

From Waste to Traffic Fuel

W-Fuel



Environmental impact assessment of biomethane production and use

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MTT



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Content

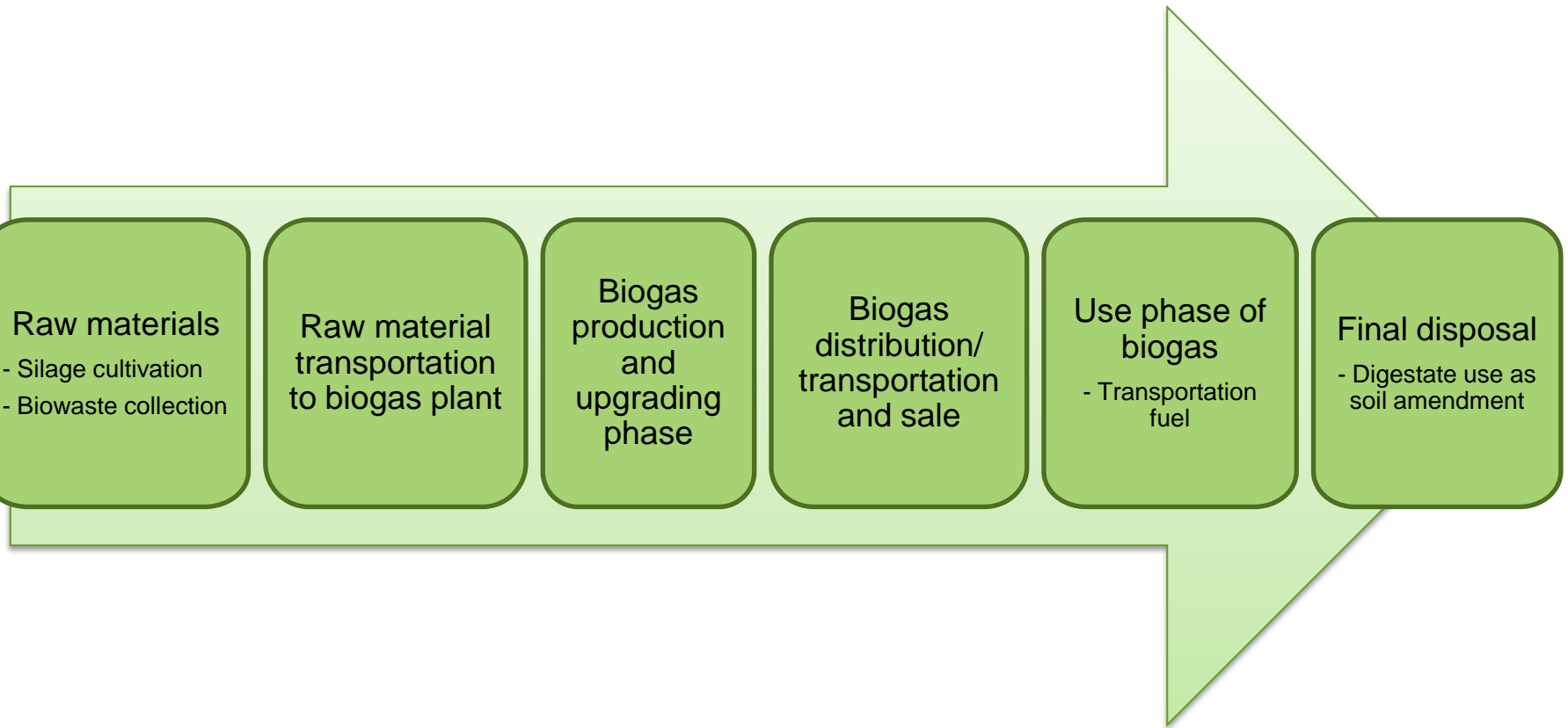
- Calculation methods
- Base and methane cases
- Background of calculations
- Results
- Conclusions

Methods

- Aim was to calculate the life cycle GHG emissions and energy balance of biomethane production and use and compare the results of the methane and base cases.
- Climate change is used as environmental impact factor.
- CO₂, CH₄ and N₂O greenhouse gas emissions are included.
 - Results are presented as CO₂ -equivalent.

Greenhouse gas emission		GWP (Global warming potential)
Carbon dioxide	CO ₂	1
Methane	CH ₄	25
Nitrous oxide	N ₂ O	298

Carbon footprint of biogas production – Simplified flowchart (cradle-to-grave –examination)



Base case

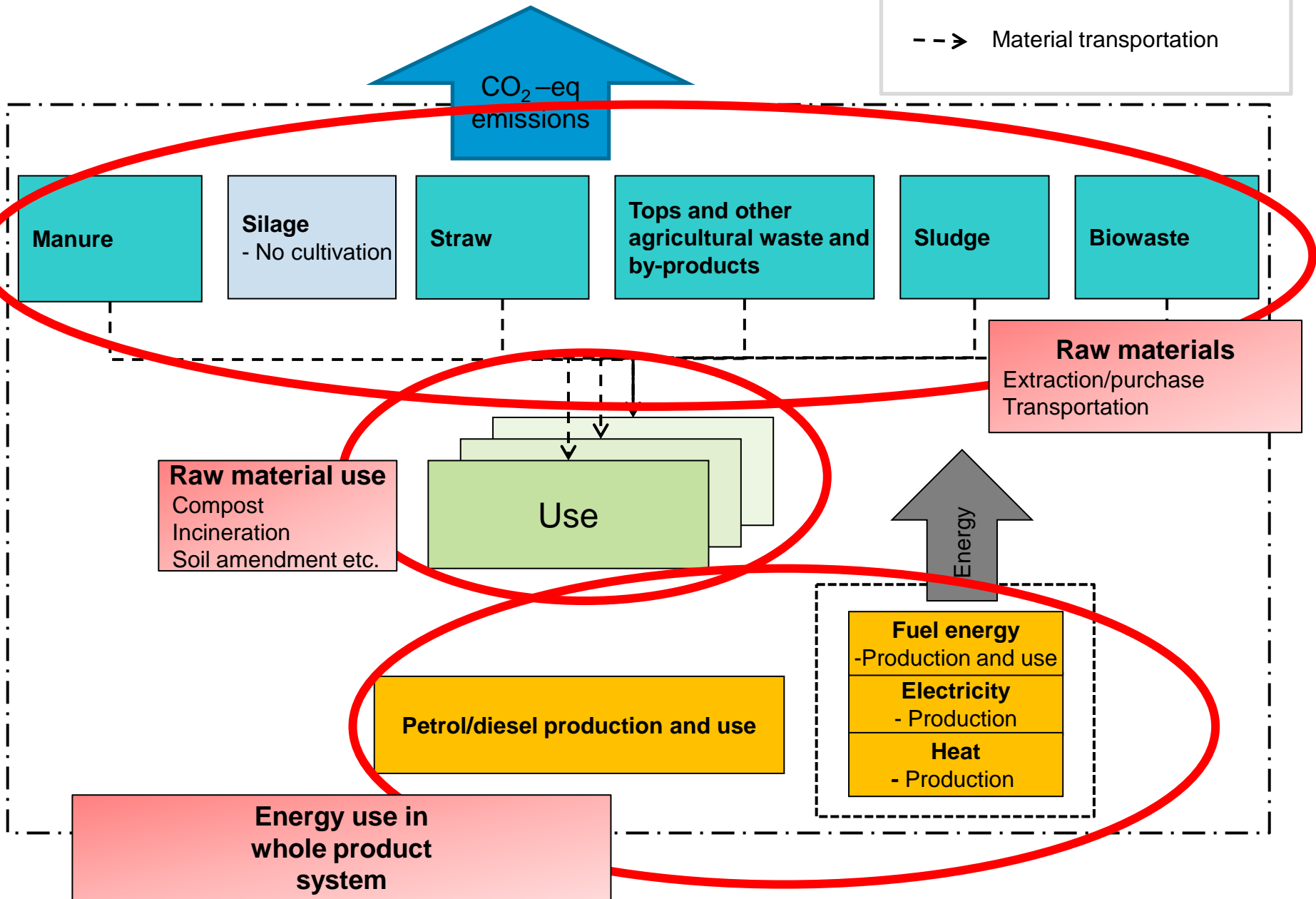


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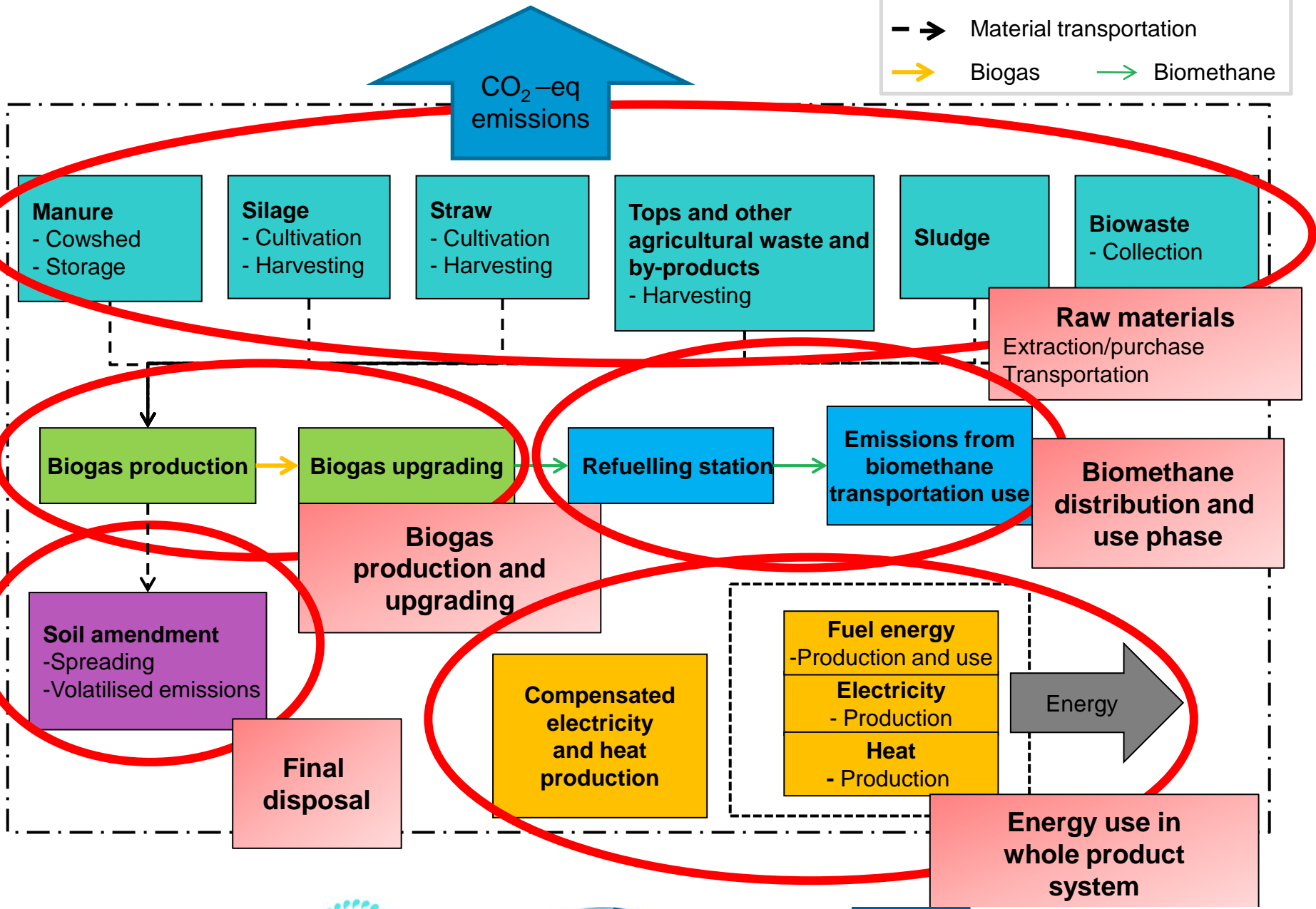
--> Material transportation



Methane case



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Background of calculations

- Based on research results and best knowledge available
 - Supplemented with expert opinions, assumptions and literature
- Large product system based on future operation
 - Some simplification were made
- Main critical assumptions
 - Energy used: Finnish average electricity and chip boiler heat
 - Technology choices: e.g. energy consumption of biogas plant
 - Compensation processes (electricity and heat production in base case vs. transportation fuel in methane case)
 - Final use of biogas (transportation fuels, type of vehicle)

Emission cuts correspond to emissions of over 100 000 petrol cars in total

		Kymenlaakso	Salo	Turku
Base case, total	t, CO ₂	192 220	195 520	266 200
Methane case, total	t, CO ₂	62 890	62 260	92 880
Emission reduction		67 %	68 %	65 %
Number of petrol cars, 20 000 km/a		32 000	33 000	43 000
Share of region's total number of cars		34 %	85 %	29 %
Energy consumption/Energy production		20 %	18 %	22 %

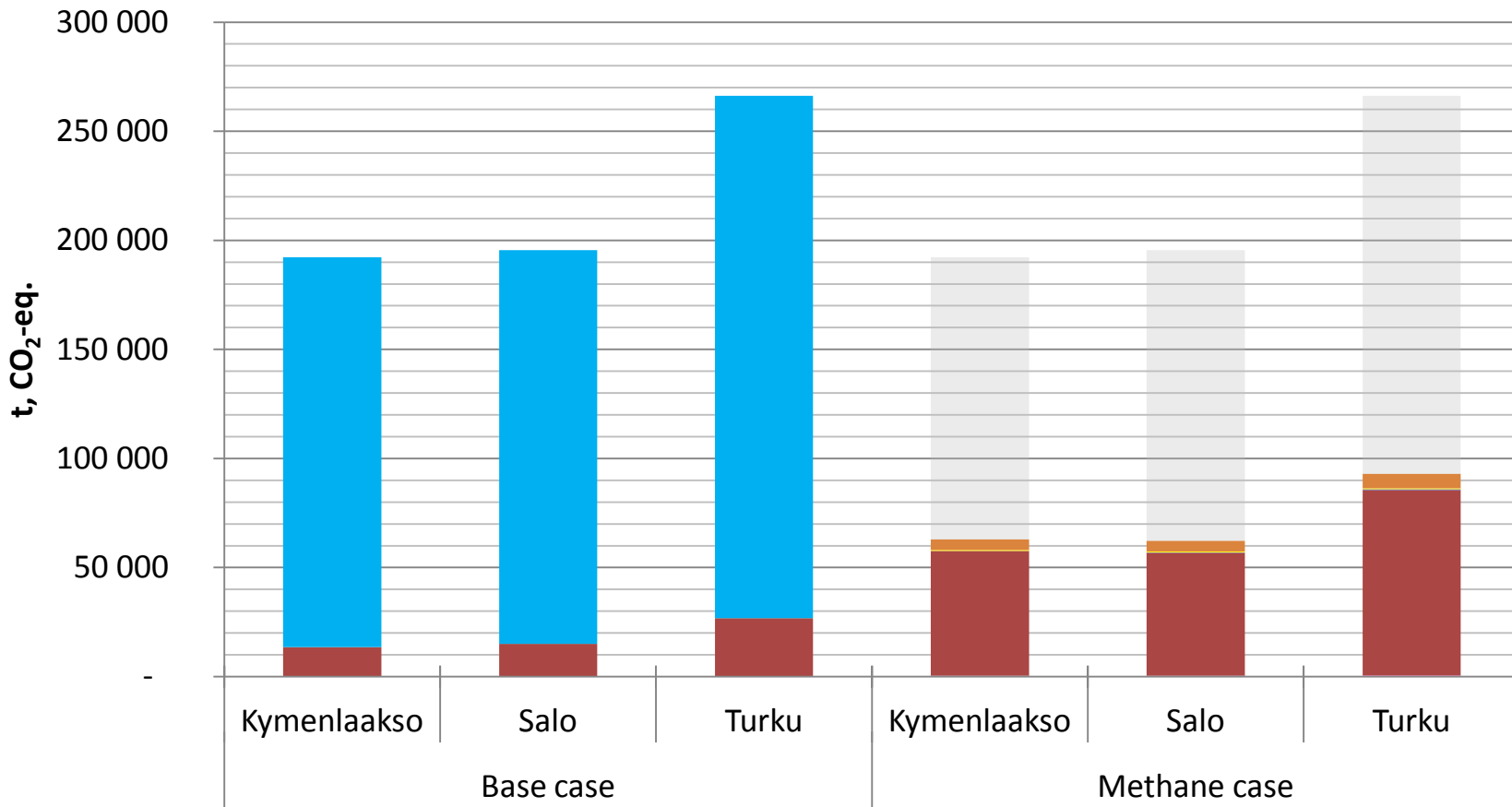
- Calculation includes also landfill gas produced in every region.
- Different situation in Helsinki region, where biogas is already produced and used a lot in a base case.

Raw material based emission factors in methane case

		Kotka	Salo	Turku
Biowaste	kg, CO ₂ -eq/t	117	264	233
	g, CO ₂ -eq/MJ	33	76	67
Liquid manure, pig	kg, CO ₂ -eq/t	51		
	g, CO ₂ -eq/MJ	140		
Silage	kg, CO ₂ -eq/t	113		
	g, CO ₂ -eq/MJ	30		

Total emissions in base and methane cases

- Raw material transportation
- Raw material extraction
- Petrol/diesel car traffic emissions
- Biomethane transportation
- Reject transportation
- Biomethane car traffic emissions
- Emission reduction



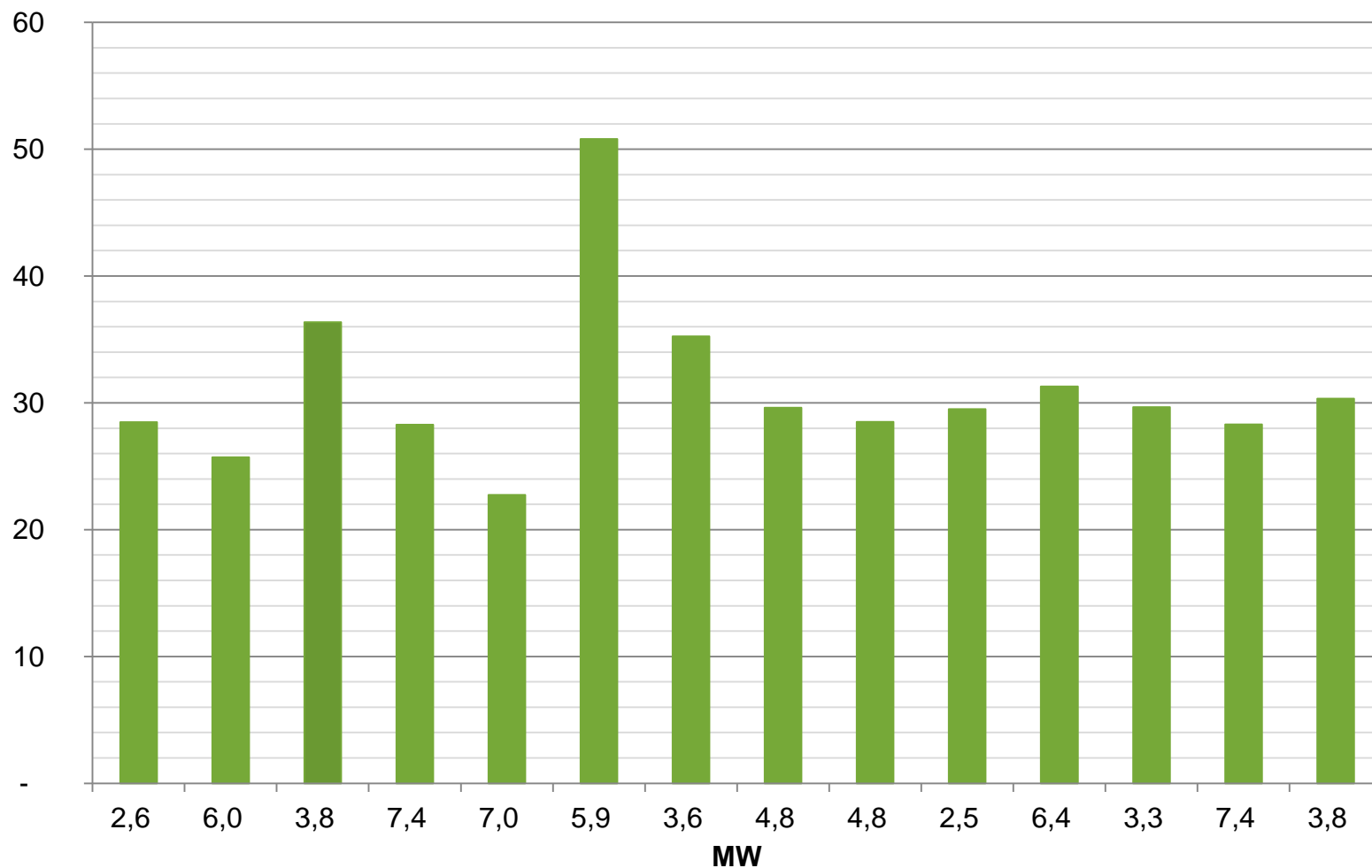
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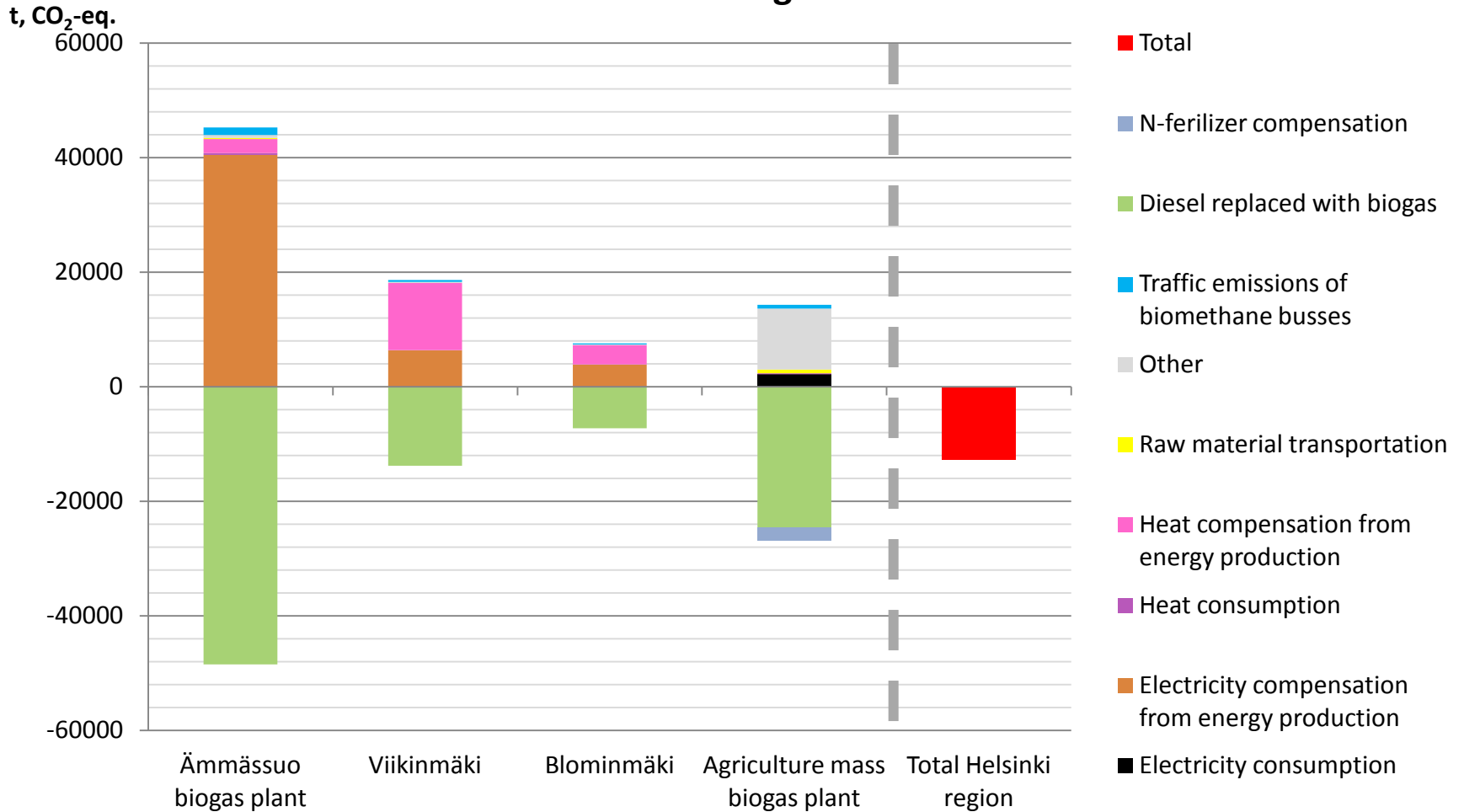
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Biogas plant specific emissions in Kymenlaakso methane case

g,CO₂/MJ



Helsinki region



Conclusions

- Methane case is better option than base case from the climate change point of view.
 - Emission reduction ~65%.
- In addition to biogas production and use, digestate can be used as soil amendment to replace chemical fertilizer.
- If raw material is used already for energy production in base case, it is important to use renewable energy sources to replace it in methane case.

Contact information

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