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Potential synergies between CH_4/N_2O and NH_3 abatement

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Background

- Reductions of NH_3 emissions will be increasingly important for approaching WHO health guidelines and biodiversity targets
- The 1.5 degree climate target will not be achievable without drastic mitigation of non-CO_2 emissions (CH_4, N_2O)
  - The ambition on non-CO_2 will determine the extent of negative CO_2 emissions
- NH_3, CH_4 and N_2O emissions often originate from the same sources, thus there might by synergies
- However, many emission control measures will result in trade-offs, at least if the interactions are poorly managed

Multi-pollutant measures (1)

- Stationary sources:
  - SCR, SNCR: NO_x, CO ↓, NH_3, N_2O ↑
  - Fluidized bed combustion: SO_2, NO_x↓, N_2O ↑
  - New residential boilers: VOC, PM, CO, CH_4 ↓
  - IGCC: CO_2, SO_2, NO_x, PM ↓
  - CHP: all pollutants ↓
- Mobile sources:
  - Euro-standards: NO_x, VOC, PM, CO ↓ NH_3, N_2O ↑
  - Low sulfur fuels: SO_2, PM ↓
  - Diesel: CO_2 ↓, PM ↑
- Structural measures:
  - Energy savings, efficiency improvements, bans: all pollutants ↓
  - Increased use of natural gas: CO_2, SO_2, VOC, NO_x, PM ↓ CH_4 ↑
  - Biomass: CO_2 ↓ VOC, PM, CH_4 ↑

Multi-pollutant measures (2)

- Agricultural sources:
  - Low emission pig housing – NH_3, CH_4 ↓ N_2O ↑
  - Covered storage of slurry – NH_3 ↓ CH_4 ↑
  - Injection of manure – NH_3 ↓ N_2O ↑
  - Anaerobic digestion (biogas) – CH_4, CO_2, N_2O ↓ NH_3 ↓↑

- Other sources
  - Gas recovery and flaring: CH_4 ↓ CO_2, PM, VOC, SO_2, NO_x, CO ↑
  - Gas recovery and re-use: CH_4, CO_2 ↓
  - Improving flaring efficiency: PM, VOC, NO_x, SO_2, CO ↓
  - Waste incineration: CH_4, CO_2 ↓
  - Gas recovery from wastewater treatment: CH_4, CO_2 ↓

Conclusions

- Potential synergies: Diet changes with reduced demand for meat and dairy products
- Potential trade-offs:
  - Introduction of some ammonia control options (NH_3 ↓) might lead to leaching (NO_3 ↑) and higher nitrous oxide emissions (N_2O ↑)
  - Intensified agricultural production driven by demand for biofuels might lead to increased fertilizer use (NH_3 ↑, NO_x ↑, N_2O ↑, NO_3 ↑)
- The topic is currently under-explored, but will gain increasing importance in the contemporary air and climate policies