Human health-related externalities in energy system modelling

Zvingilaite, Erika

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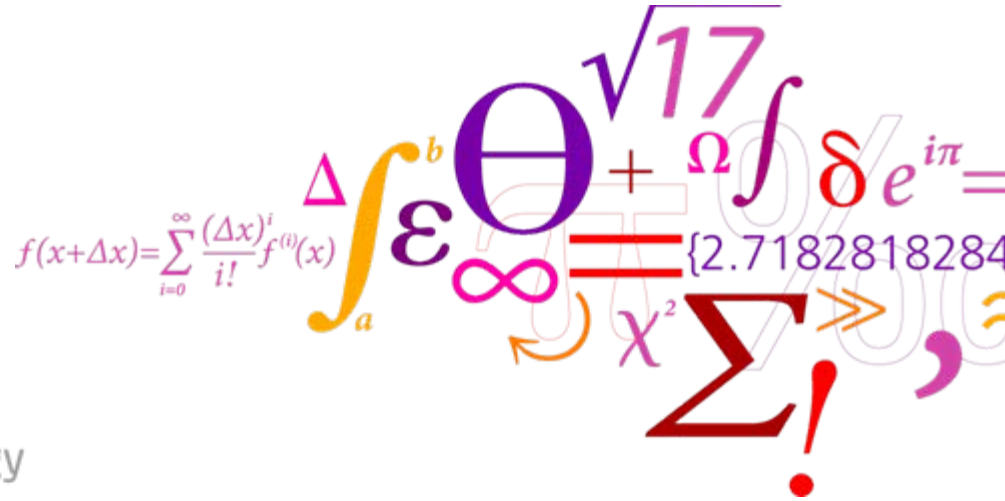
Erika Zvingilaite

PhD Student

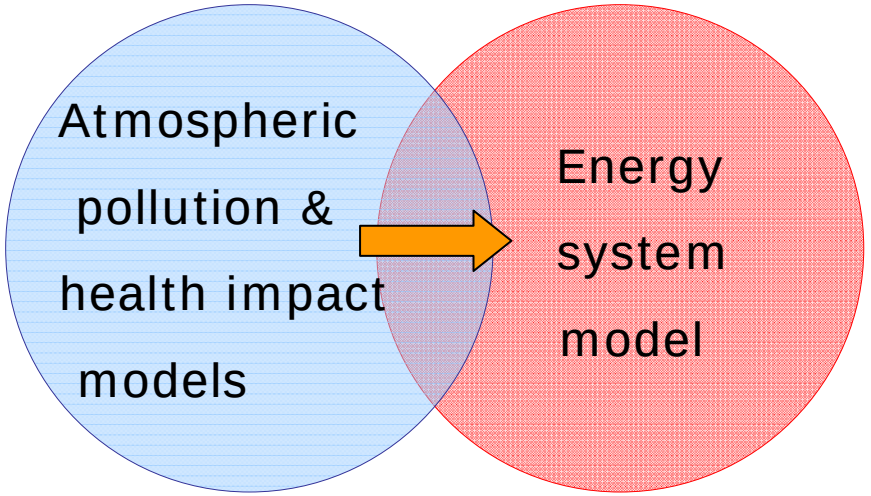
System Analysis Division

Risø DTU
National Laboratory for Sustainable Energy



Introduction - motivation

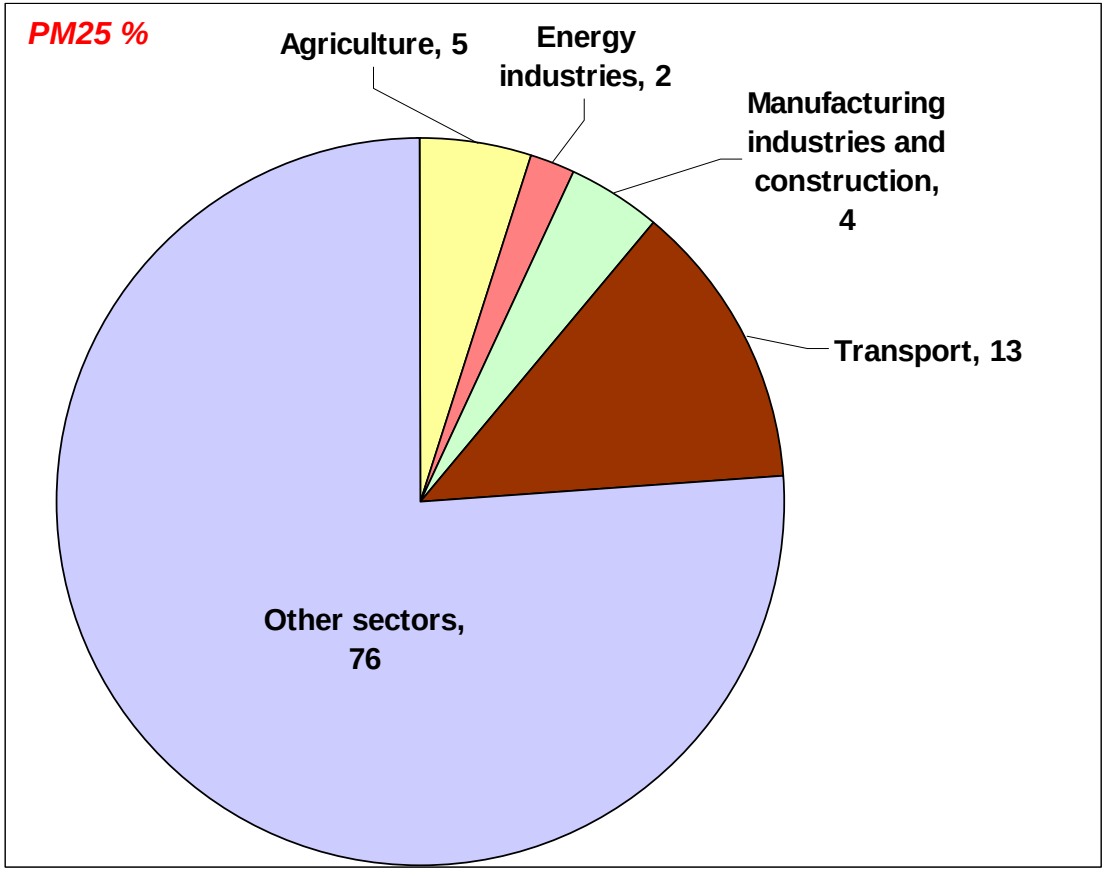
- Air pollution cause health effects
- Including into energy planning
- Co-benefits local and global
- Gap between air pollution & health impact assessment and energy models
- Adapting energy models



Outline

- BACKGROUND:
  - Sector contribution
  - Example of three plants
- THE MODEL AND SCENARIOS
- RESULTS
- CONCLUSIONS

Air pollution – PM25, NOx, SO2 in Denmark in 2007



from www.DMU.dk

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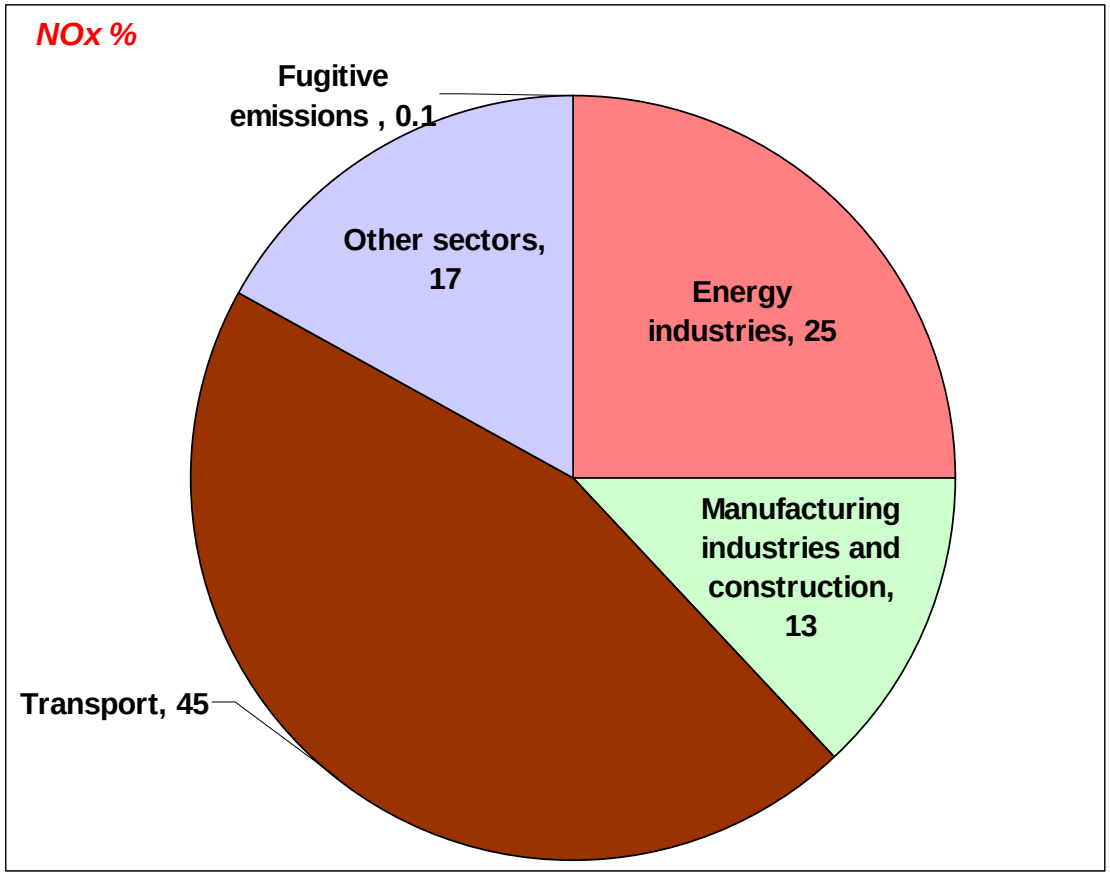

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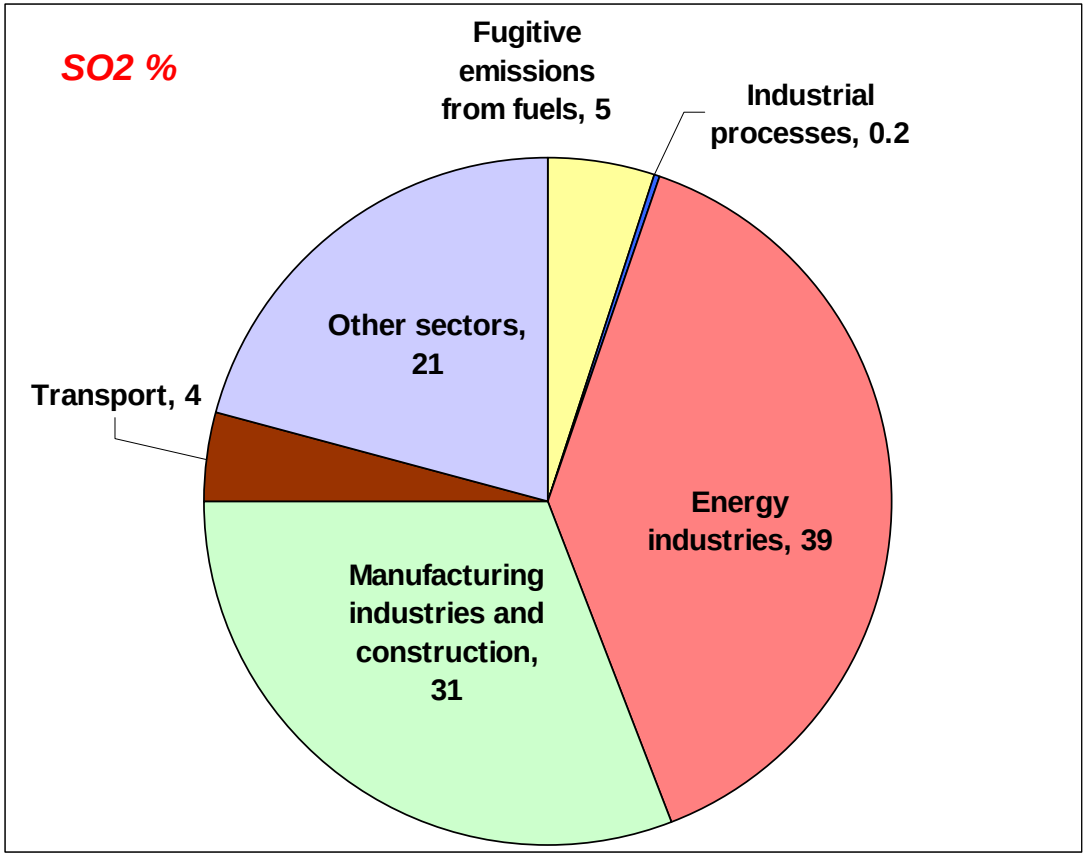


from www.DMU.dk

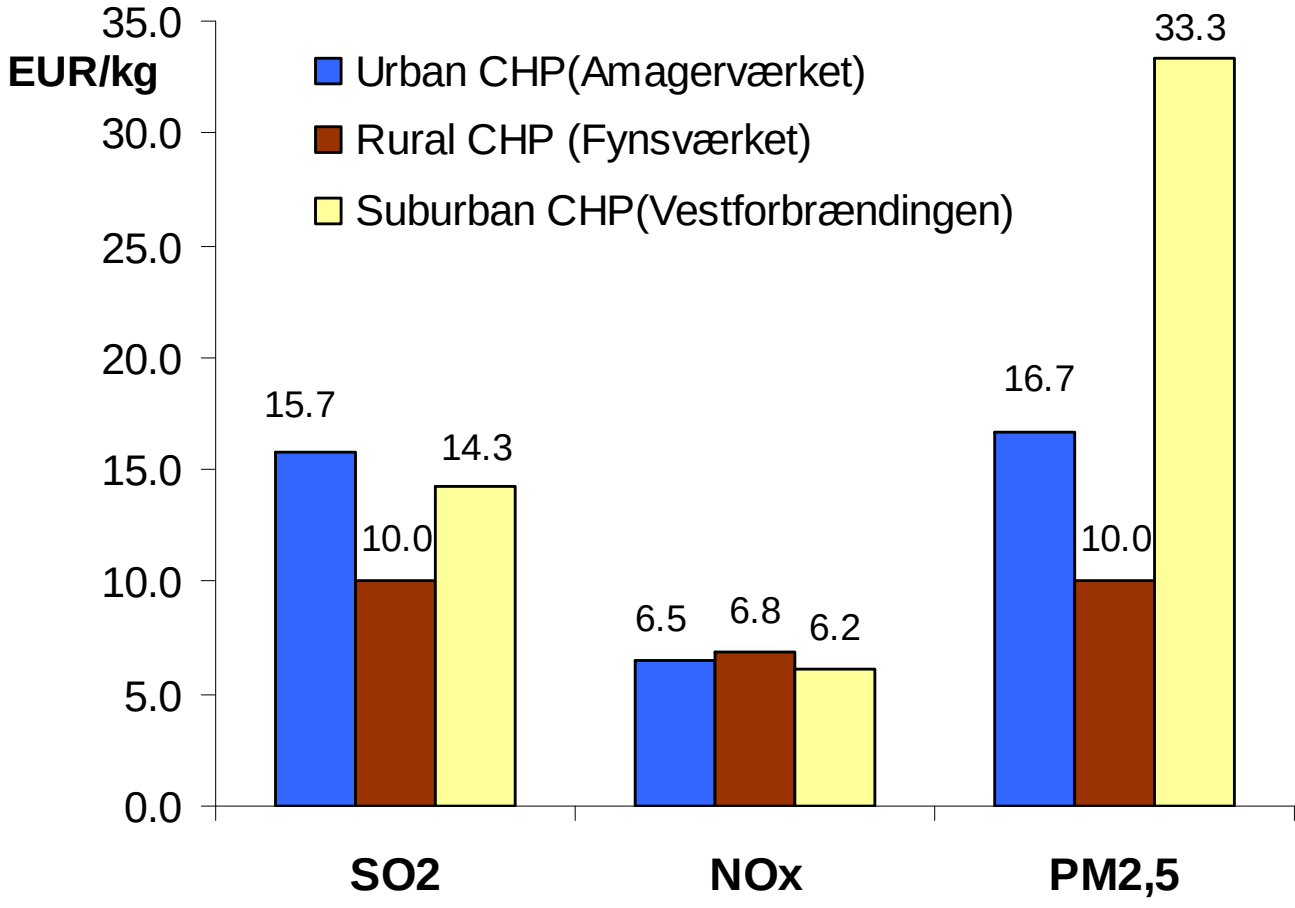
Health related externalities and energy production

– Location

- Meteorology
- Population

– Stack height

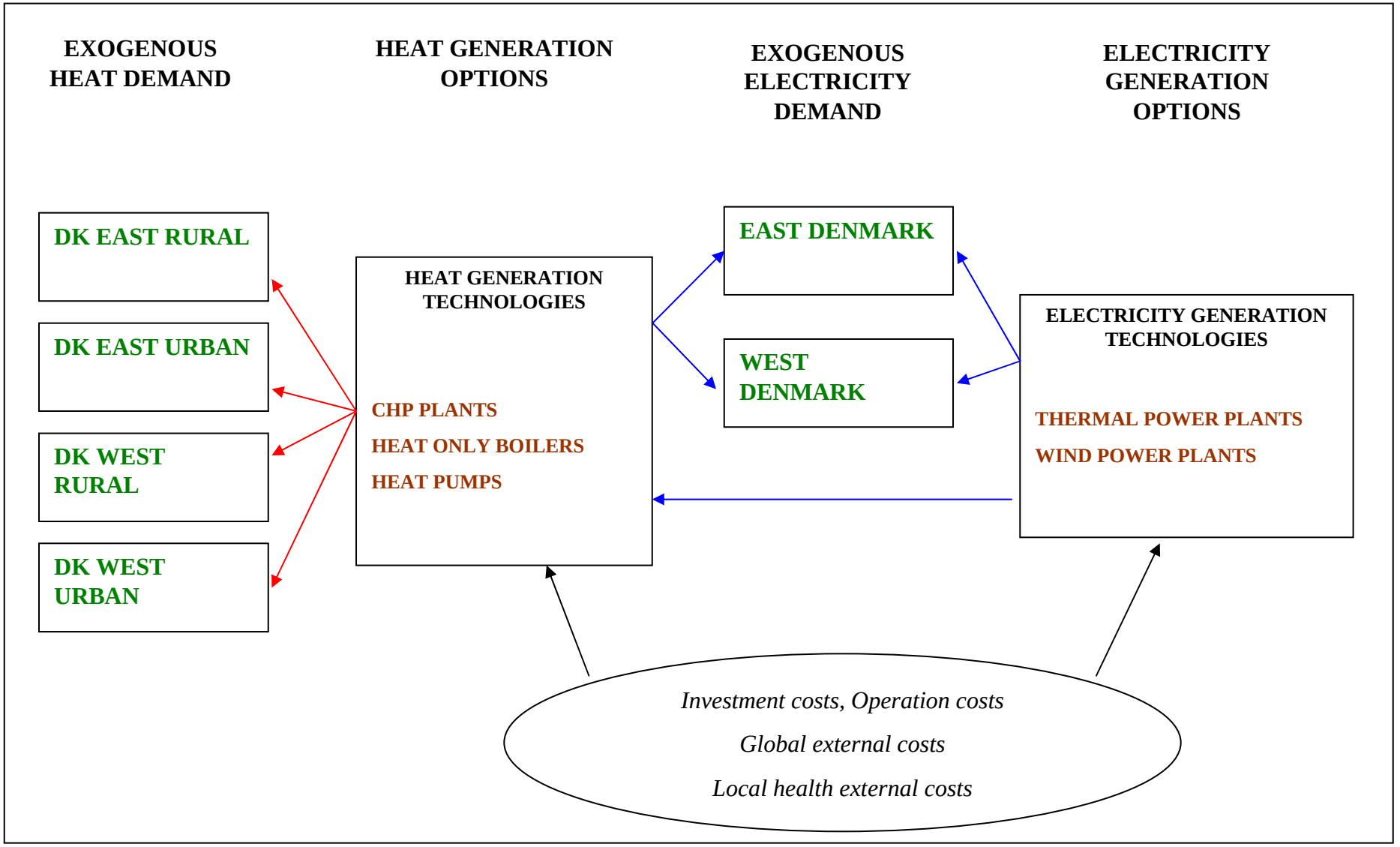
- Plant size



based on Andersen et al., 2008

The model - Balmorel

– a linear optimisation model of heat and power sectors (Denmark)

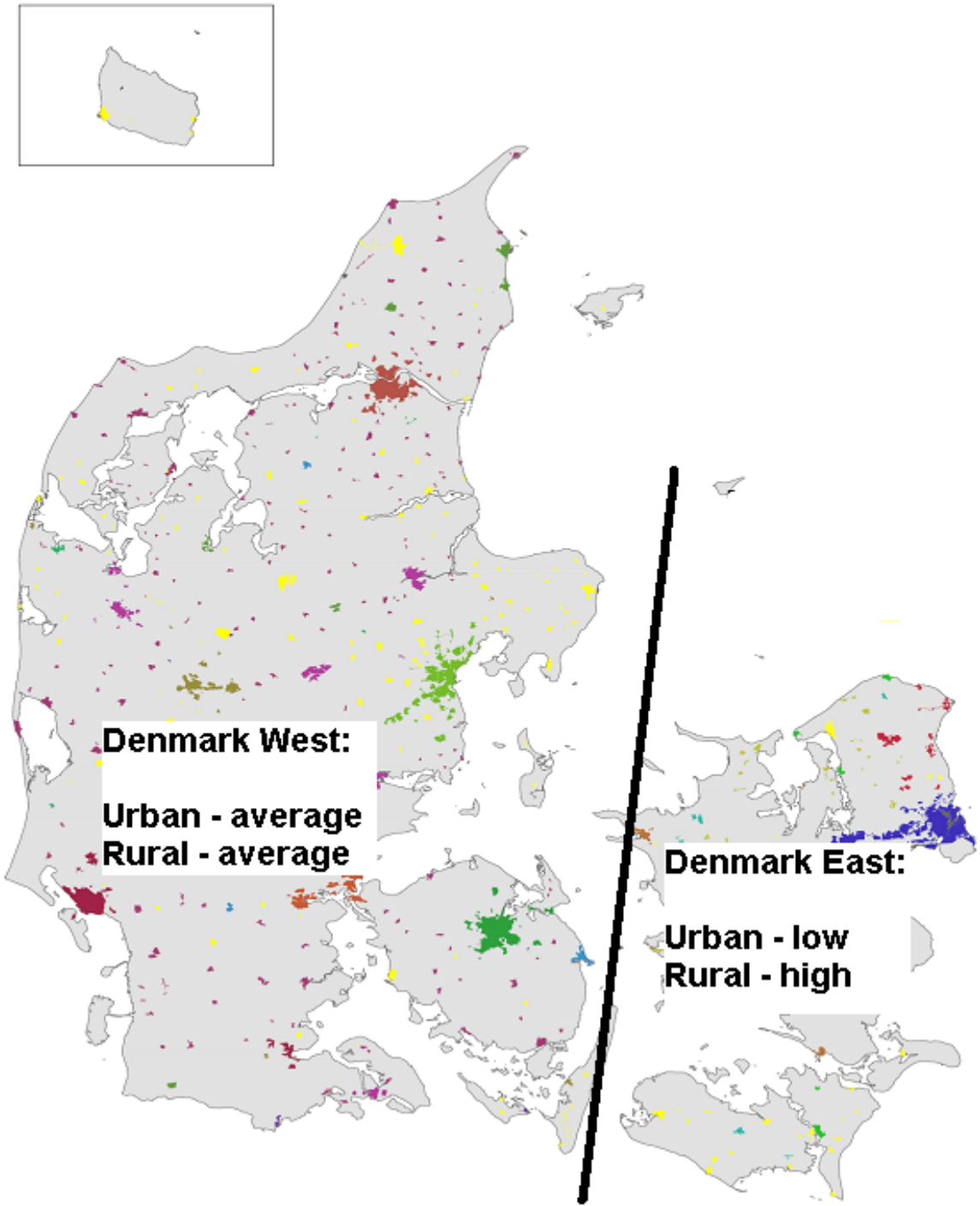


Scenarios – 2005, 2015, 2030

Scenario	*Description*
No Externalities	**No health externalities – only an external cost of CO_2 - 15 EUR / t**
Uniform cost	**The single average local externality cost in addition to CO_2 cost**
Different area cost	**Different local area externality costs in addition to CO_2 cost**

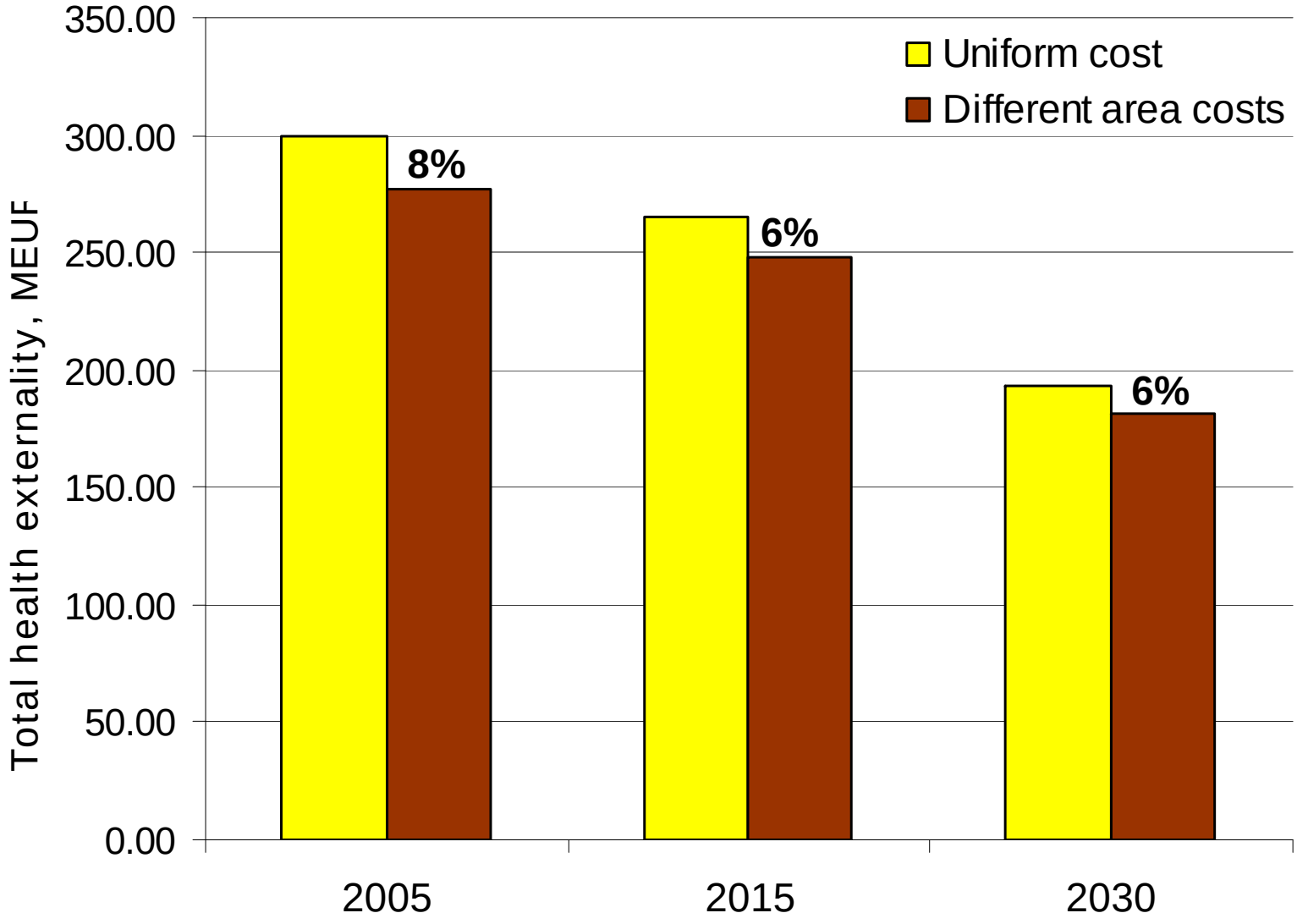
Health related external costs included in the model

	SO2 Cost, EUR / t	NOx cost, EUR / t	PM2,5 Cost EUR / t
Average cost	**9100**	**5870**	**10900**
High cost	**13542**	**10483**	**18533**
Low cost	**5962**	**2533**	**7595**



adopted from Bernd Möller, Aalborg University 2008

Results I – The external costs



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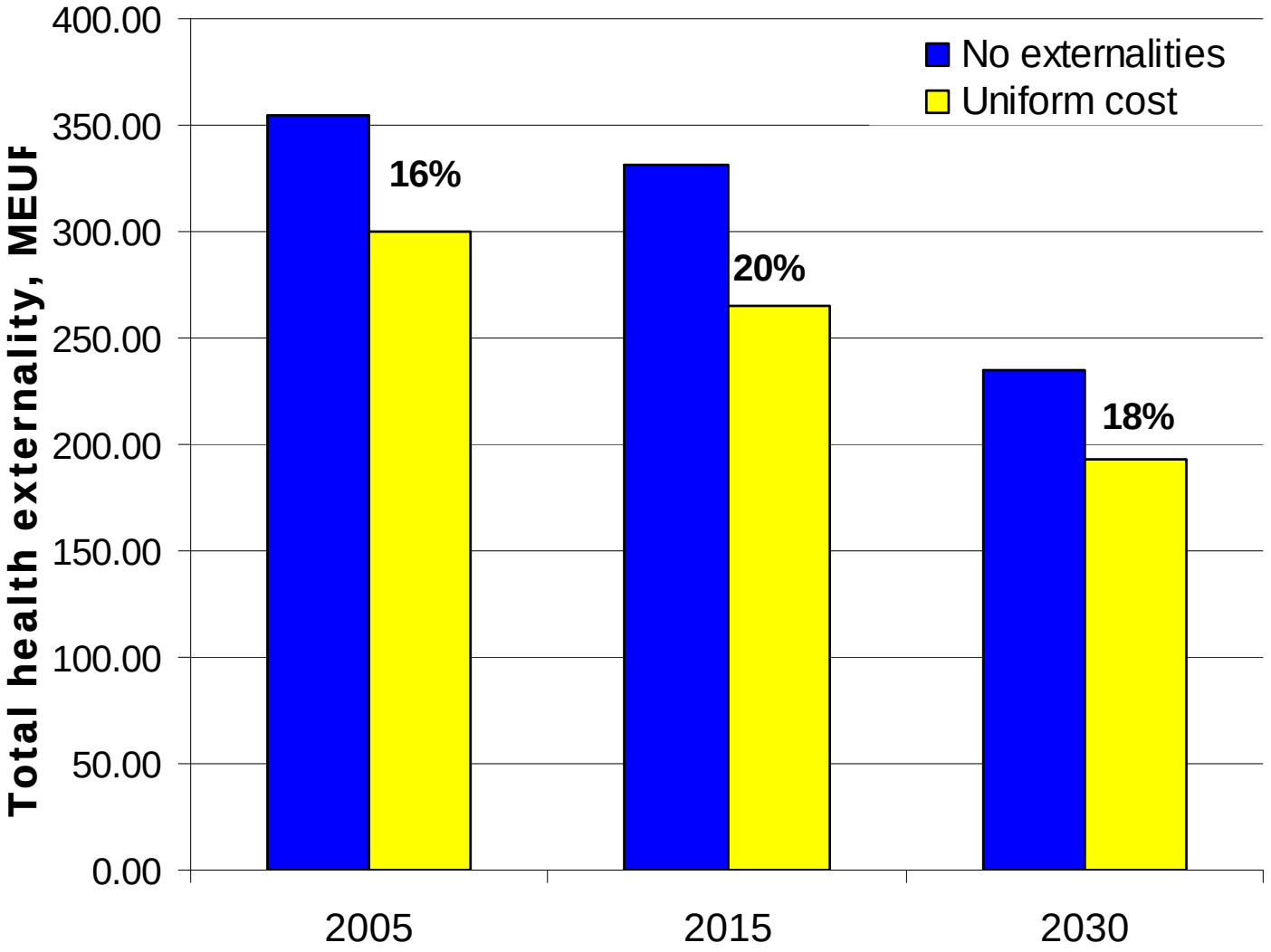
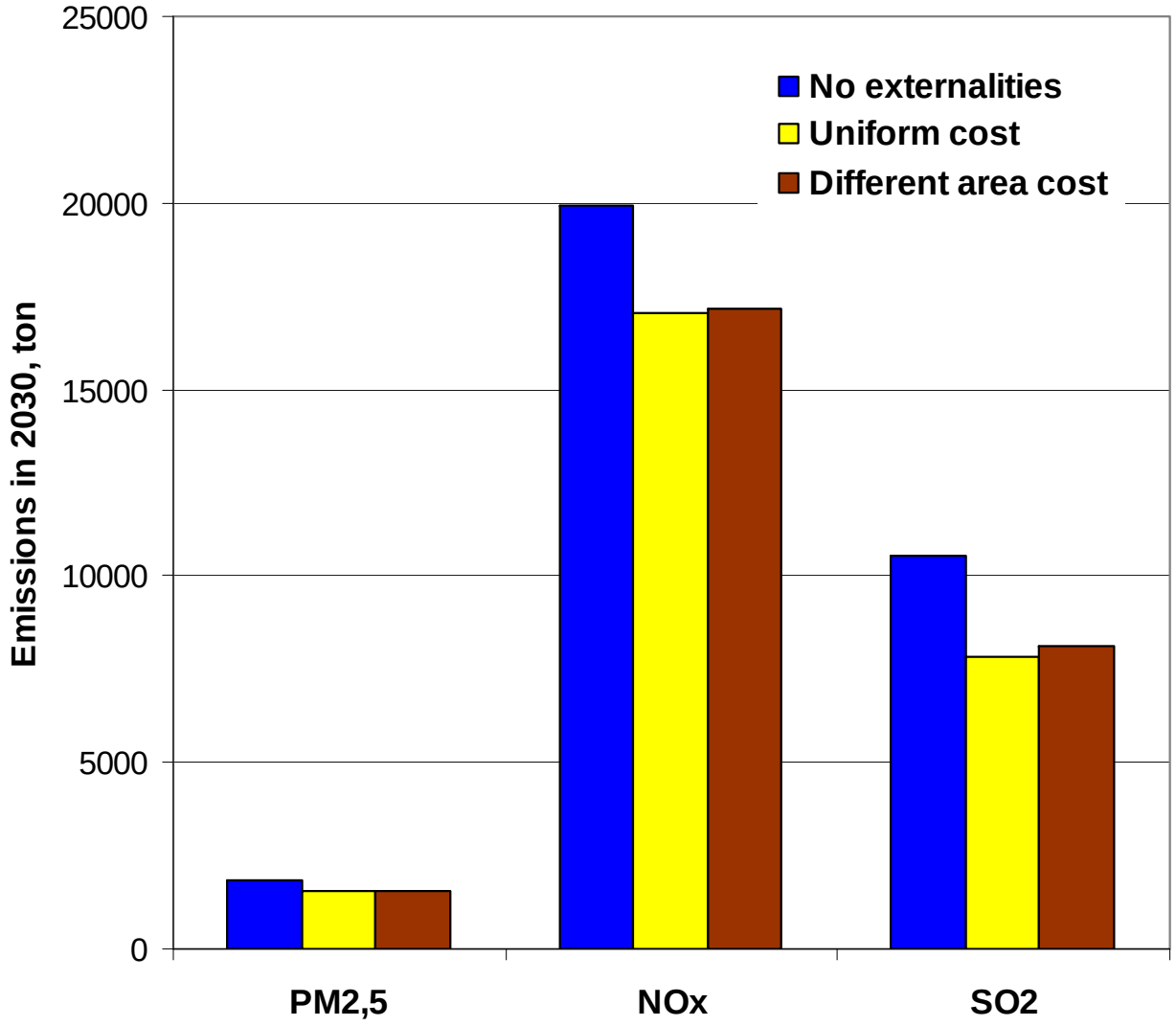


Results II – pollution emissions in areas



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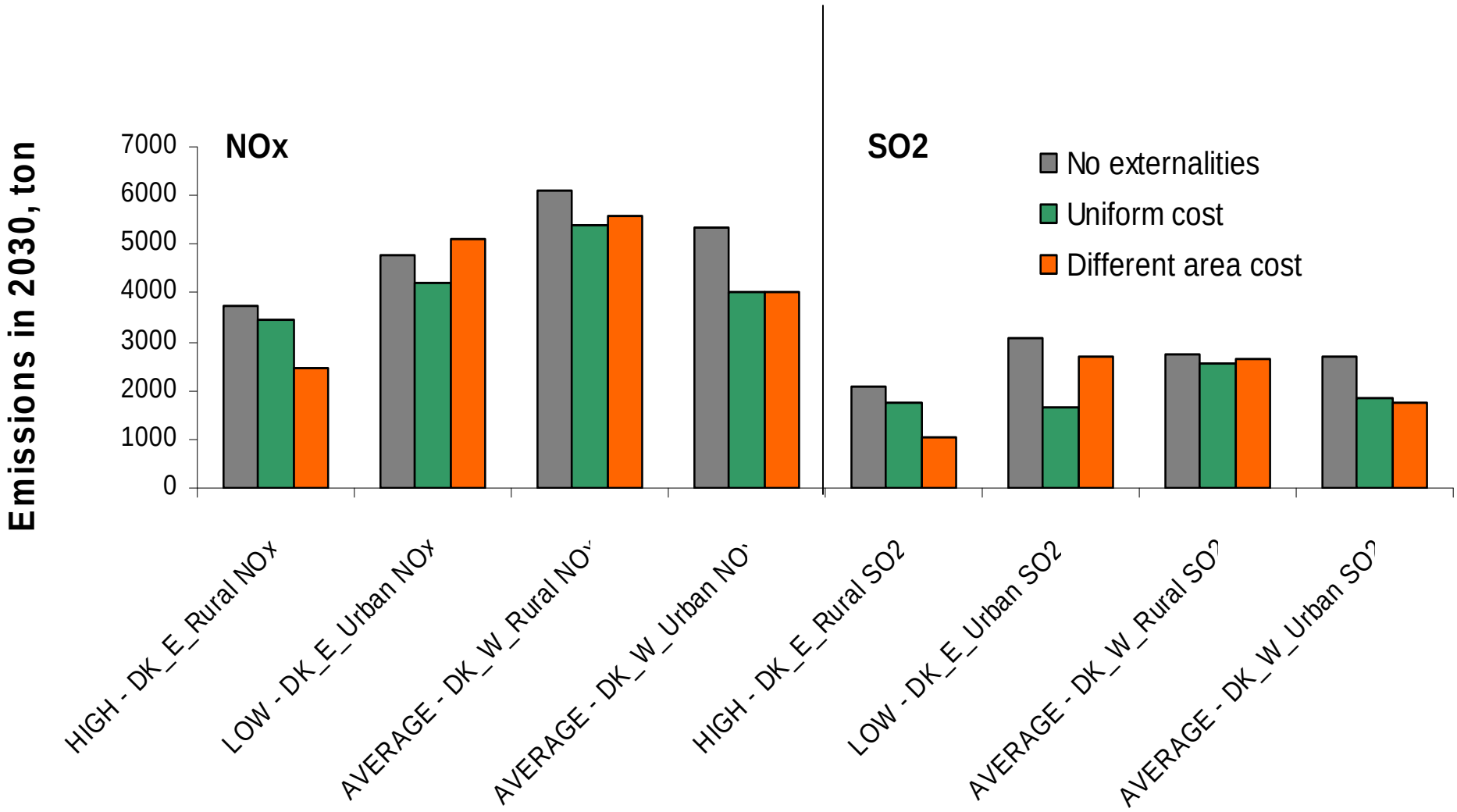
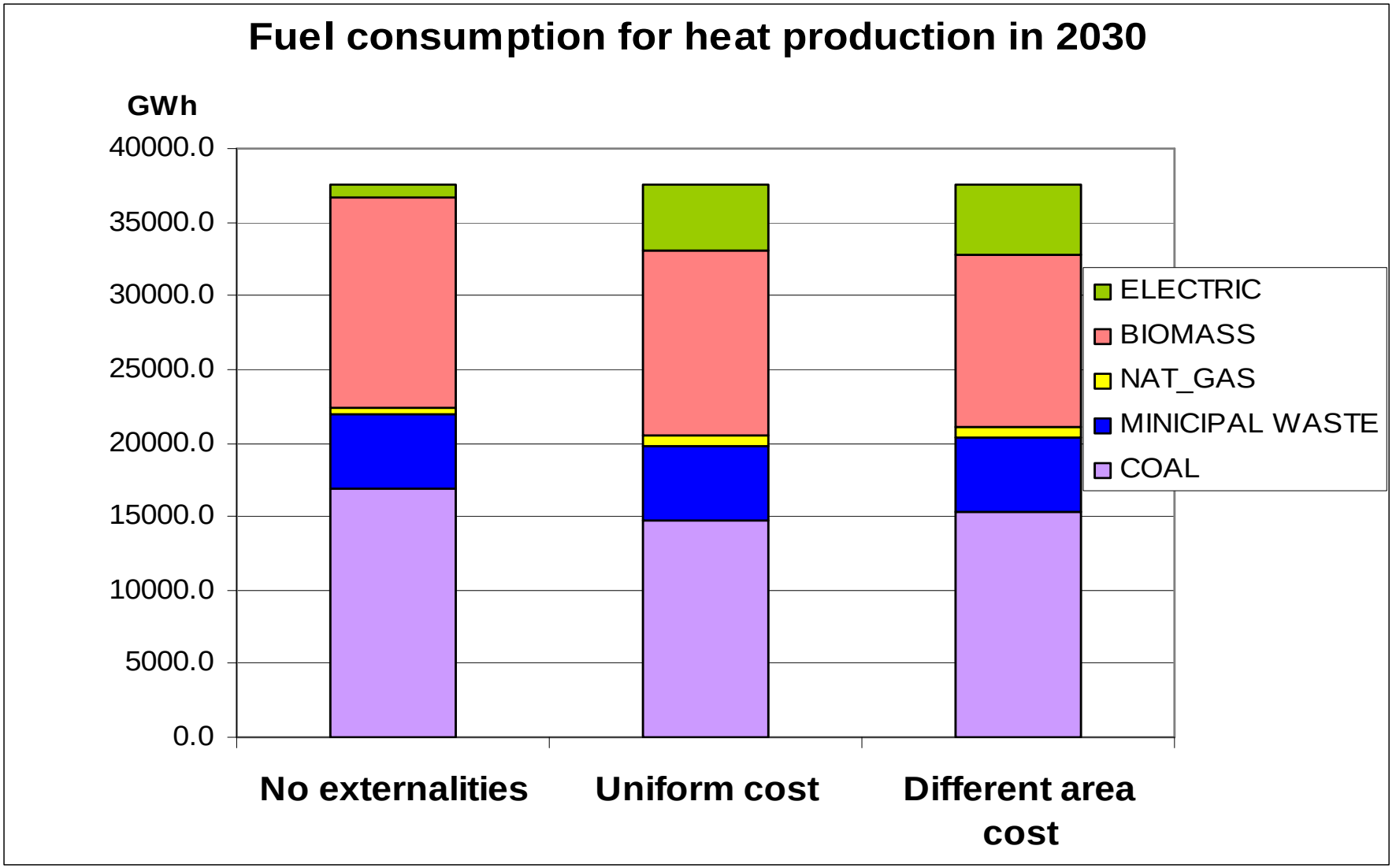


Results III – fuels used for heat production



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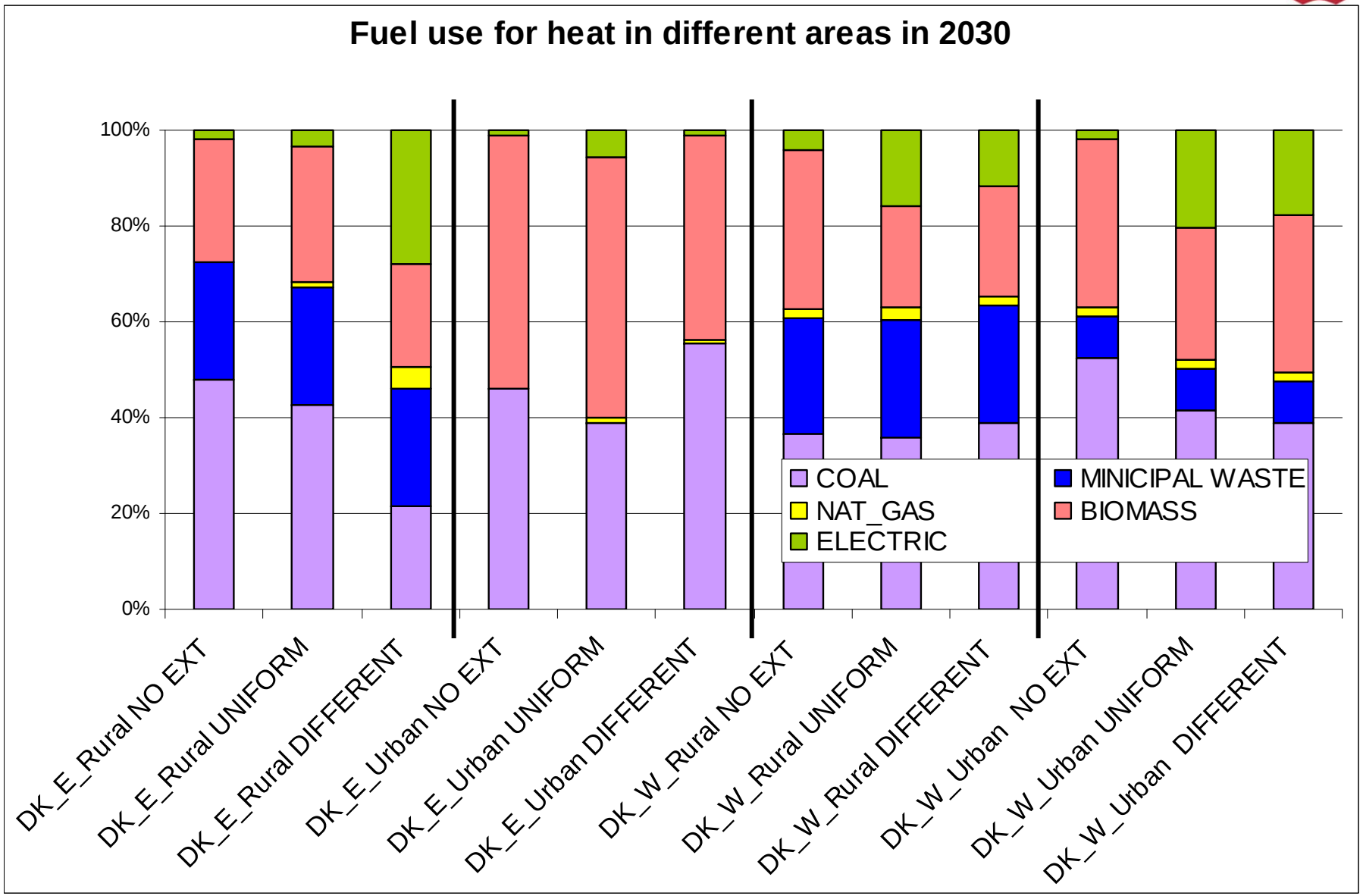
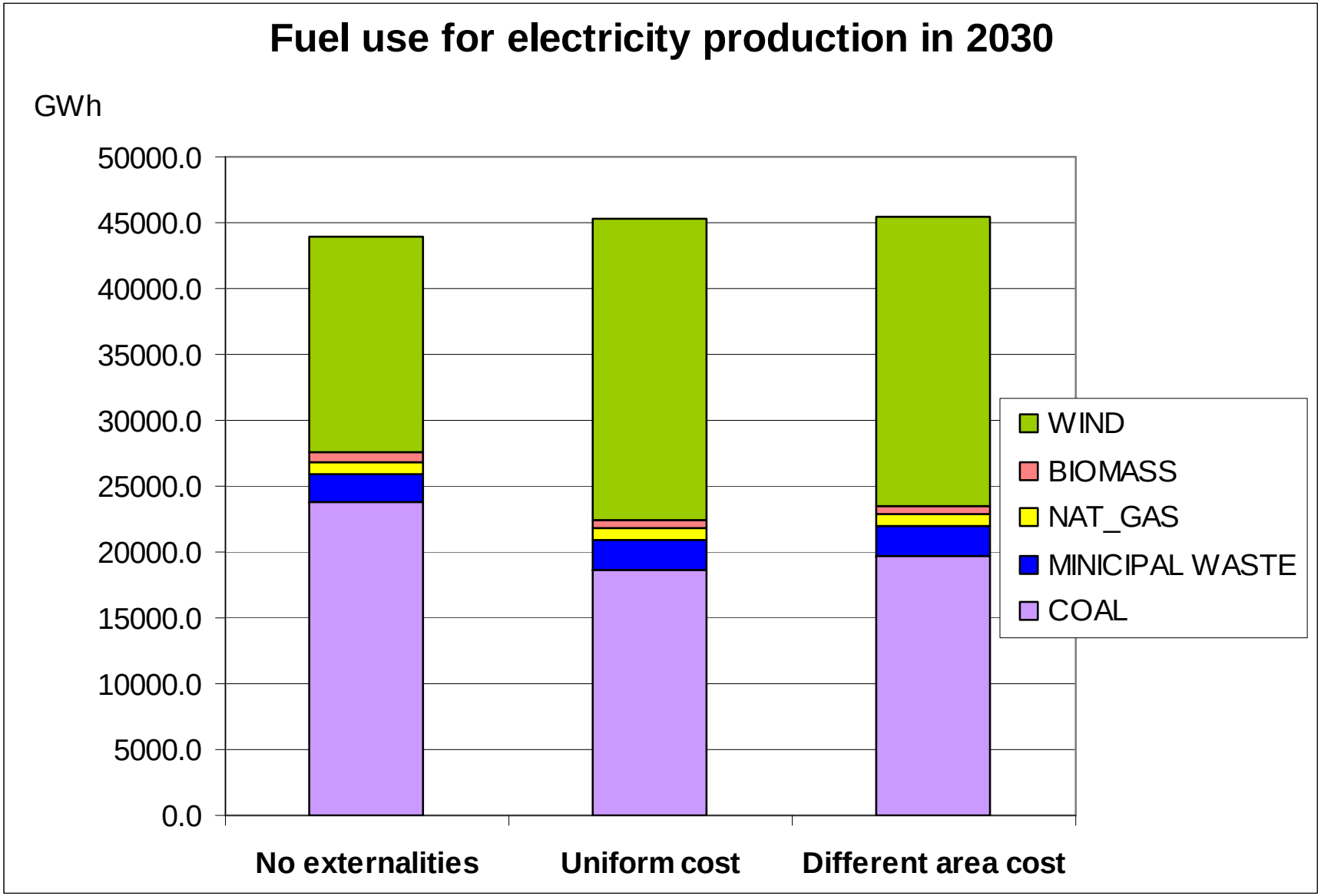


Results IV – fuels used for electricity production



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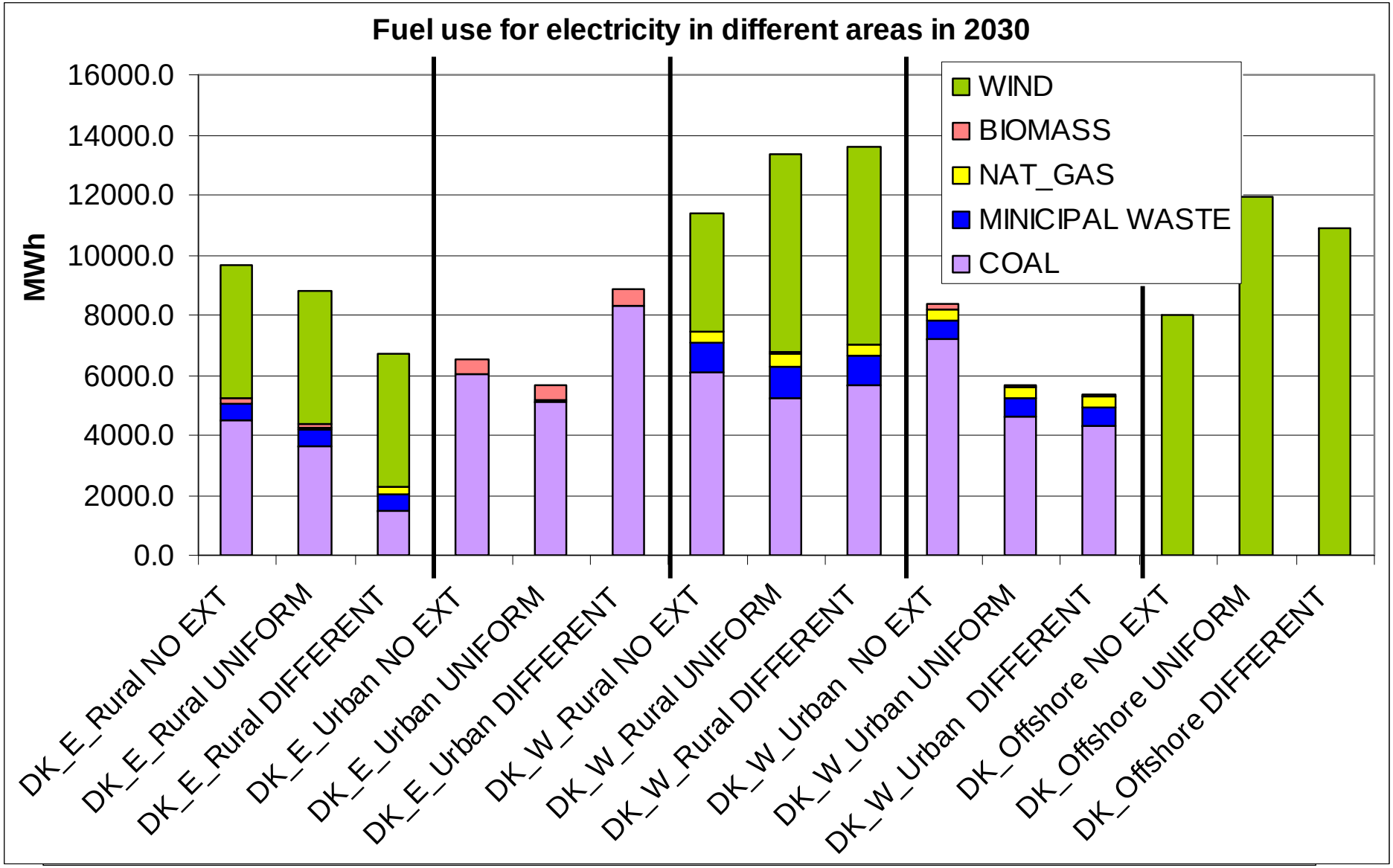
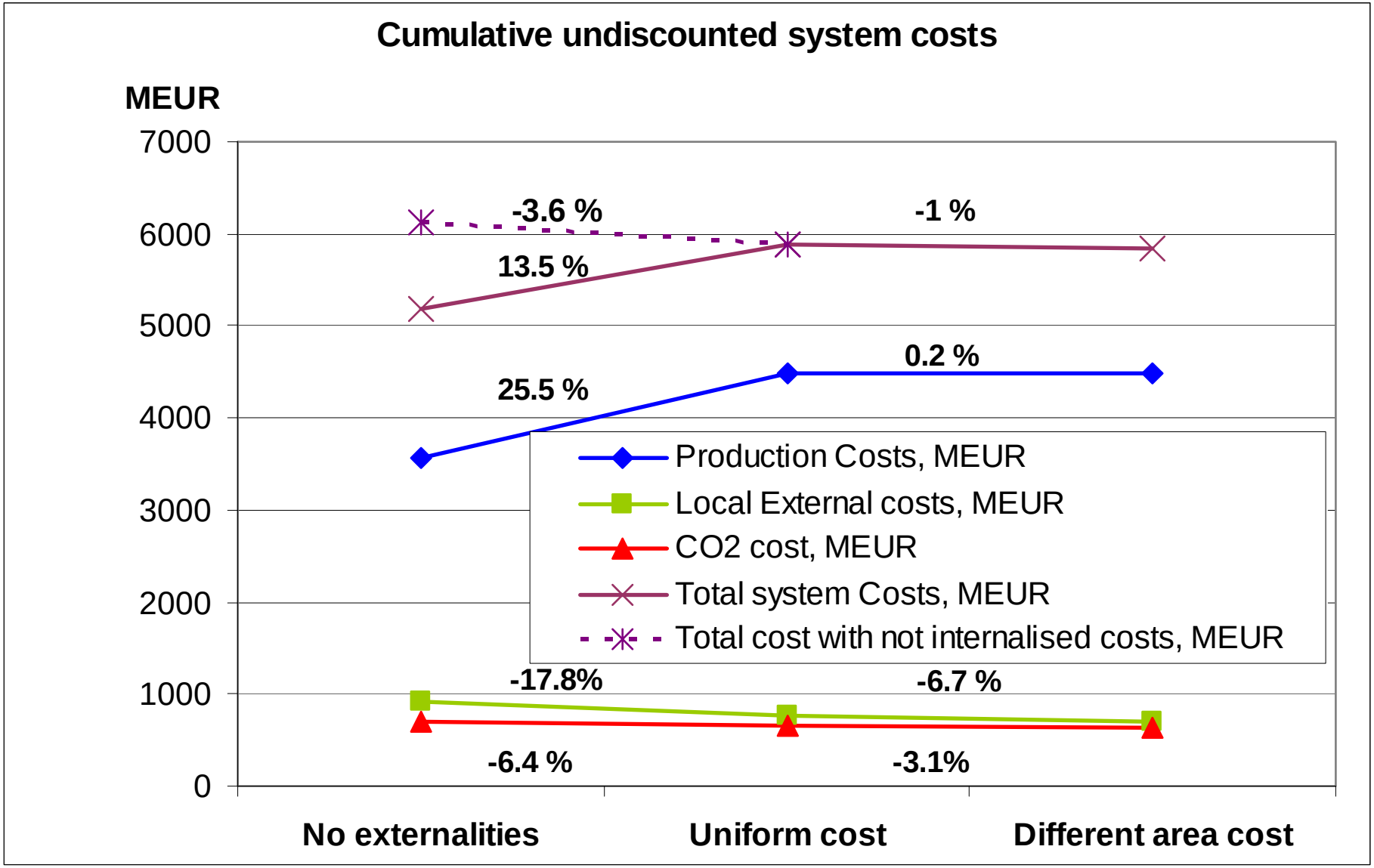


Results IV – System costs



Conclusions

- Internalising local externalities leads to around **18%** decrease in local external cost of the system

- Considering different local area costs leads to further reduction in local external cost by around **7%**

- Reflecting
  - Technology
  - Goals
  - Location

- Identify areas with different health costs of air pollution:
  - atmospheric pollution modelling
  - health impact assessment modelling

Thank you for attention!

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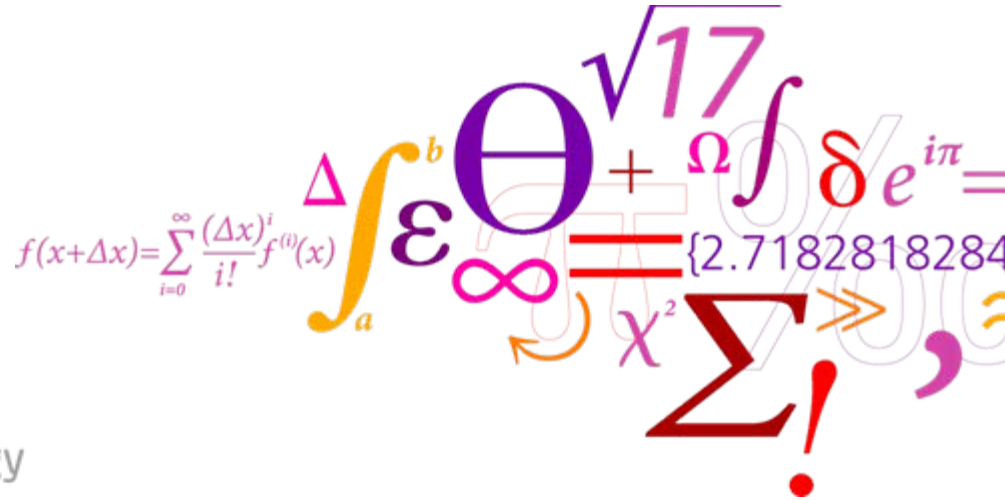
For more information visit www.ceeh.dk



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