

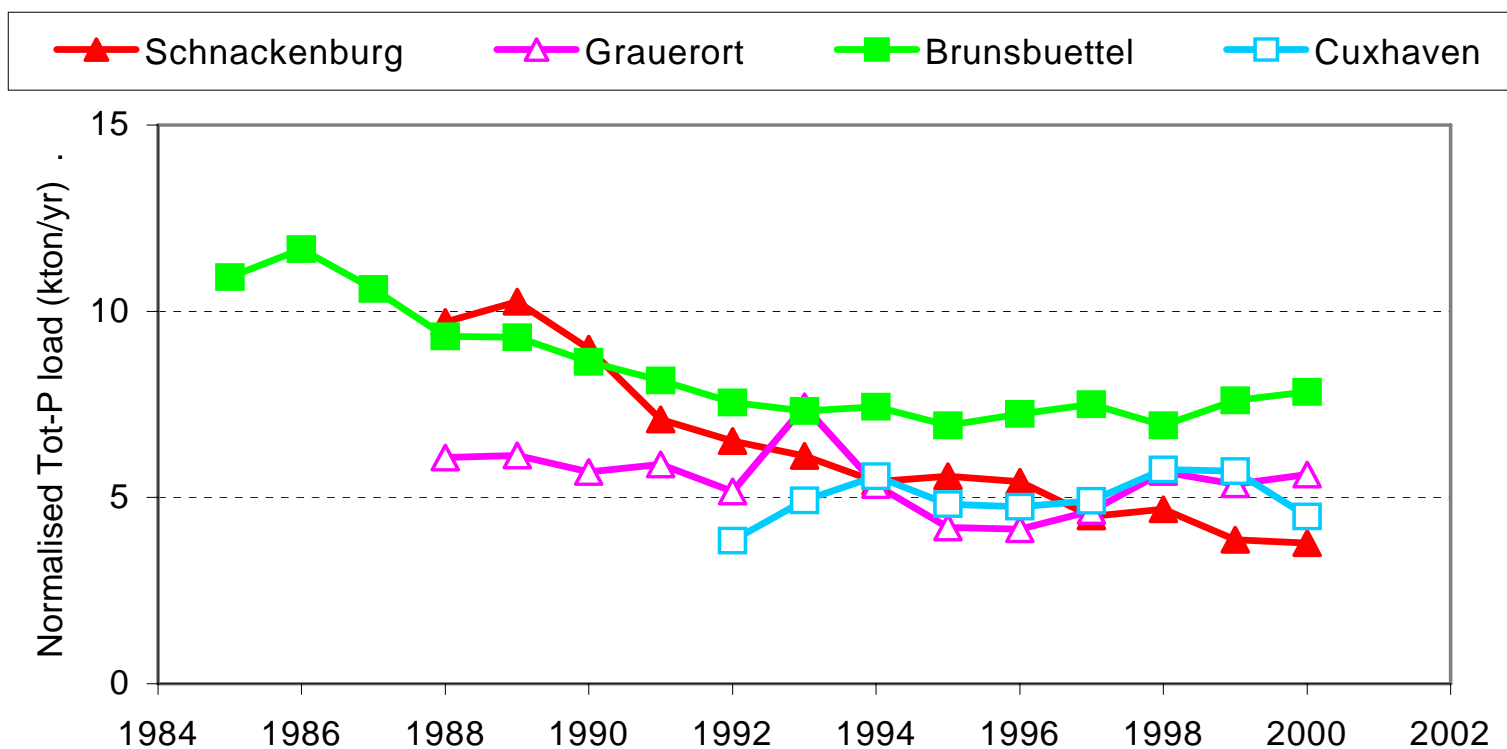


Normalisation with respect to water discharge (and load of suspended particulate matter)

What has caused the reduction in N load?

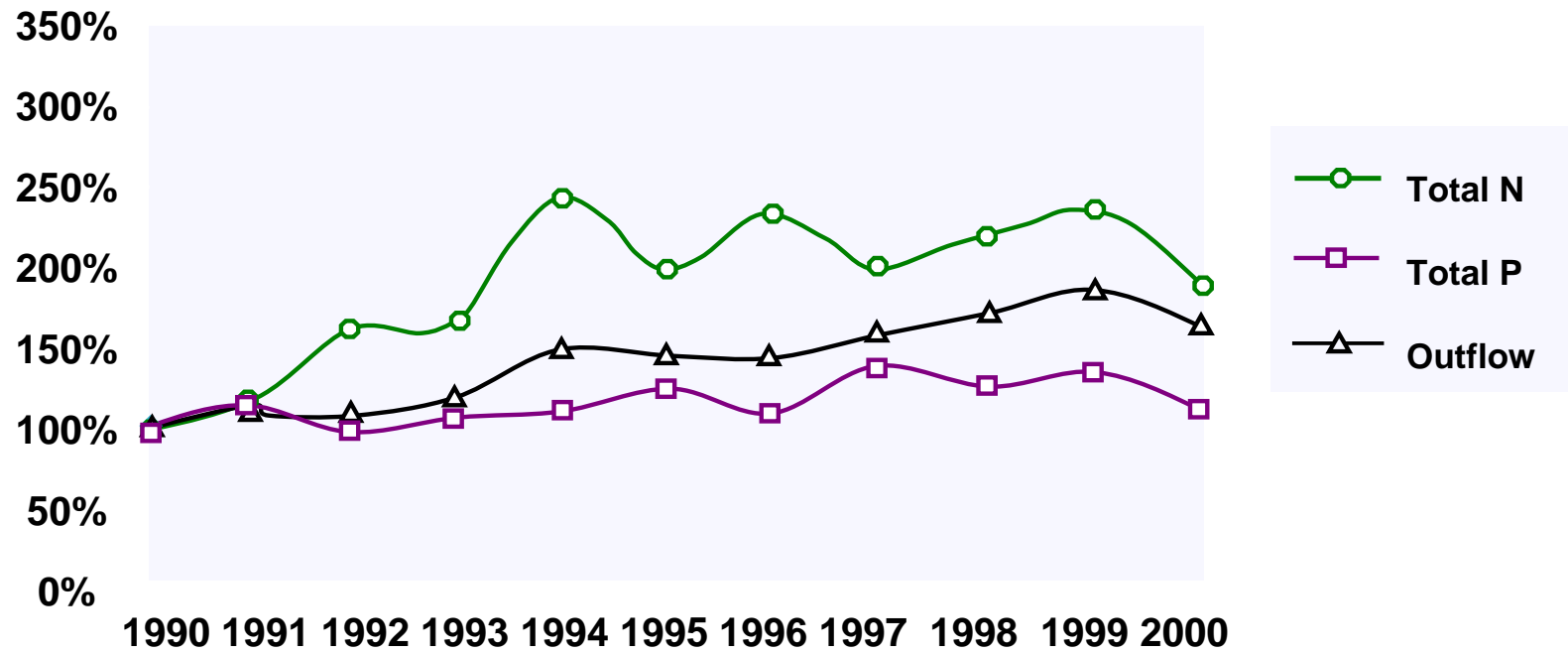
| Five-year-period | Direct industrial discharge (kton/year) | Discharge from wastewater treatment plants (kton/year) |
|------------------|---|--|
| 1983-1987 | 59.8 | 69.0 |
| 1993-1997 | 18.0 | 45.6 |

Normalised load of total phosphorus carried by the Elbe River



Normalisation with respect to water discharge (and load of suspended particulate matter)

Nutrient load to the Baltic from Poland 1990 - 2000



Conclusions

Marine input of nutrients

- The agreements to reduce nutrient input within HELCOM and OSPAR areas with 50% have failed.
- Investments in measures have to a large extent been focused on point sources.
- Reductions within the agricultural area has so far been limited.
- There is an increasing interest in reducing P emissions within the Baltic area.

Why have we failed to achieve substantial reductions in N emissions?

- Lack of scientific evidence linking environmental effects (risks) with emissions?
- Lack of control technologies?
- Focusing on the wrong problems?
- Lack of policy instruments?
- Interference from other policies?
- Too costly?
- Lack of interest?

Why have we failed to achieve substantial reductions in N emissions

- Lack of scientific evidence linking environmental effects (risks) with emissions? (the N/P debate, the importance of ship emissions not known until recently)
- Lack of control technologies? (agriculture, air traffic)
- Focusing on the wrong problems? (industry and wastewater instead of agriculture)
- Lack of (or bad) policy instruments? (marine emissions, agriculture)
- Interference from other policies? (CAP)
- Too costly? (some of the agricultural measures)
- Lack of interest? (biodiversity?)

How do Conventions and EU act in their development of policies?

| Policy framework | Openness and transparency | Internat. scientific support | Scientific involvement in organisation | Legally binding decisions |
|------------------|---------------------------|------------------------------|--|---------------------------|
| CLRTAP | High | High | High | Yes, weak |
| HELCOM | Low | High | Intermediate | No |
| OSPAR | Intermediate | High | Intermediate | No |
| EU Directives | Intermediate increasing | Increasing | Intermediate | Yes, strong |
| | | | | |

Why should we focus more on ammonia emissions to the atmosphere

- Present policies will give priority to NO_x.
- Emissions of NO_x are decreasing in industrial areas and there are options for a further decrease.
- The control options for ammonia are limited.
- It takes time to influence the agricultural sector.
- New initiatives are urgently needed
- Two main ways forward:
 - Pollution control
 - Control of the overall fixation of nitrogen

Control of emissions

- The present control systems will not be able to reduce ammonia emissions substantially.
- Pressure on agriculture has been limited. Technology development not driven by environmental needs.
- Will economic instruments help?
- Internalisation of damage costs. Recent study by von Blottnitz et al indicate that the environmental costs are of the order of 300€ per ton of nitrogen released.
- To be compared with the price of fertilizers: 500€ per ton N.
- A system of internalizing costs depends on how it is established.

Some thoughts about N₂O in relation to Paul Crutzen' talk

- What would happen if the N₂O emissions were included in the European CO₂ trading system? .
- Using the data from the presentation will give a CO₂/N ratio of approx. 20 in GWP units.
- With a price of 10-30€ per ton CO₂, the corresponding price on N release would be 200-600€ per ton.

How should ammonia control systems develop in the future?

- Regional approaches?
- Global approaches?
- Problem driven versus sector driven approaches?
- Integrated approaches? Large changes in agricultural practices and policies necessary in order to substantially decrease N emissions (air and water) in Europe
- Scientifically sound and possible from a policy point of view

Few sources to Nitrogen surplus in the environment

- Main yearly emission of N within EU 15 (million tonnes)
 - N surplus in agriculture (6.7)
 - Agricultural ammonia emissions 3.0
 - Agricultural N to soils and water 3.7
 - NOx emissions 3.0
 - Sanitary N emissions 2.0
- Total N input within EU 15 approx. 12

**Thank
you**

