



JOANNEUM RESEARCH Forschungsgesellschaft mbH



Environmental Assessment of Biomethane Injected into the Gas Grid



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The work for this presentation was conducted in the Austrian project "Biogas Gesamtbewertung" which is financed by the Austrian "Klima- und Energiefonds" and is carried out within the framework of the programme "Energiesysteme der Zukunft".

- Background information
- Project „Biogas Gesamtbewertung“
- Modeling
- Results
- Conclusions

Emissions in Agriculture in Austria

- Greenhouse gas emissions (2008):
 - 8.8% of total GHG emissions
 - **72% of total N₂O emissions**
 - Use of fertilizers on agricultural soils
 - 62% of total CH₄ emissions
 - Enteric fermentation
 - Manure management
- Air pollutants (2008):
 - **92% of total NH₃ emissions**
 - Livestock breeding and manure management
 - Use of fertilizers on agricultural soils

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Austria's National
Inventory Report 2010

Submission under the United Nations Framework
Convention on Climate Change and the Kyoto Protocol

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Austria's Informative
Inventory Report (IIR) 2010

Submission under the UNECE Convention on
Long-range Transboundary Air Pollution

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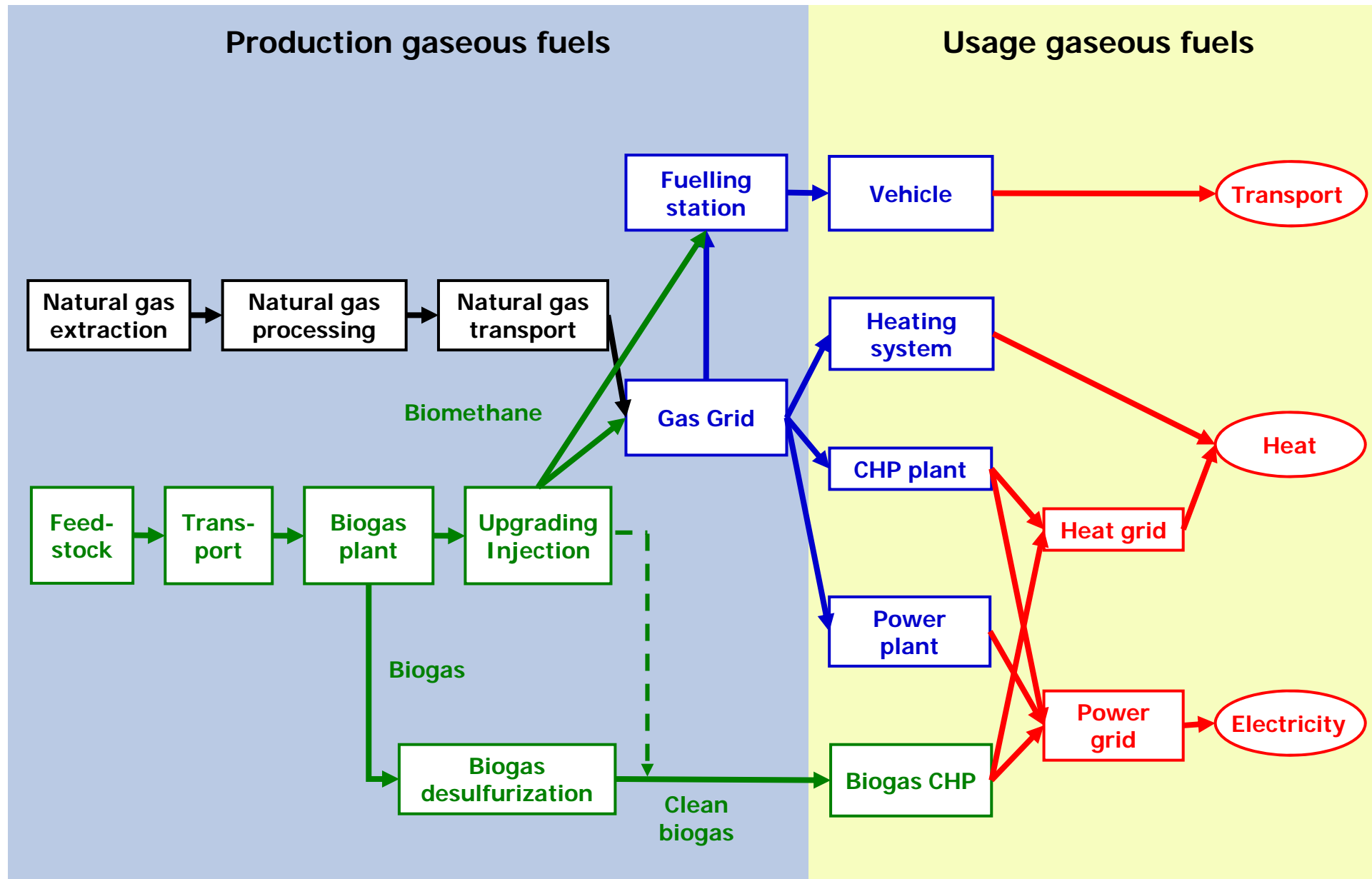
„Biogas Gesamtbewertung“

- Environmental, economic and socio-scientific assessment of biogas from the gas grid used as transport fuel and in stationary applications
- Work packages

1	Cost and potential analysis of biomass production and fermentation
2	Environmental assessment of biomethane energy services
3	Economic analysis and assessment of biomethane energy services
4	Social science analysis of framework conditions for implementation
5	Analysis of agricultural and energy policy
6	Energy market perspectives of biomethane
7	Macro economic analysis: employment, fiscal and foreign trade balance

The project is financed by the Austrian “Klima- und Energiefond” and is carried out within the framework of the program “Energiesysteme der Zukunft”.

Overview biomethane pathways



Investigated production pathways

- 15 different production pathways investigated
- Results for 5 selected production pathways

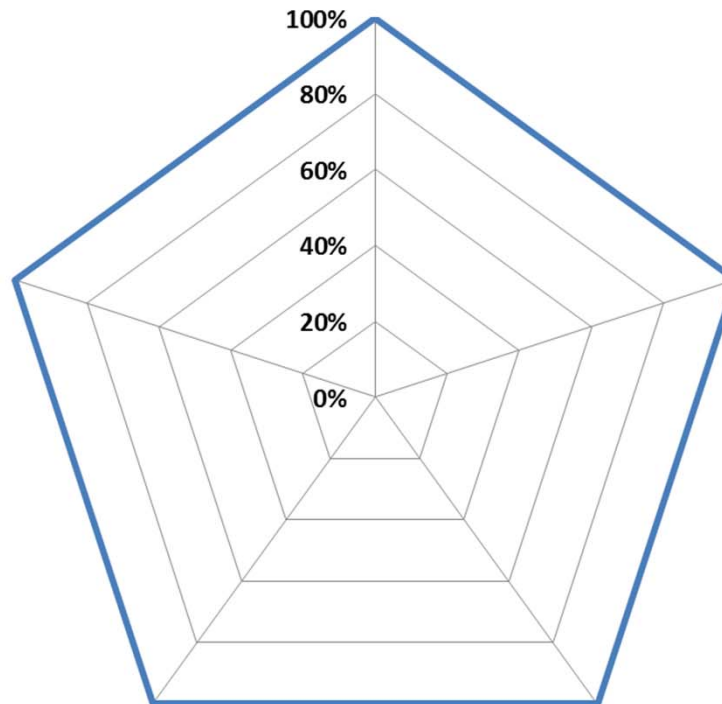
Name [Capacity injection, share feedstock]	Feedstock	Biogas production [Nm ³ /h]	Upgrading technology
600 Nm ³ /h_85% energy crop rotation+15% manure	corn, triticale, green rye, sunflower, cattle manure	1,500	pressurized water washer
400 Nm ³ /h_100% residues	foul food, lecithin, grease separator, sugar beet residues, vegetable residues, kitchen residues	800	gas permeation
130 Nm ³ /h_52% Int. crop rotation+6% straw + 43% manure*	corn straw, sunflower straw, clover gras silage , corn silage, green rye silage, pig manure	450	amine gas treating
22 Nm ³ /h_50% gras+50% manure	gras, cattle manure	45	pressure swing adsorption (PSA)
20 Nm ³ /h_25% pig manure+75% cattle manure	cattle and pig manure	45	pressure swing adsorption (PSA)

Investigated environmental impacts

Greenhouse gas emissions

Fossil primary
energy use

Acidification
potential



Particulate
Emissions

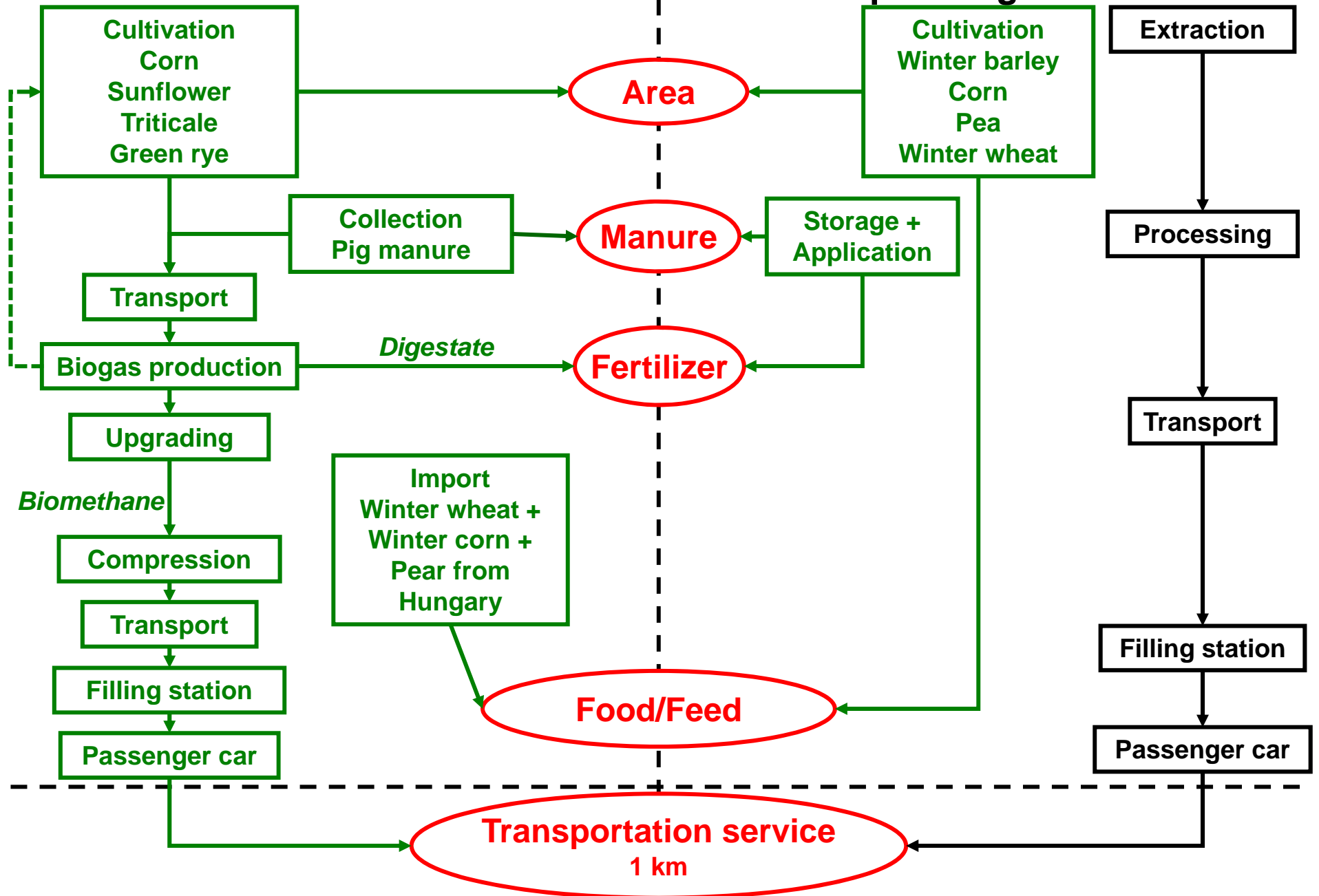
Ozone creation
potential

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Biomethane systeme

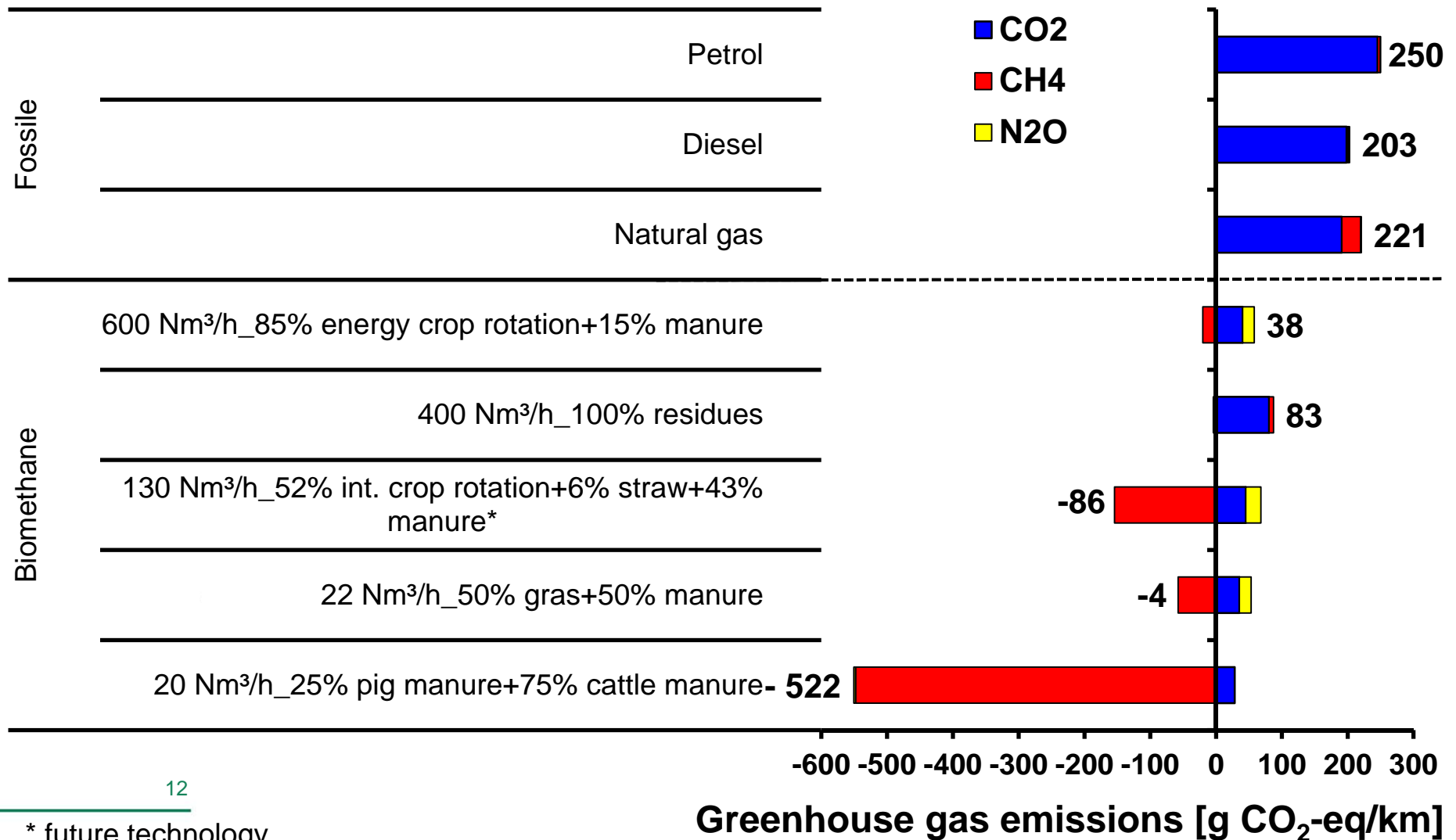
600 Nm³/h_85% energy crop rotation + 15% manure



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Greenhouse gas emissions biomethane as transportation fuel



GHG reduction potential with 200,000 bioCNG vehicles

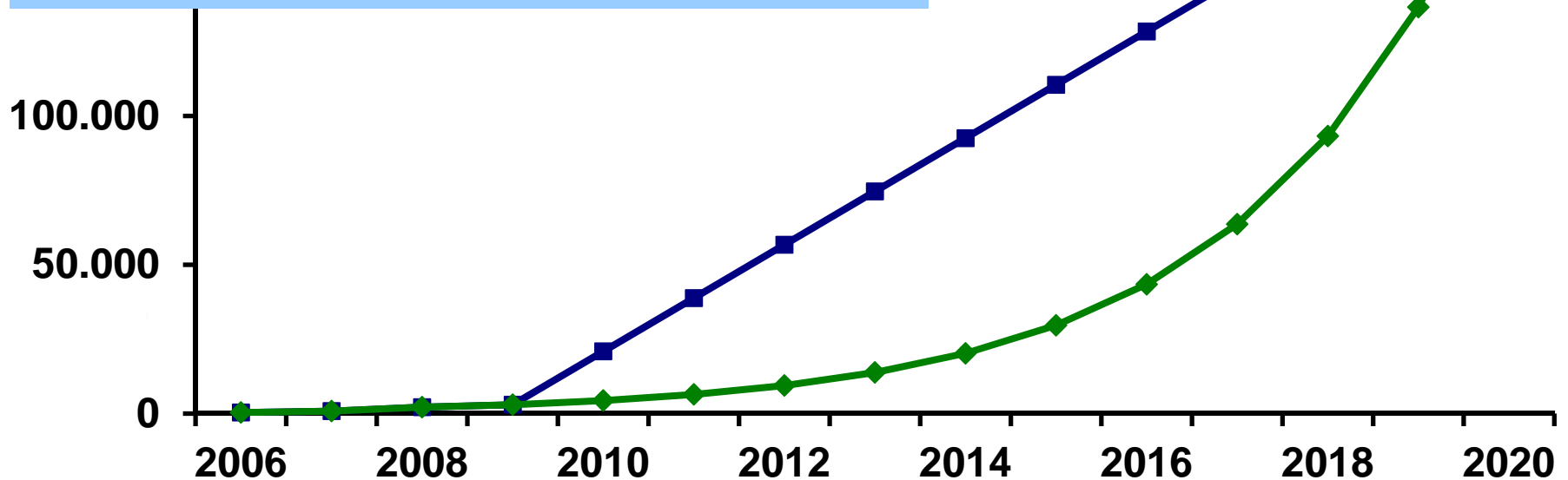
- 100% biomethane
- 0.66 [kWh/km] (EURO 6 passenger car)
- 14,000 [km/year]

→ 6.7 [PJ Biomethan / Year]

→ Reduction: 0.4 bis 2 Mio. [t CO₂-eq.]

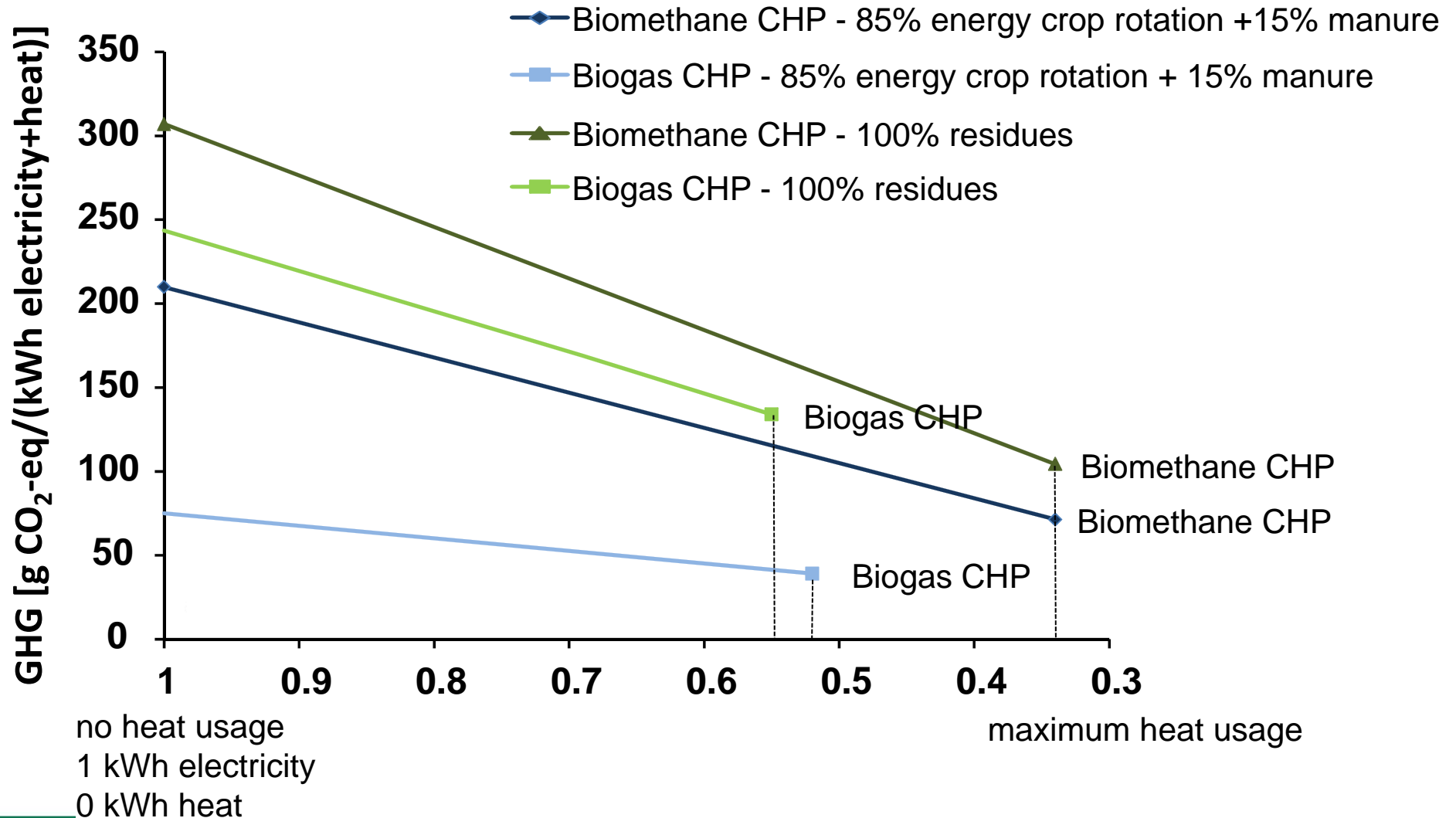
200,000 bioCNG vehicles
2020 goal
Energy Strategy Austria

Number of vehicles

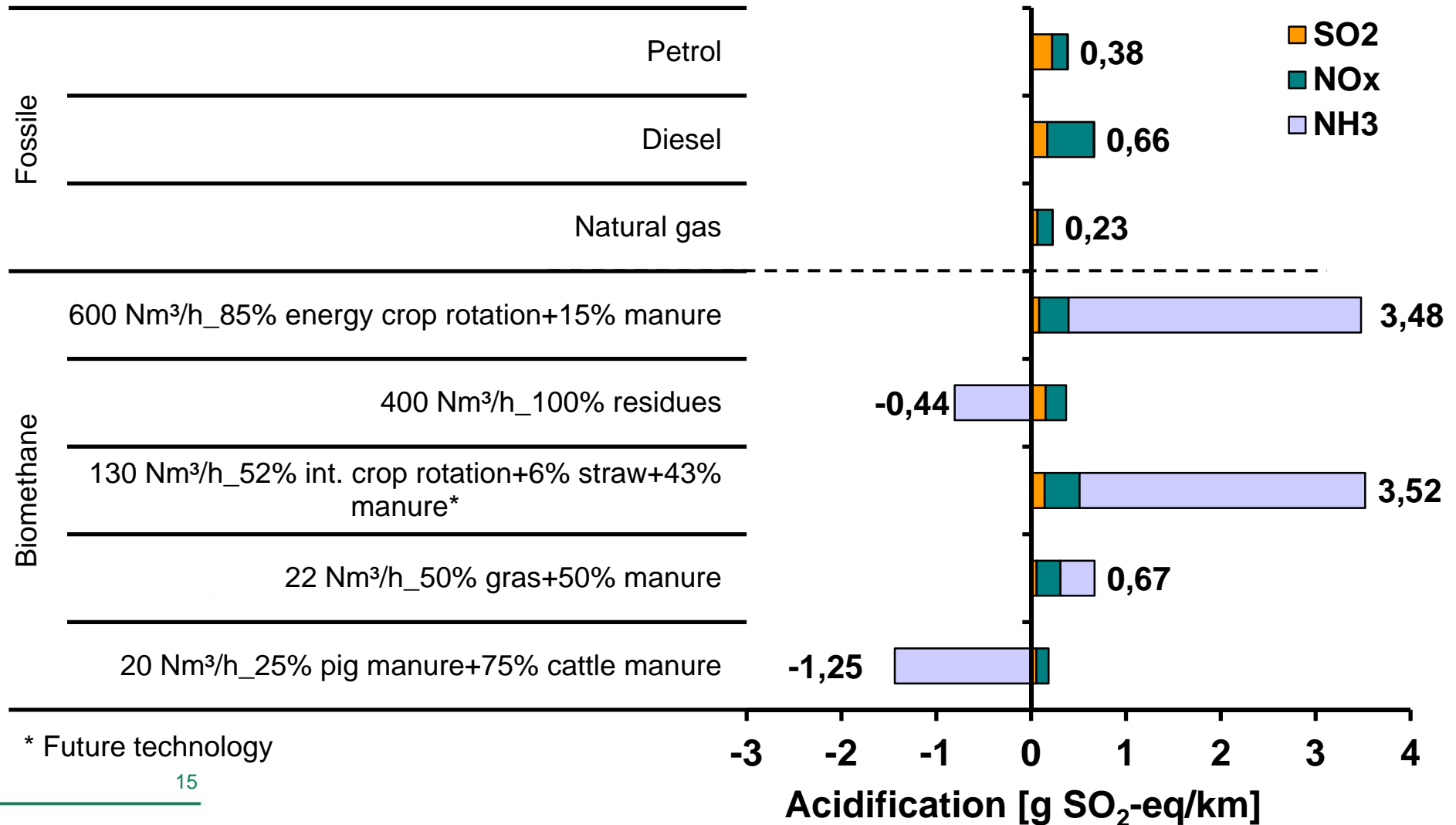


■ CNG Vehicles (CNG + CNG/Petrol) linear
◆ CNG Vehicles (CNG + CNG/Petrol) exp.

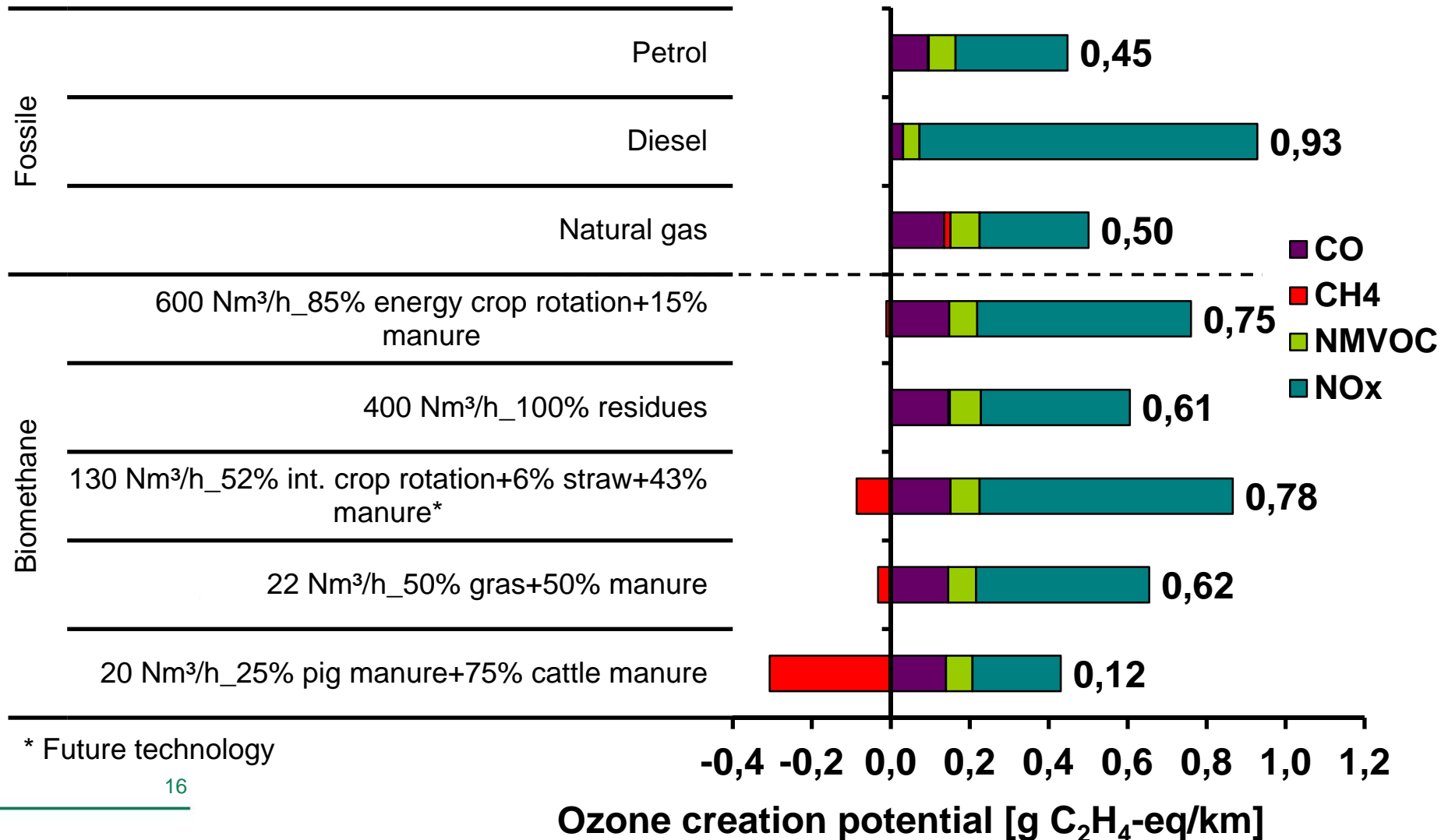
Biogas CHP versus biomethane CHP



Acidification potential biomethane as transportation fuel



Ozone creation potential biomethane as transportation fuel



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Conclusions

Comparison of biomethane to natural gas:

- Environmental effects are almost independent from type of energy service
- Greenhouse gas emissions
 - Reduction in all cases (-56% to -400%)
 - Higher reduction with liquid manure than with energy crops (-90% to -400%)
 - When residues are used reduction depends on reference use of residues with its products
- Acidification potential
 - Increasing or decreasing – depending on the feedstock
 - Highest impact: NH_3 emissions from digestate and manure management

Conclusions

- Ozone creation potential
 - Increase or decrease possible (+ 280% to -145%)

- Particulate emissions
 - Higher compared to fossil systems for most cases (+5% to +650%); one case shows a reduction
 - Lower compared to renewable system if solid biomass is used for heat generation (-55% to -95%)

- Fossil primary energy demand
 - Reduced in all cases (-60% to -100%)

Thank you for your attention!



Questions... ?

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