Swedish experiences in agricultural modelling and a brief overview of Norwegian developments

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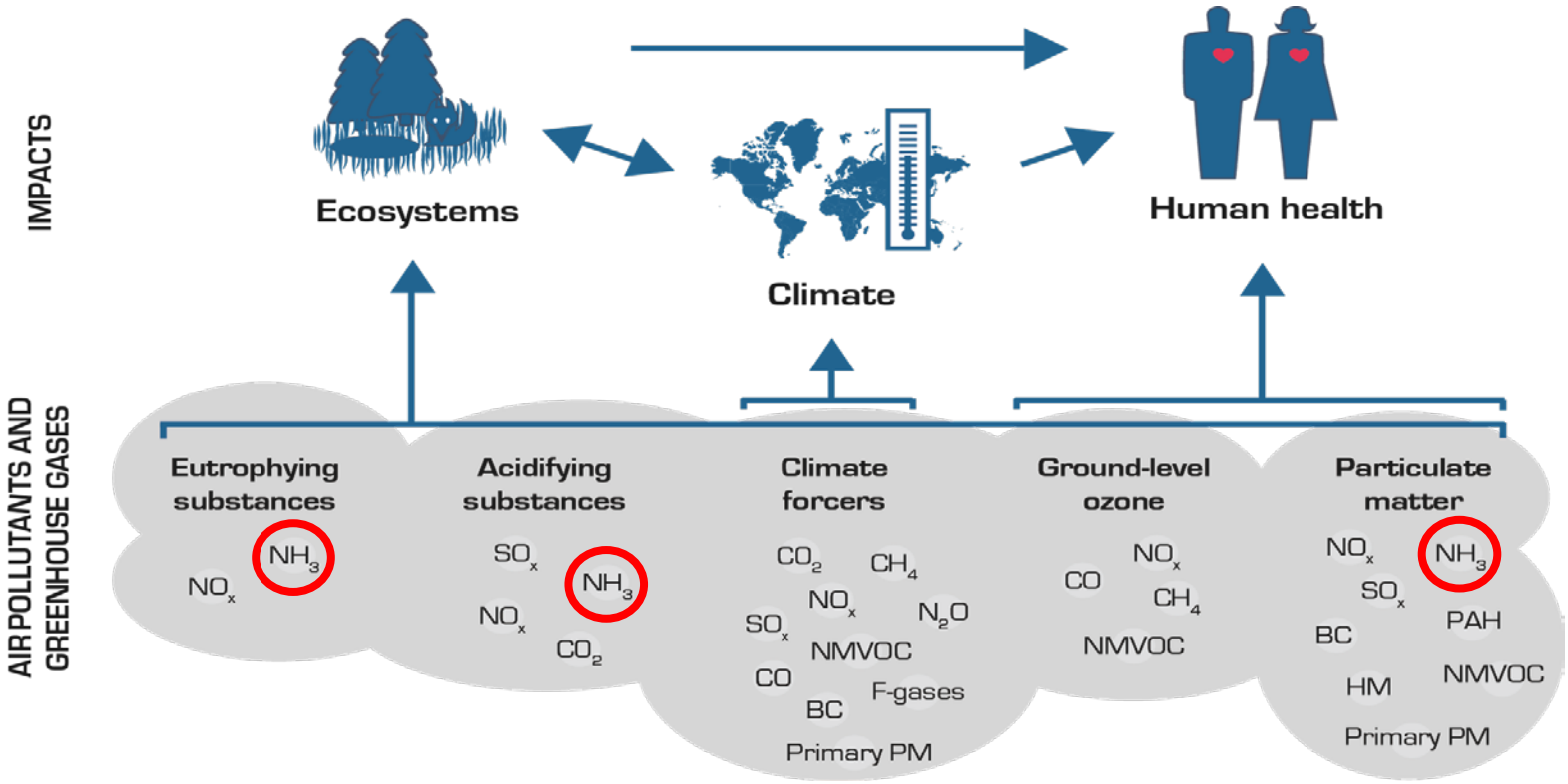
Disposition

- An overview of NH3 and the environment
- Brief methodological description
- Swedish emission trends
- Swedish emission projections & proposed ceilings
- Available abatement measures
- Discussion
  - Important considerations
  - Co-benefits with CH4-abatement
- Norwegian state-of-the-art
- Disregarded measures

Main impacts of NH_3 emissions to air – An overview

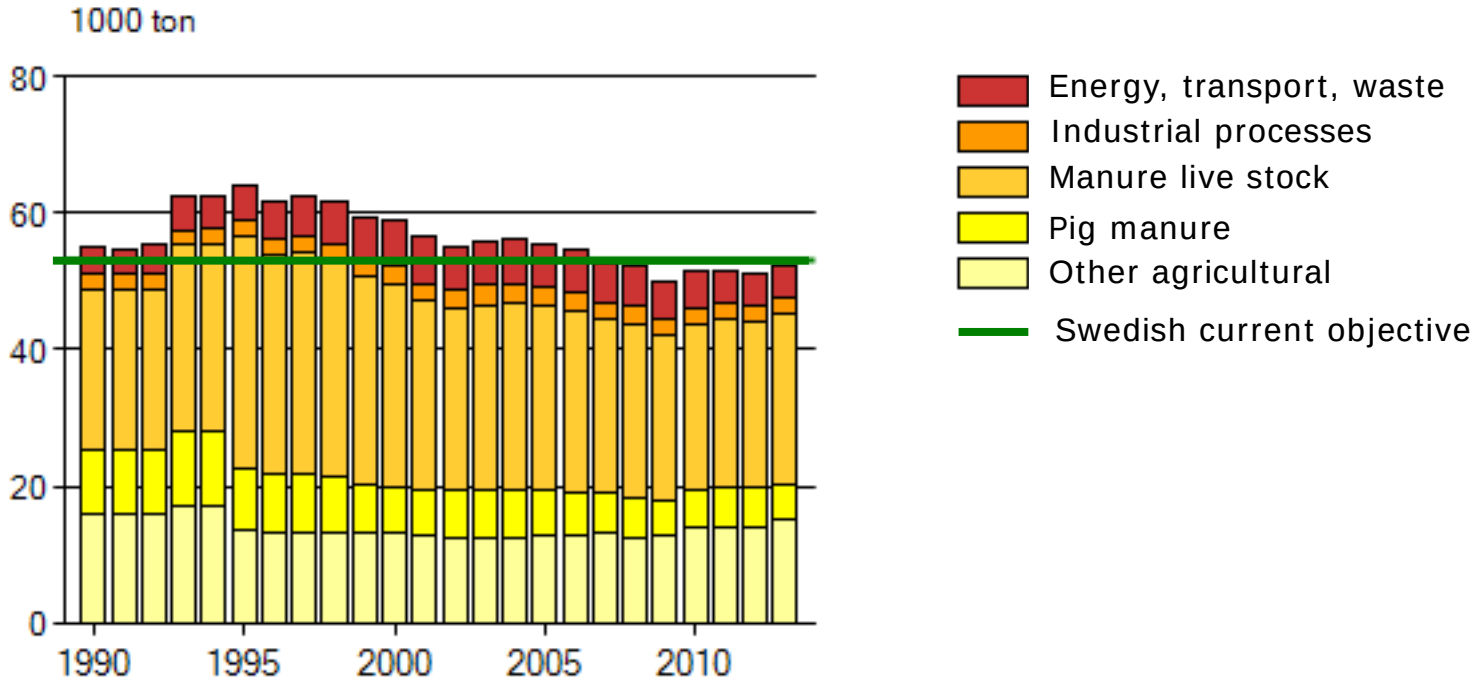


Swedish NH_3 emission inventories and projections – a brief methodological overview

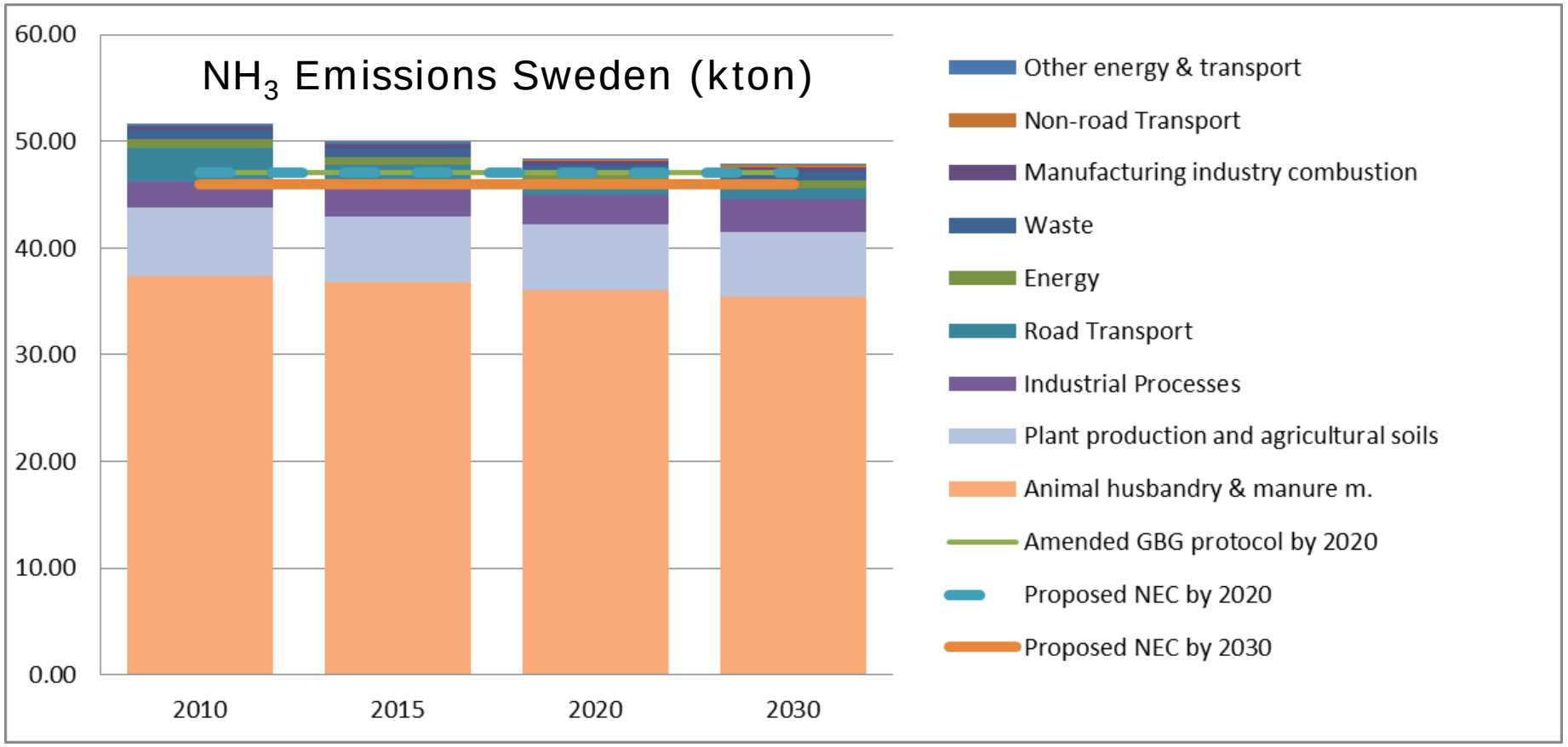
- Changes in number of animals and crops are projected using the SASM model.
  - Answers the question: ”What would the Swedish agricutural production be if farmers tried to maximise profit/minimise costs, given existing economic, political, and technical conditions”
- Other emission related parameters are kept at base year values
- No changes in farm sizes considered
- Annual costs calculated (4% interest rate)
- No specified integrated Nitrogen assessment
- No specified consideration of changing food import patterns

Emission trends and current objectives

NH_3 Emissions Sweden



2013 - Projections and future objectives



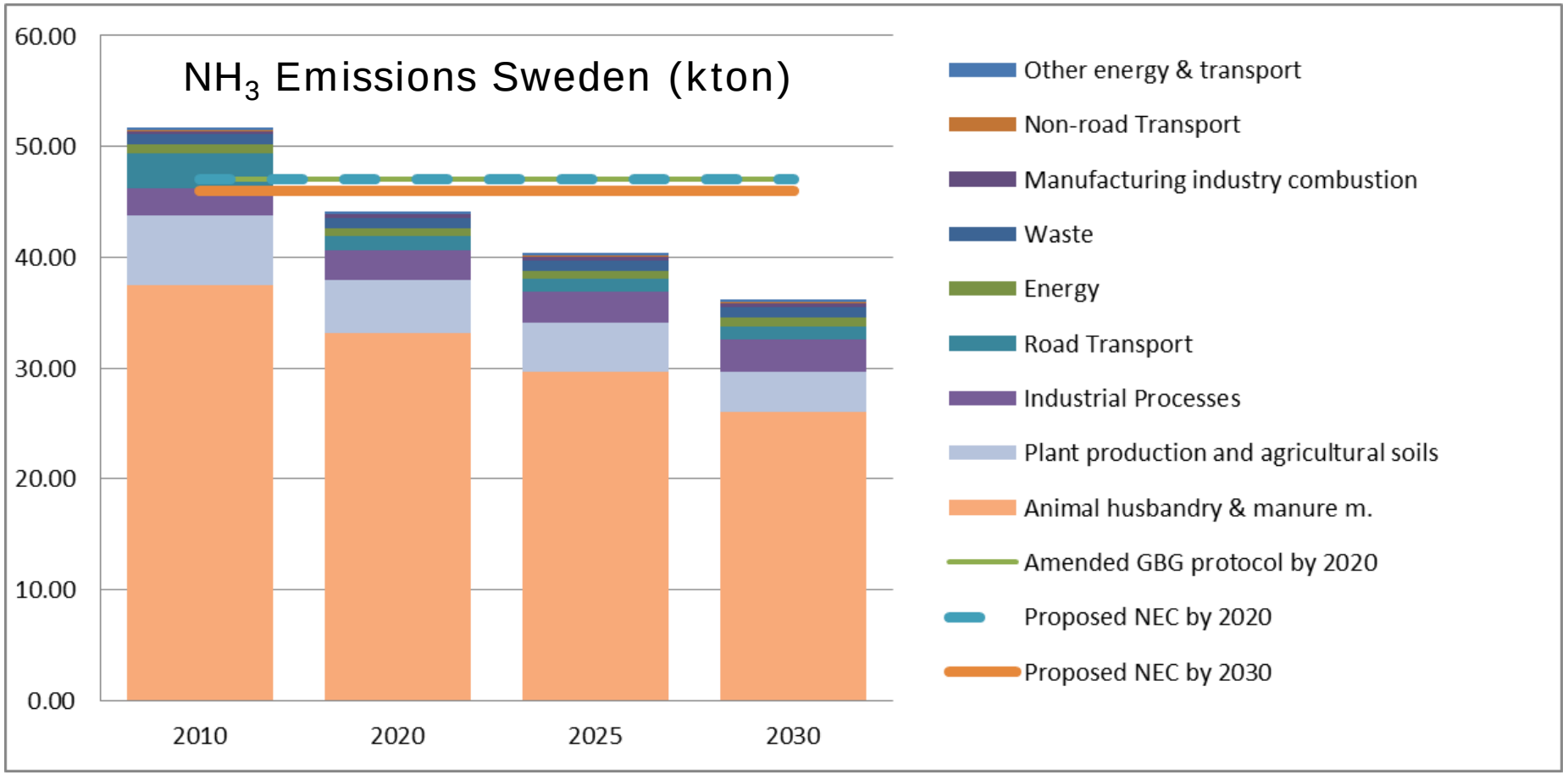
Key NH_3 abatement options in the agricultural sector by 2030 based on 2013 projection?

Measure	Potential	Cost	Accumulated effect
	[kton NH_3]	[€/ton NH_3-N]	[kton NH_3]
Tilling within 24 hours	0.5	1 800	0.5
Covered urine storage	0.8	2 000	**1.3**
Direct injection liquid manure	1.0	5 000	2.3
Tilling within 4 hours	0.4	80 000	2.7
”Slurry injector”	1.0	120 000	3.7
Covered liquid manure storage	1.2	150 000	5.0

Regional differences – based on 2013 projection

Measure	Potential – plains	Potential – forests areas	Potential - North
	[kton NH_3]	[kton NH_3]	[kton NH_3]
Tilling within 24 hours	0.2	0.2	0.1
Covered urine storage	0.4	0.4	0.0
Direct injection liquid manure	0.3	0.5	0.2
Tilling within 4 hours	0.2	0.2	0.1
”Slurry injector”	0.5	0.4	0.1
Covered liquid manure storage	0.6	0.5	0.2
Regional total	2.2	2.1	0.7

UPDATE! 2015 - Projections and future objectives, problem solved?



Important considerations

- Live stock is considered important for rural development
- Grazing live stock are important to keep ecosystem and cultural values of the landscape
- There are some places in Sweden with shortage of grazing live stock
- Is there a risk of exporting emissions?

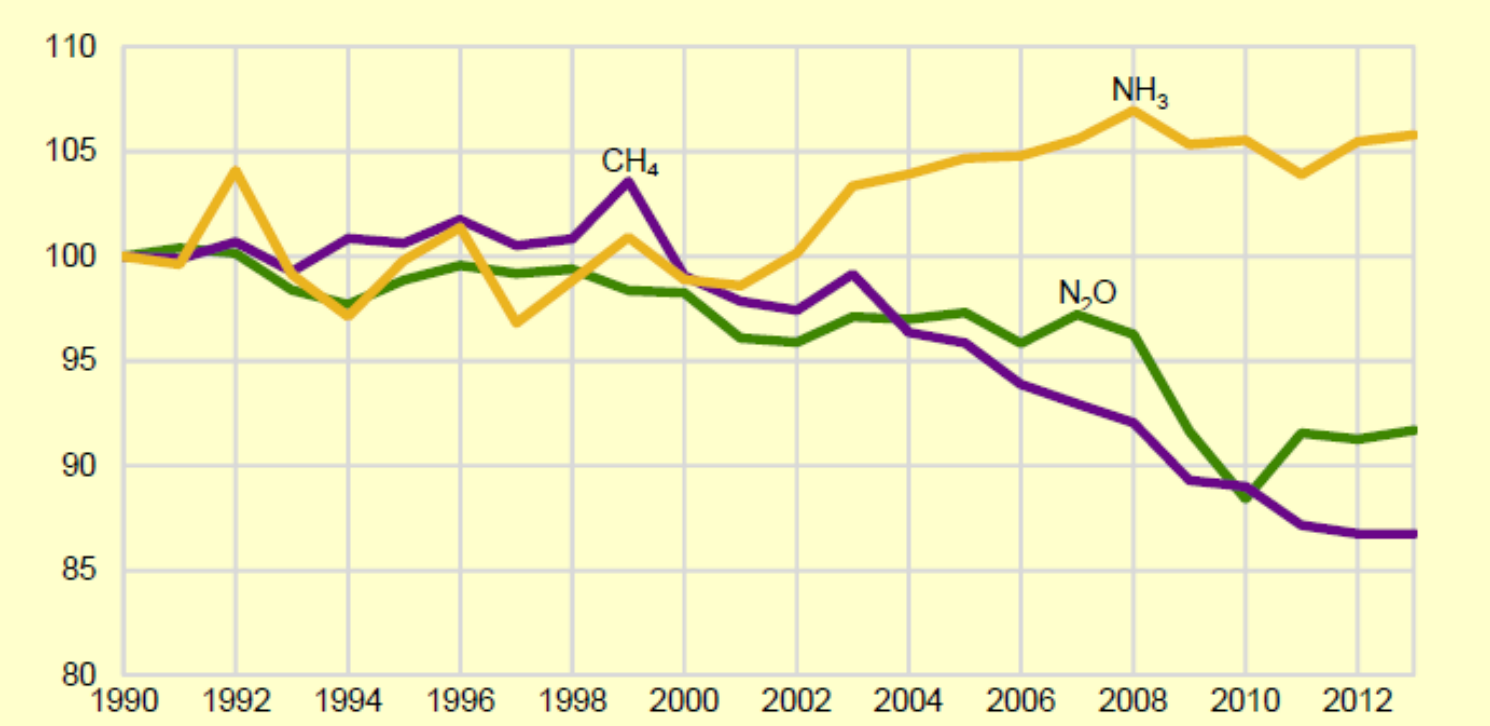
How large are co-benefits with CH_4-measures?

- The agricultural sector projected to stand for 70% of Swedish CH_4-emissions by 2030
- High profile measures:
- Gasification (fermentation) of manure with corresponding biogas production
  - Potential 4.8 kton CH_4
  - Cost: 5 600 – 7 800 €/ton CH_4
- Covering liquid manure (NH_3-measure)
  - Potential 0.5 kton CH_4
  - Cost: 4 900 – 7 900 €/ton CH_4
- Acification of liquid manure
  - 0.5 kton CH_4
  - Cost 14 600 – 18 500 €/ton CH_4

Norway

Emission trends from Norwegian agriculture

Indexed emissions of NH3, CH4, N2O, 1990=100



Kjelde: Statistisk sentralbyrå.

Norway - The distance to target for NH3

- Amended GBG protocol -8% from 2005 emission levels
- Emissions in 2013 = -2% from 2005
- Official programs to reduce emissions
  - Regional environmental programs
    - 3 mill €/year to reduce emissions to air
  - Special environmental efforts
    - ~4 mill €/year to reduce environmental pollutants
- More efforts probably needed

Suggested Norwegian efforts to reduce emissions

- For greenhouse gases & ammonia
  - Doubled efforts to for gasification of animal manure
  - Increase funds to bio energy programme by 0.8 mill €
  - Ear mark funds for climate impacts from agricultural sector
  - Increased efforts in environmental friendly spreading of animal manure
  - Funds for drainage of agricultural soils

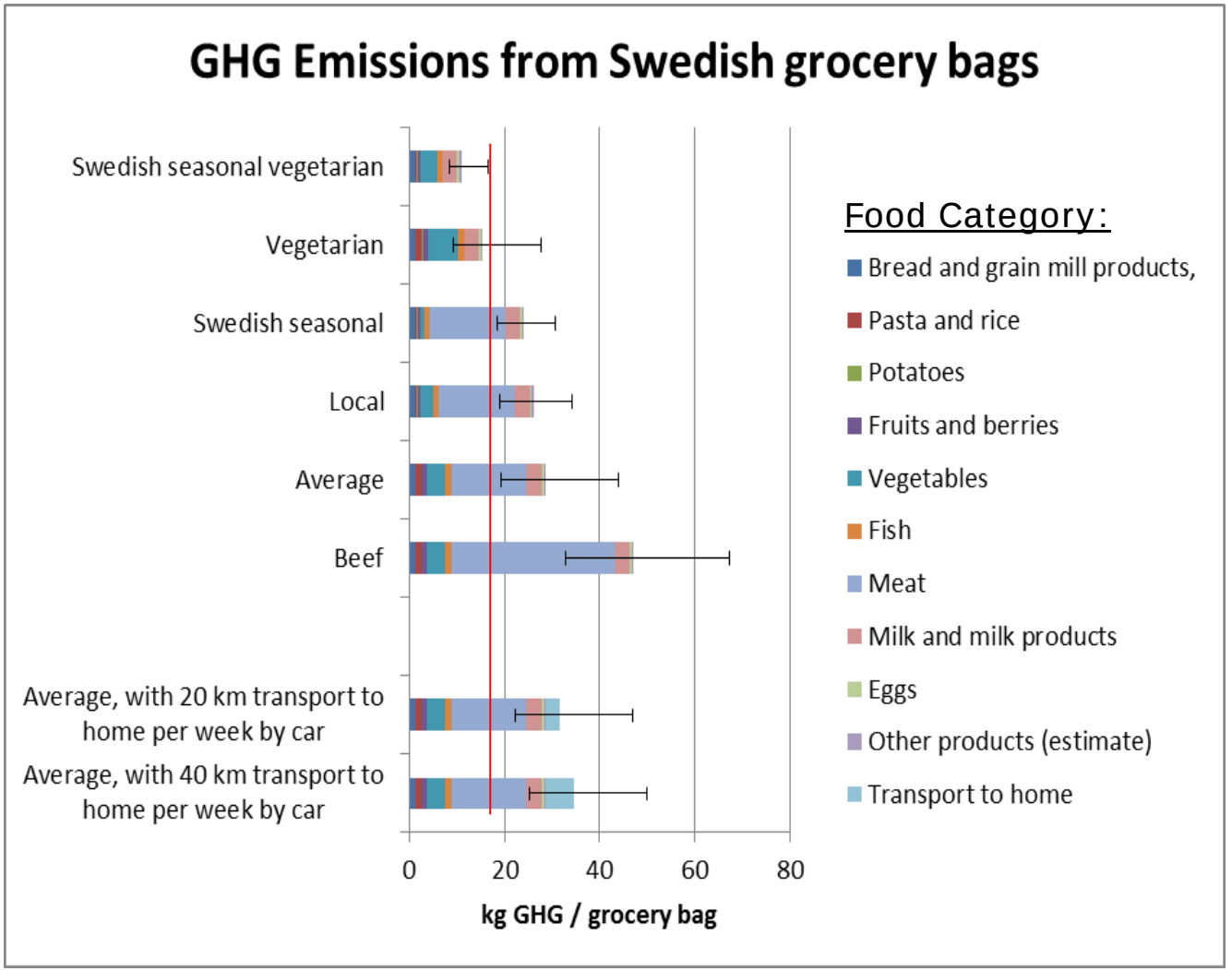
Measures outside the analysis?

Dietary changes?

A Swedish seasonal vegetarian diet could reduce Swedish CO_{2eq}-emissions by 3.6 Mton CO_{2eq}. (Swedish total ~70)

REMARK:
Vegetarian in this case include milk

Would also reduce NH_3



Thank You for Your Attention

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