Z. Klimont, M. Amann, W.A.H. Asman, W. Winiwarter
International Institute for Applied Systems Analysis (IIASA)

Integrated nitrogen approaches in the GAINS model

TFIAM/Cost729/NinE Workshop on
Integrated Modelling of Nitrogen
28-30 November 2007, Laxenburg, Austria

Conflicting goals?

- Meeting CAFE thematic strategy and NEC targets requires significant reduction of nitrogen emissions (NO_x, NH_3)
- Ambitious climate policy will ask for reduction from agriculture - N_2O represents about half of agricultural GHG
- Revision of IPPC Directive might lead to tightening of ELVs for N species
- EU Nitrate and Water Framework Directives enforcement
- Increased biomass production might have far reaching consequences on food prices and nitrogen pollution
- More...

How 'compatible' are above requirements/policies?
What is the potential for synergies and co-benefits?

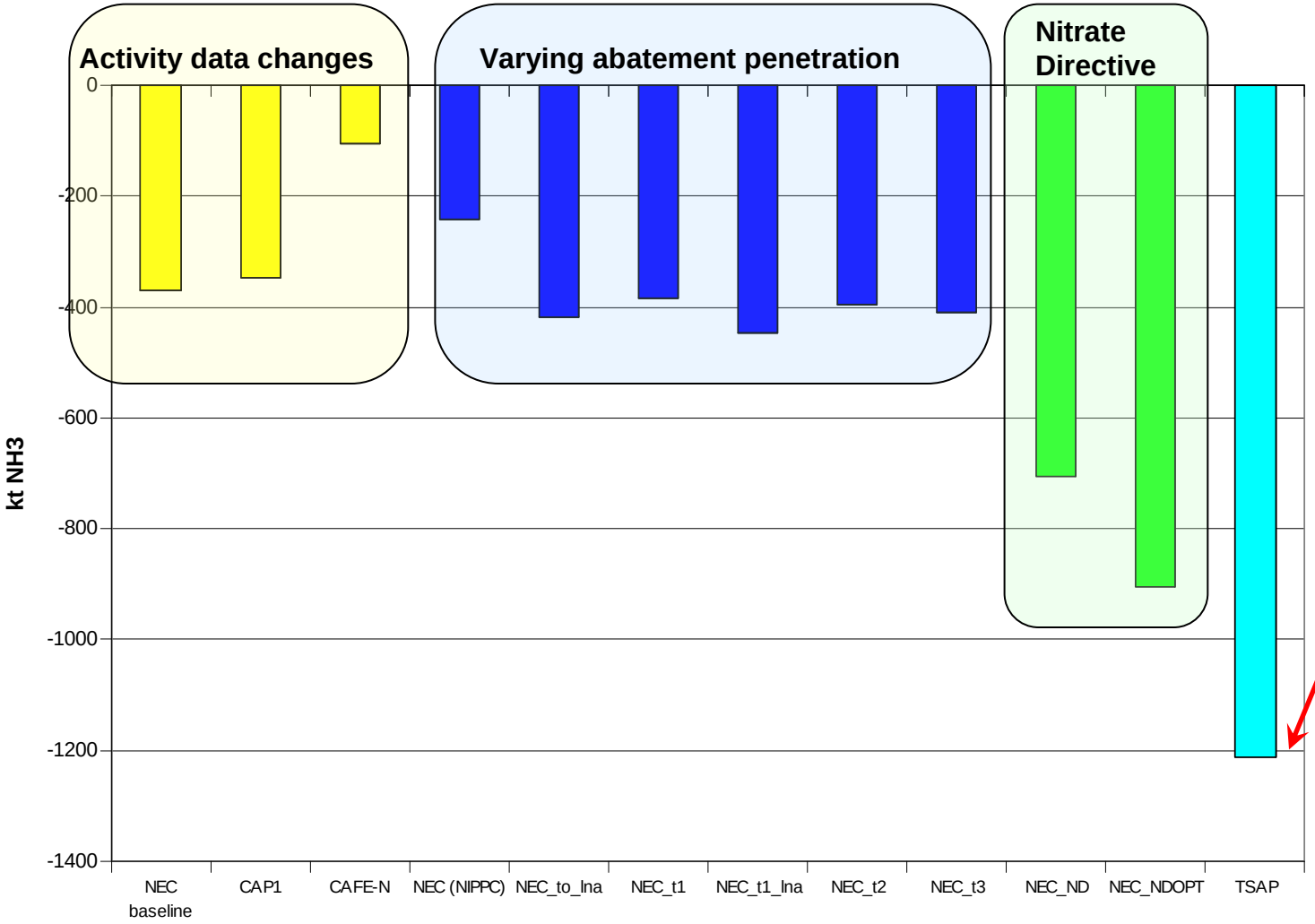
‘Nitrogen’ needs integration

- To avoid negative impacts in other areas
- To identify potential synergies / co-benefits / win-win situations / multiple benefits
- To assure cost-effective solution
- To meet targets set for
  - Air quality
  - Leaching
  - Climate change

Current tools do not allow to do this

Reductions of NH_3 in various baselines

Changes relative to the EU-25 emissions in 2000

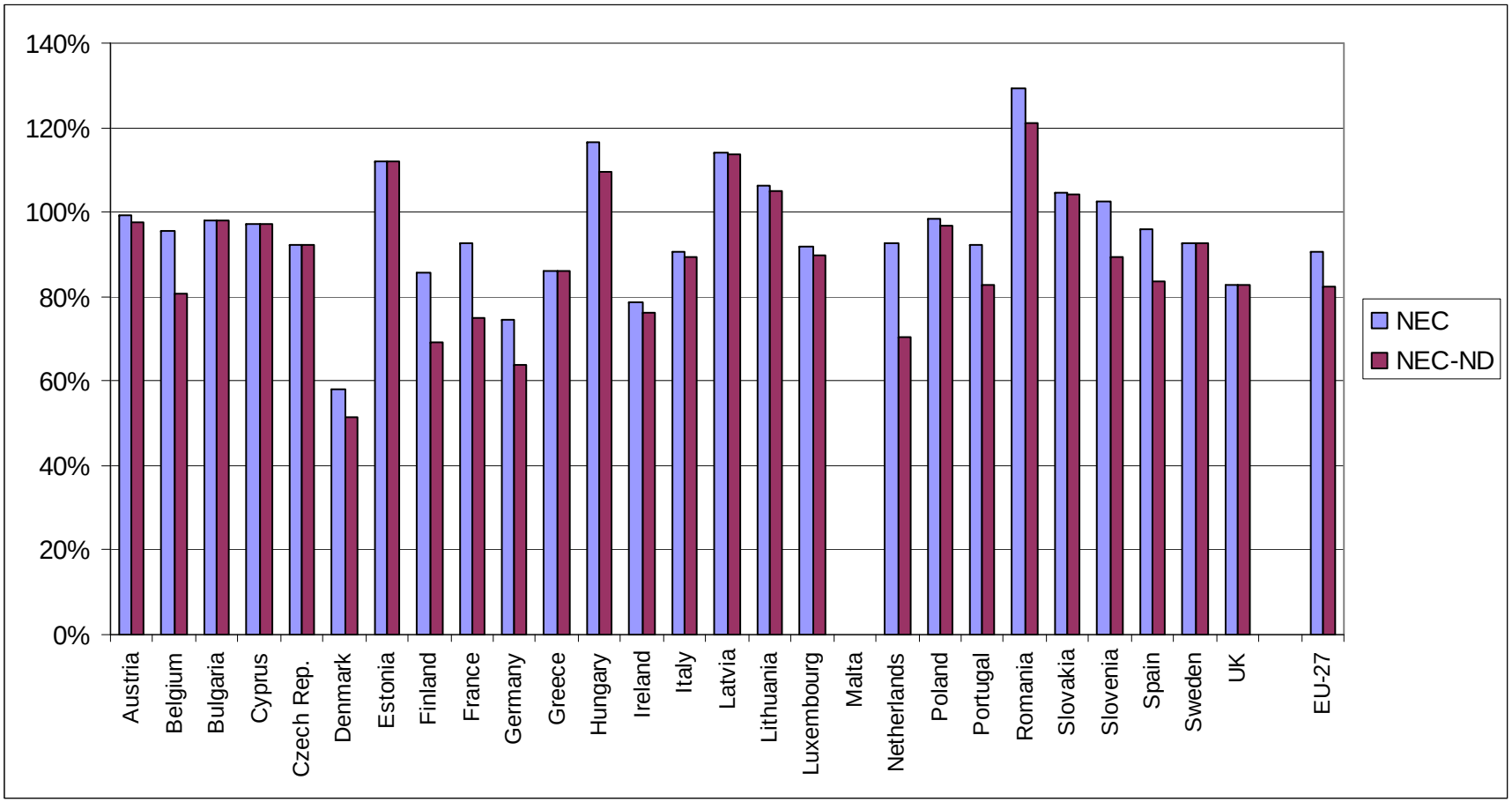


Nitrate Directive (NEC-ND) scenario

- Developed in collaboration with Alterra (NL) - MITERRA model
- Principal assumptions:
  - Full compliance with ND by 2020 within country-specific designated NVZ,
  - Developed for the EU-27 countries “National” activities scenario (NEC),
  - Reduced use of mineral fertilizers,
  - Increased penetration of low protein feed and treatment of manure,
  - Reduction of livestock density in some countries.

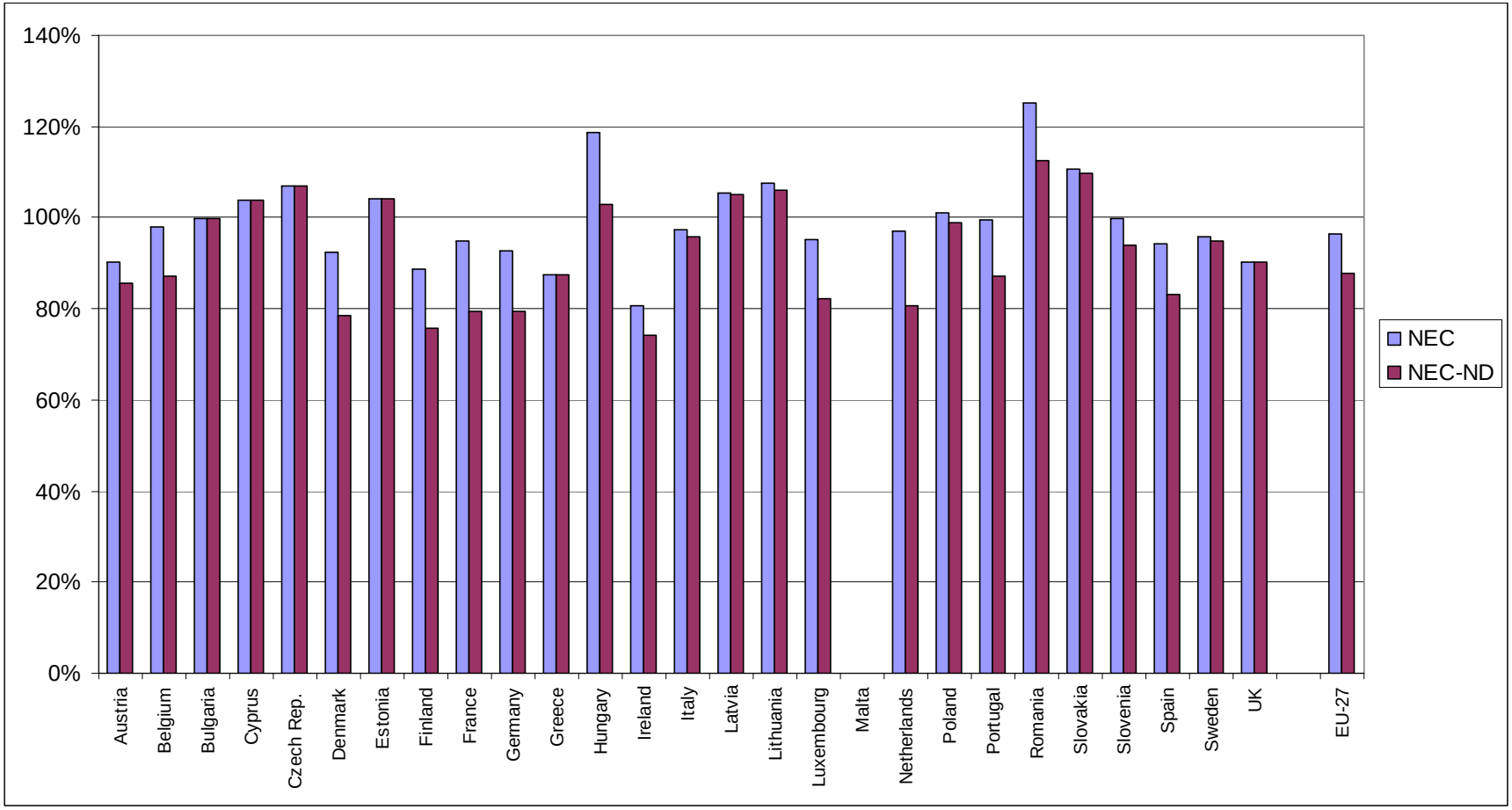
Comparing baselines for 2020

Change in NH_3 emissions compared to the year 2000



Comparing baselines for 2020

Change in N_2O emissions compared to the year 2000



Nitrate Directive (NEC-ND) scenario

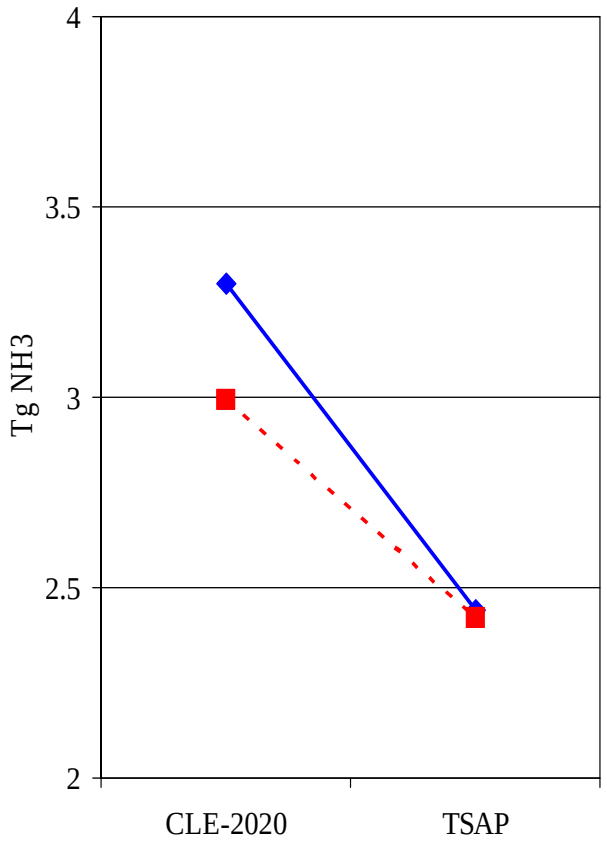
Compared to the National baseline (NEC)

- 2020-CLE emissions lower by:
  - 304 kt NH_3,
  - 92 kt N_2O
- 2020-CLE costs are higher by about 873 million €
  - 163 million € - technical measures
  - 710 million € - balanced fertilization costs estimated by Alterra (CAPRI model)
  - *Costs of revenue loss due to reduction in livestock not included (preliminary estimates range from 1.5-2 bln €)*

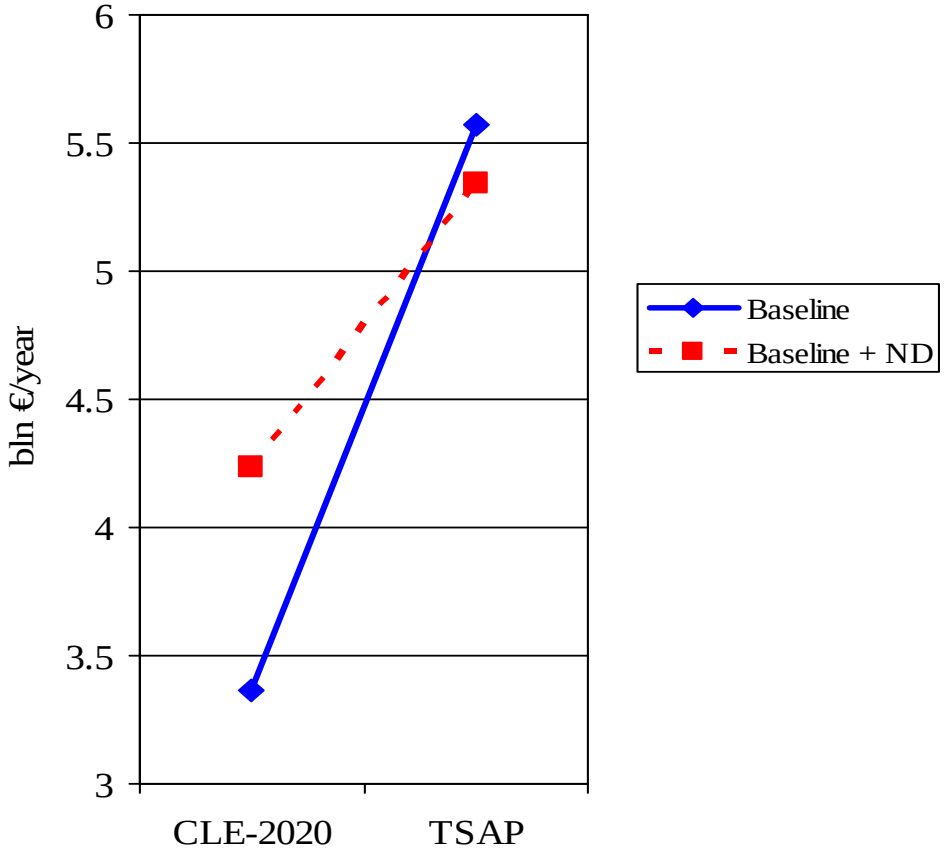
Expected impact of full implementation of the Nitrate Directive

CLE – Current legislation, TSAP – EU Thematic Strategy

Emissions from agriculture

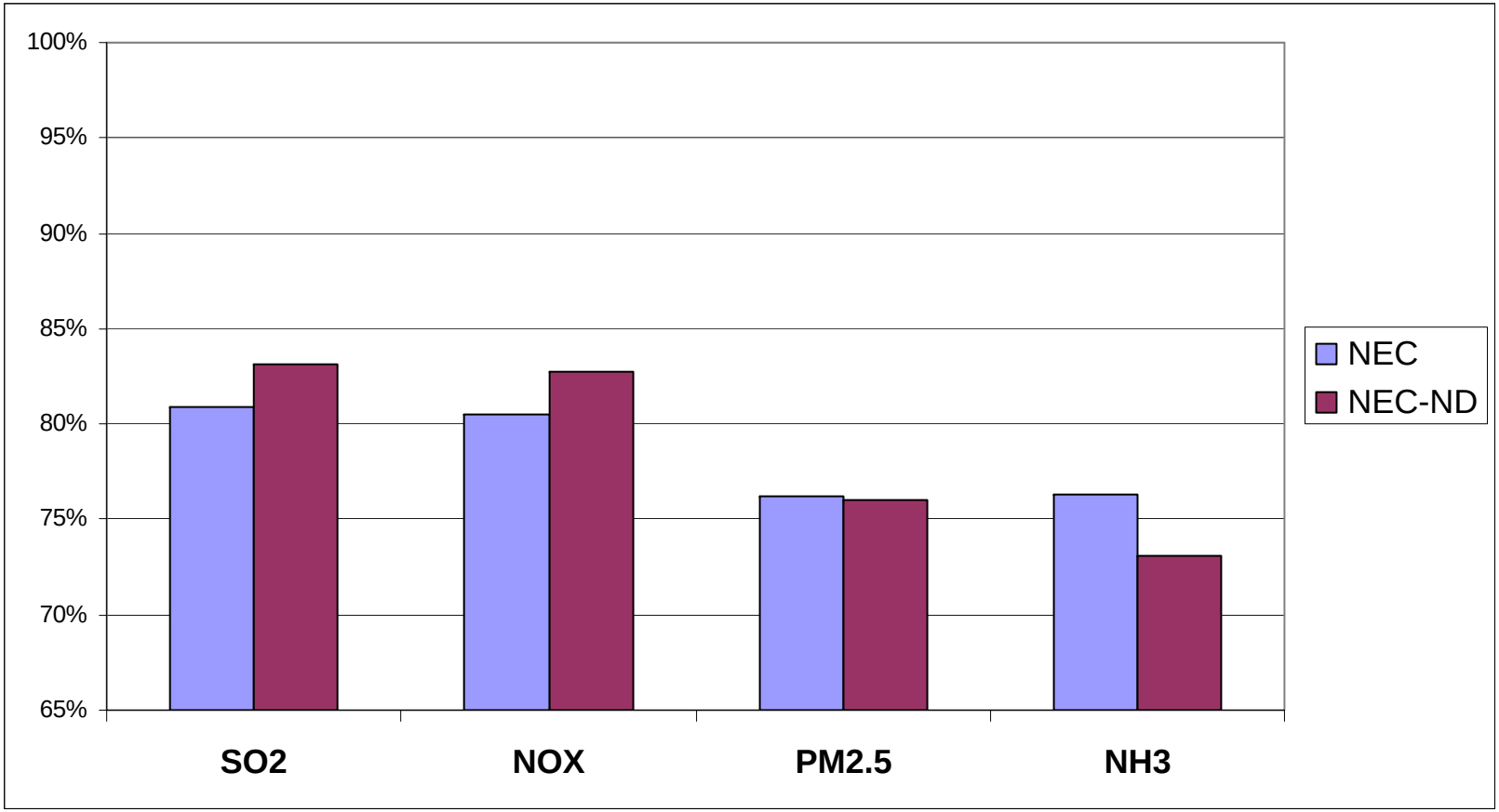


Total costs in agriculture

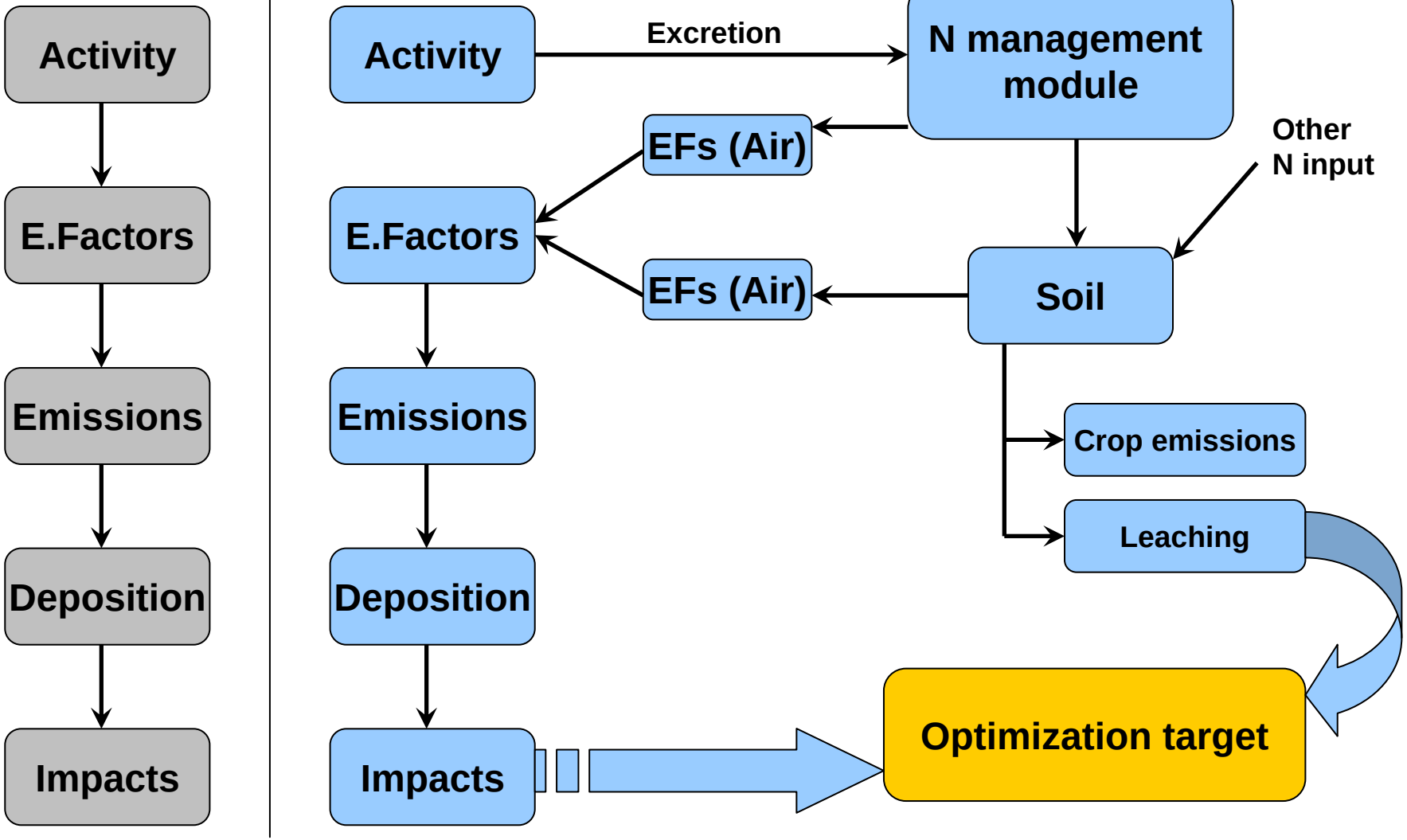


Optimizing for TSAP targets

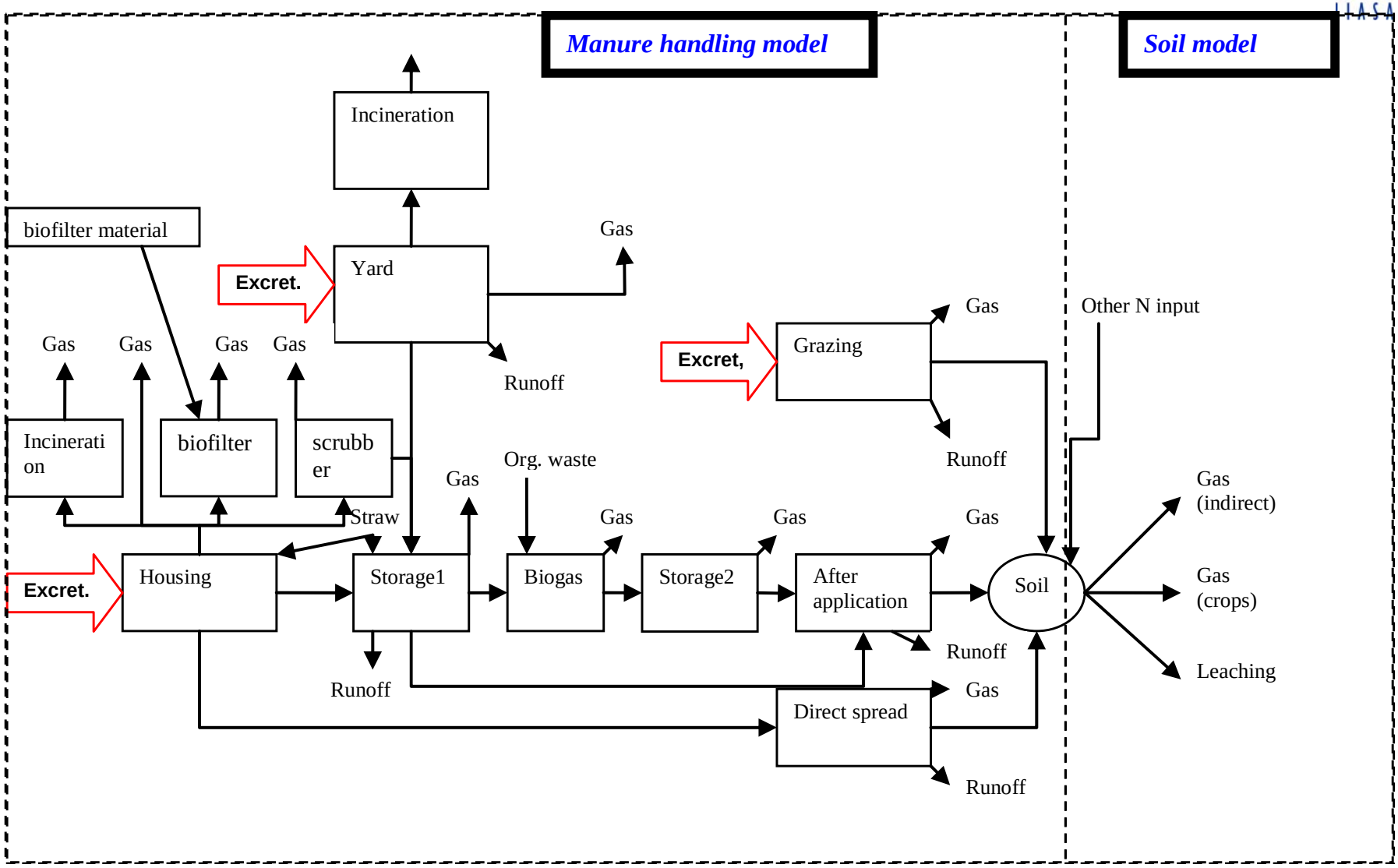
Change in 2020 emissions for various baseline



New agricultural module in GAINS



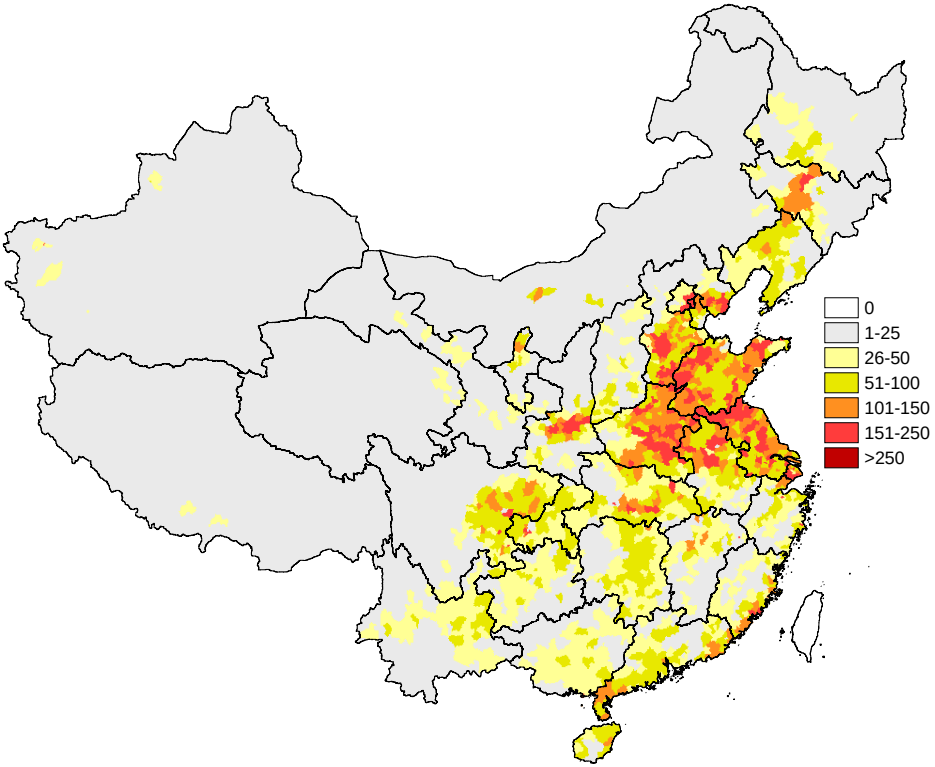
New agricultural module of GAINS



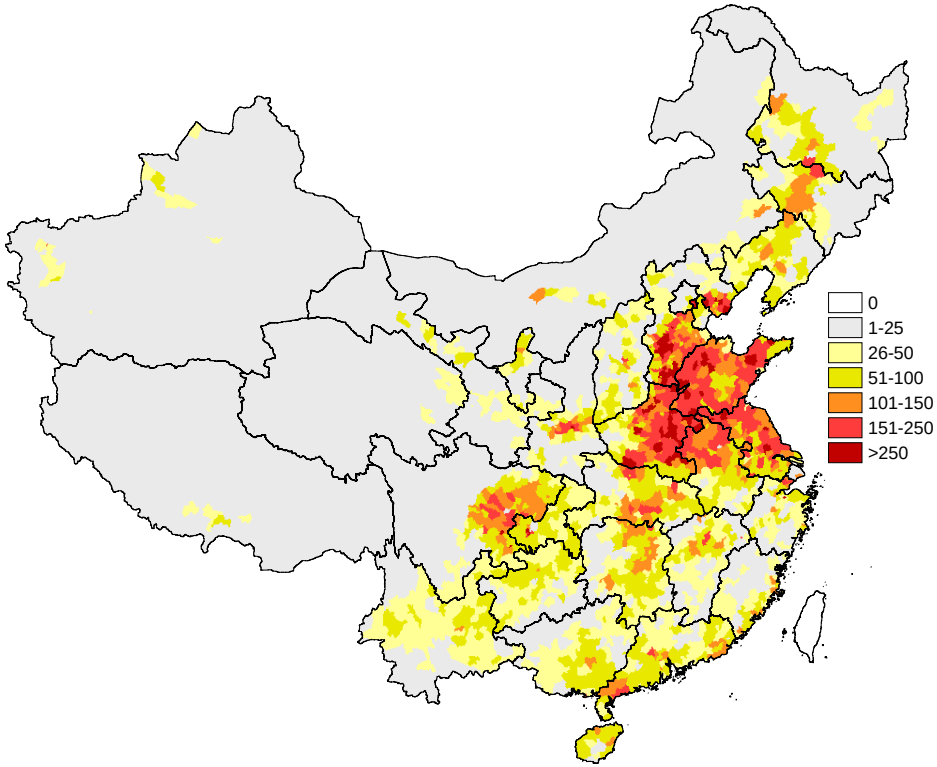
Nutrient losses per unit area, kg N/ha

Source: IIASA LUC Project

2000



2030



Conclusions

- Objectives of several policies create conflicts with respect to nitrogen management
- Tools to deal with the integrated approach can be developed
- Is the policy prepared to use such integrated approach?