

Technical University of Denmark



Optimal Investment Paths for the Danish Energy System in the CEEH Modelling System

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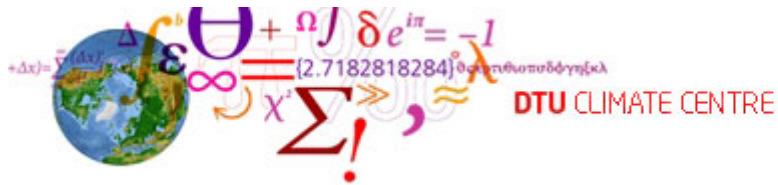
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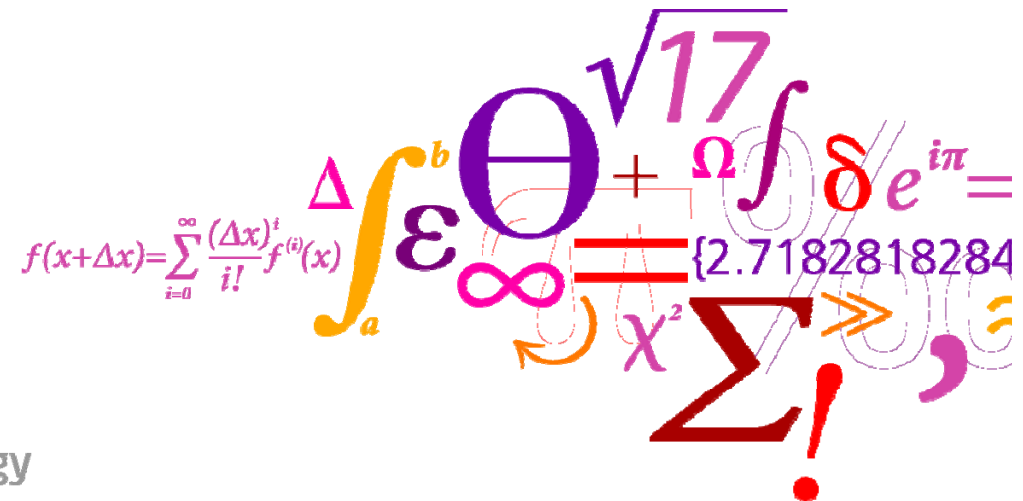
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Optimal Investment Paths for the Danish Energy System in the CEEH Modelling System

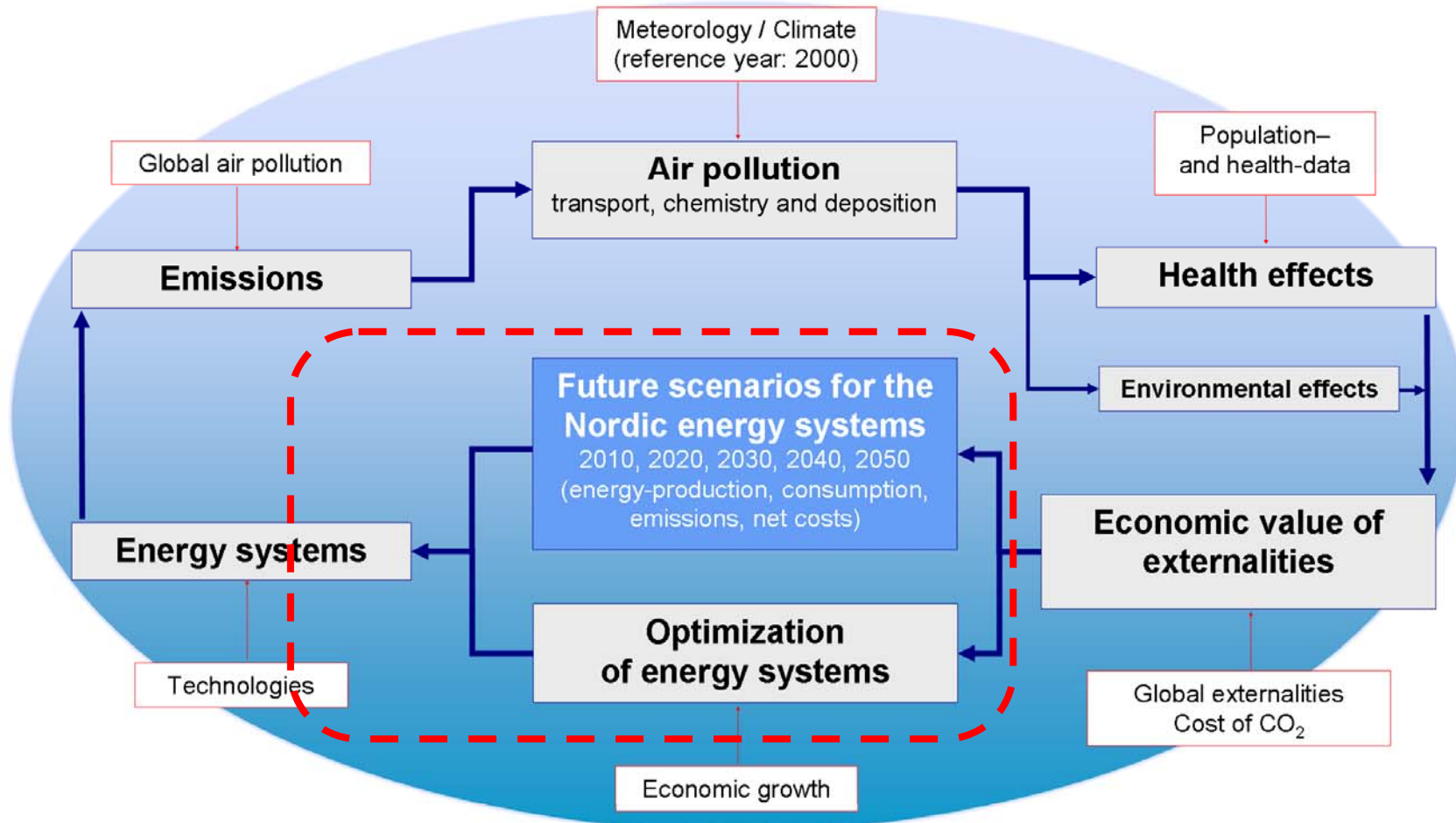
Kenneth B. Karlsson and Olexandr Balyk
 DTU Climate Centre, Risø DTU

International Conference on Energy, Environment and Health – Optimisation of Future Energy Systems
 June 2nd, 2010
 Copenhagen, Denmark

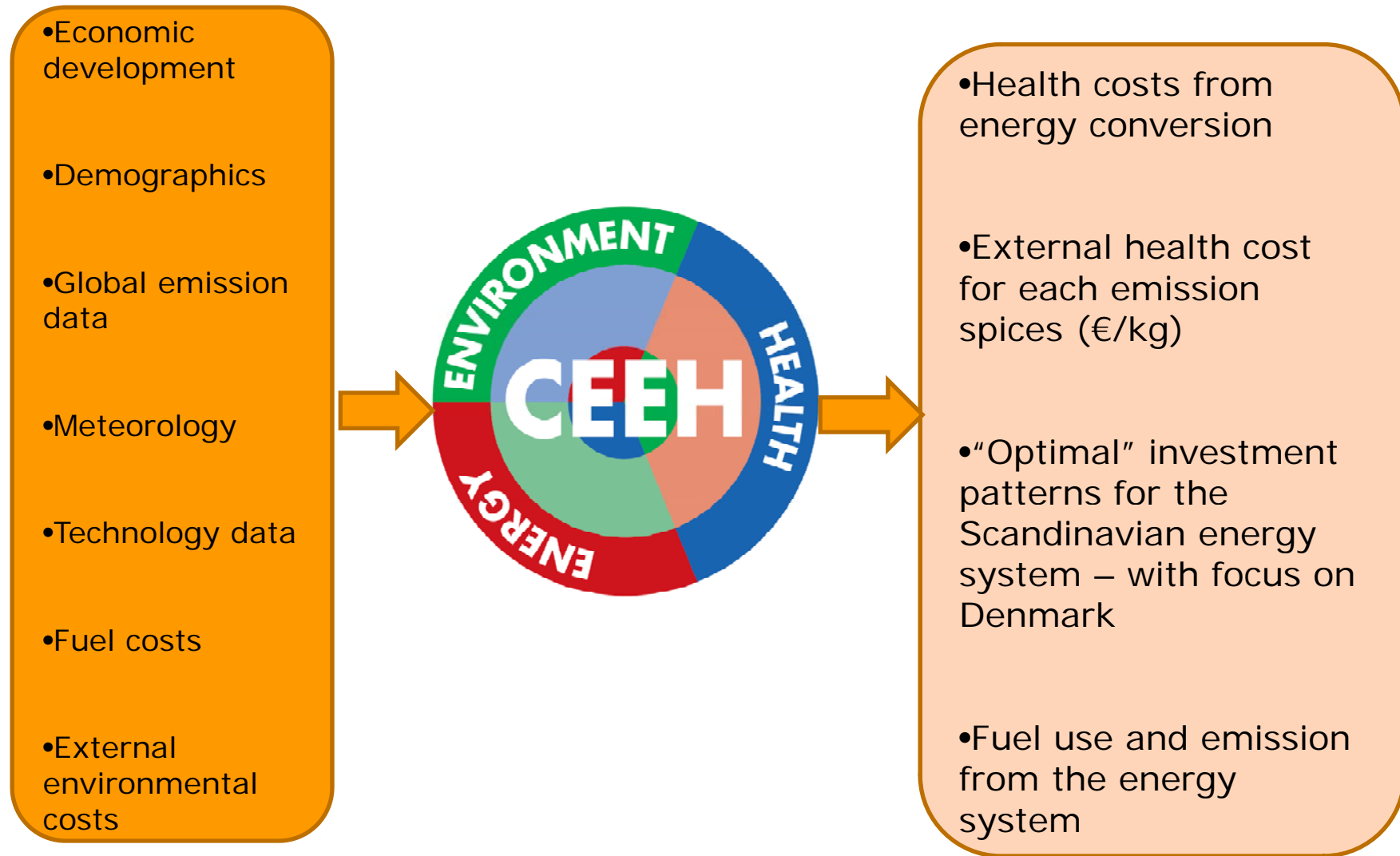


Risø DTU
 National Laboratory for Sustainable Energy

CEEH Modelling Framework

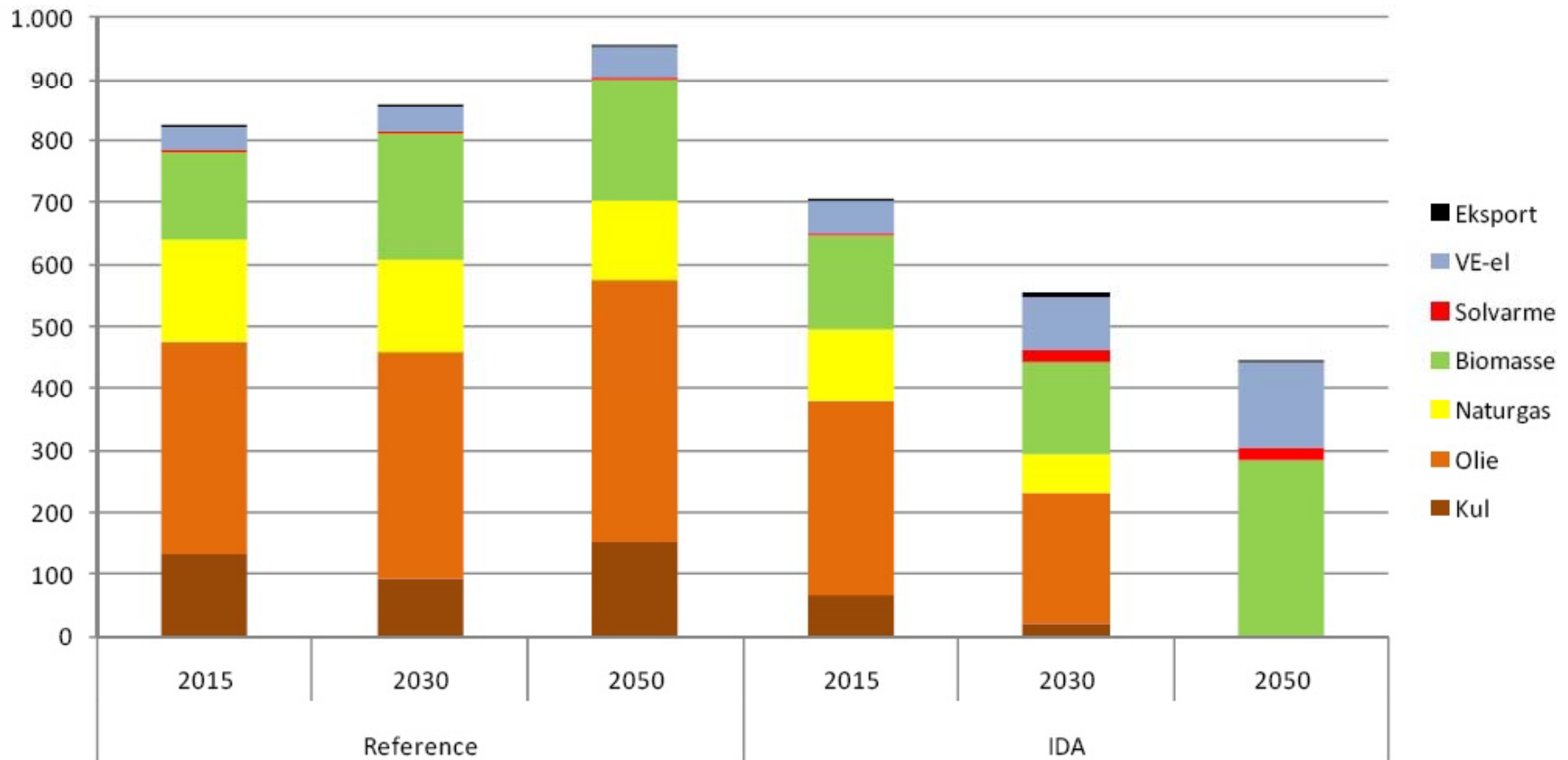


Input to the CEEH Machine and output



Use of CEEH results in IDA2050 plan – www.ida.dk

Primær energiforsyning i IDA 2015, IDA 2030 og IDA 2050, PJ



Use of CEEH results in IDA2050 plan – www.ida.dk

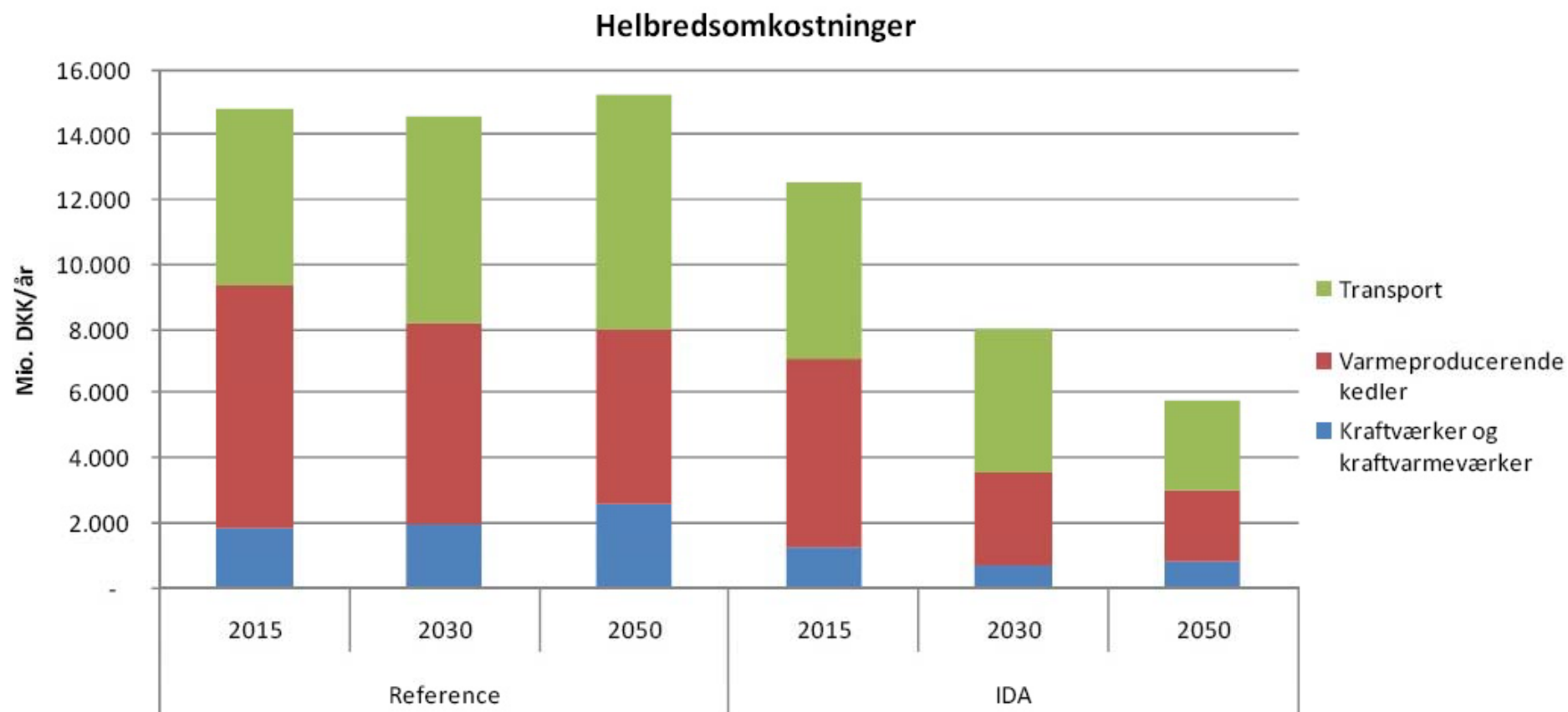
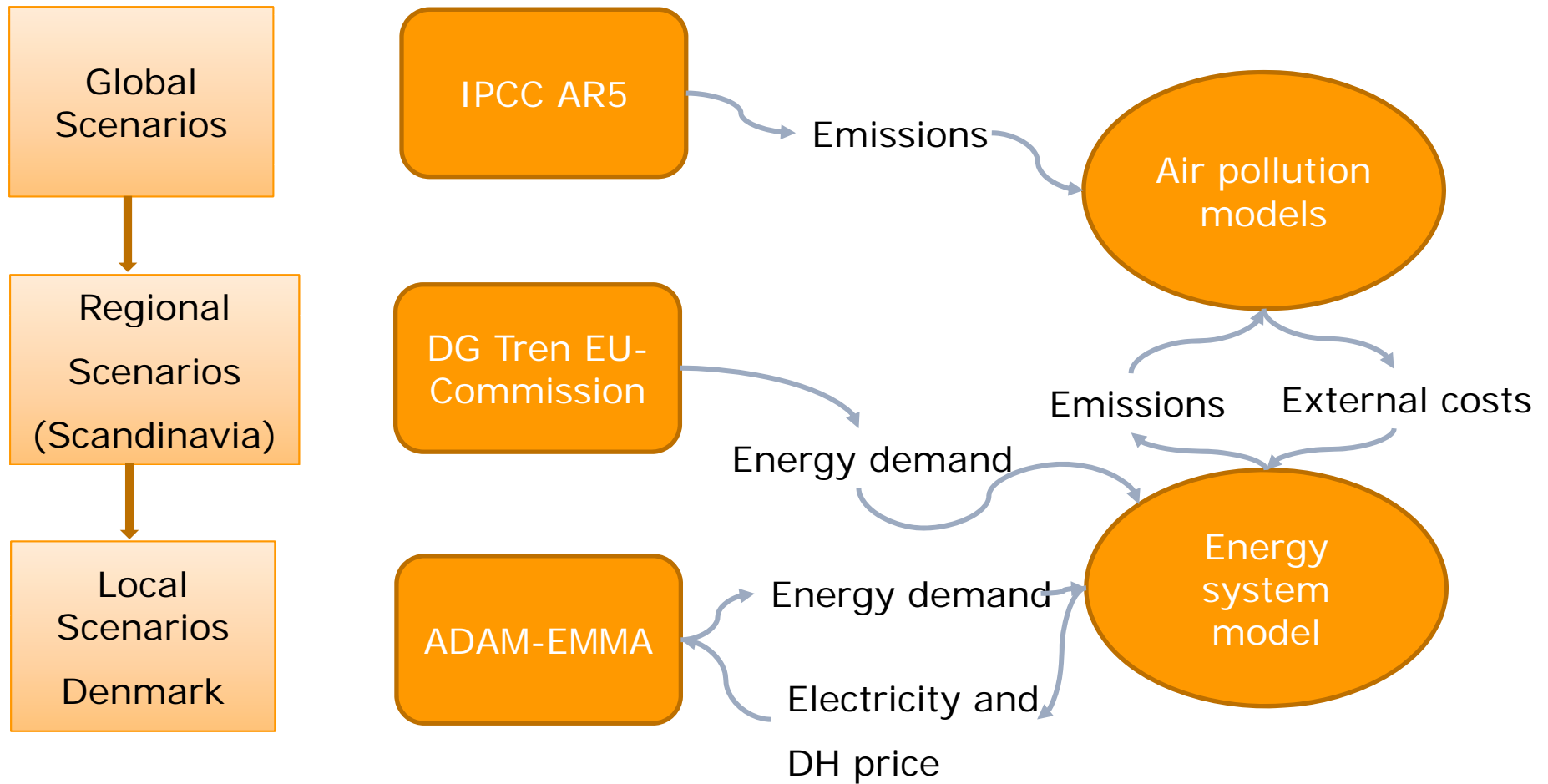


Fig. 31, Samlede helbredsomkostninger for energisystemerne fordelt på sektorer.

Scenarios at different levels

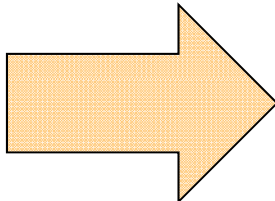


Electricity & DH prices

ADAM-EMMA

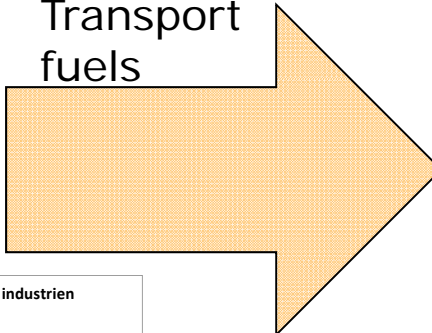
Macro economic projections

Energy services

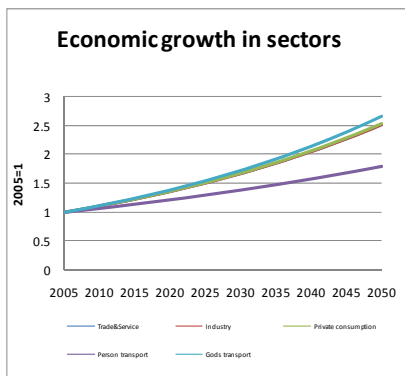
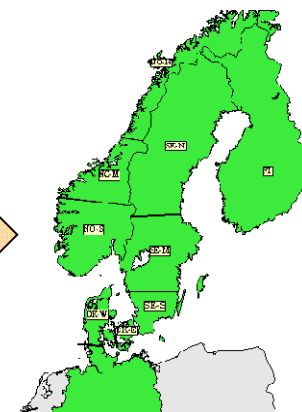


End-use energy
 Industry
 Service
 Households
 Transport

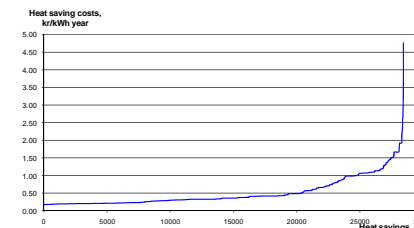
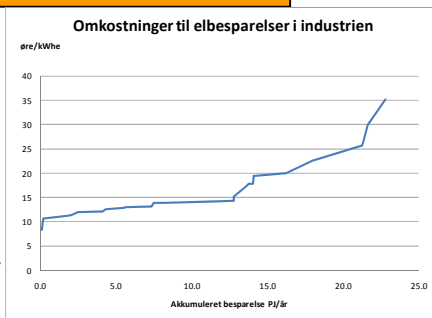
Electricity
 Heat demand
 Transport fuels



Balmorel

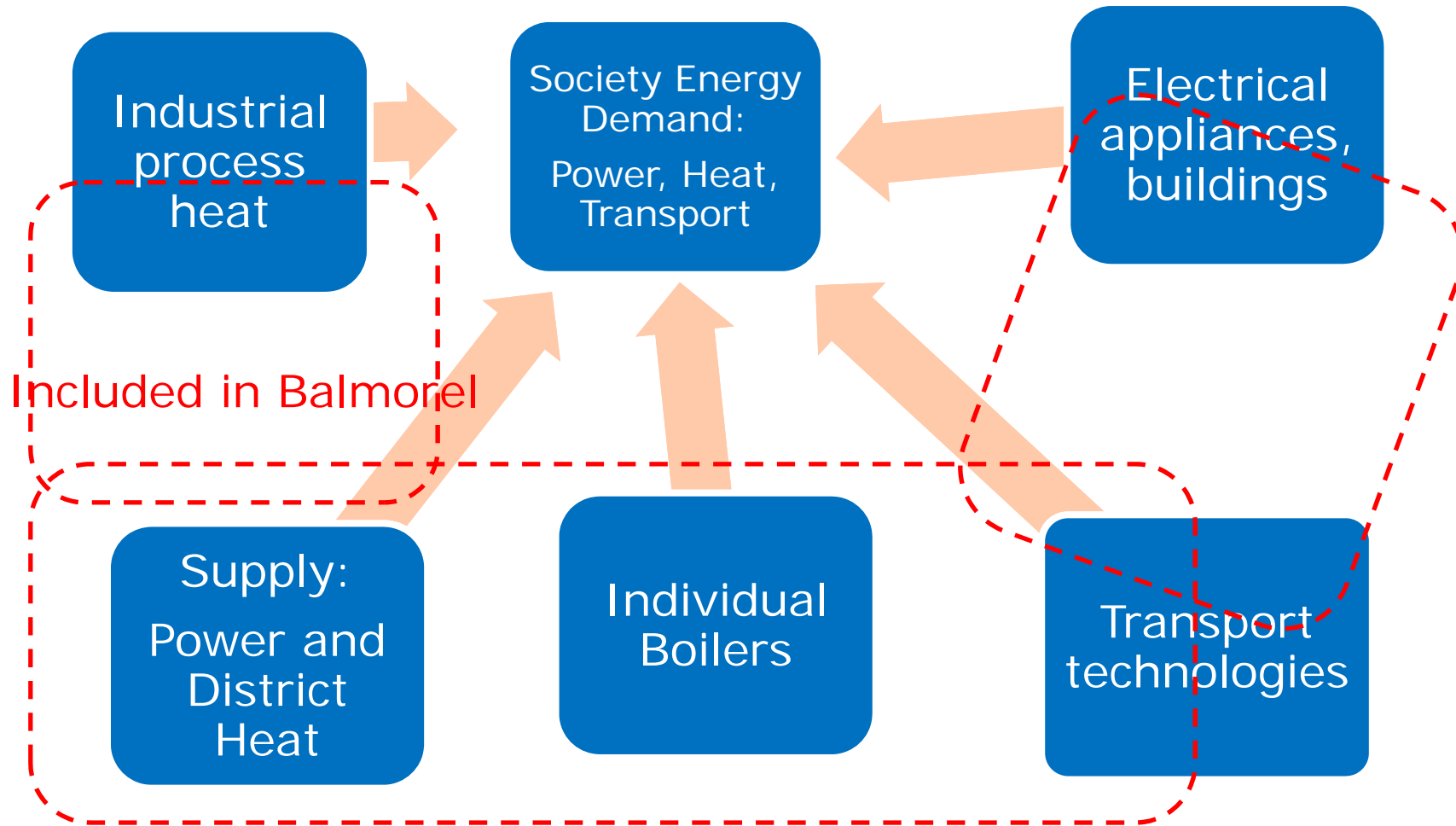


Efficiency improvements



Air emissions : CO₂, SO₂, NO_x, pm, CO

Energy System



Example of results from Balmorel

The impact of including health costs

- Comparing two scenarios with identical inputs except from the inclusion of health costs

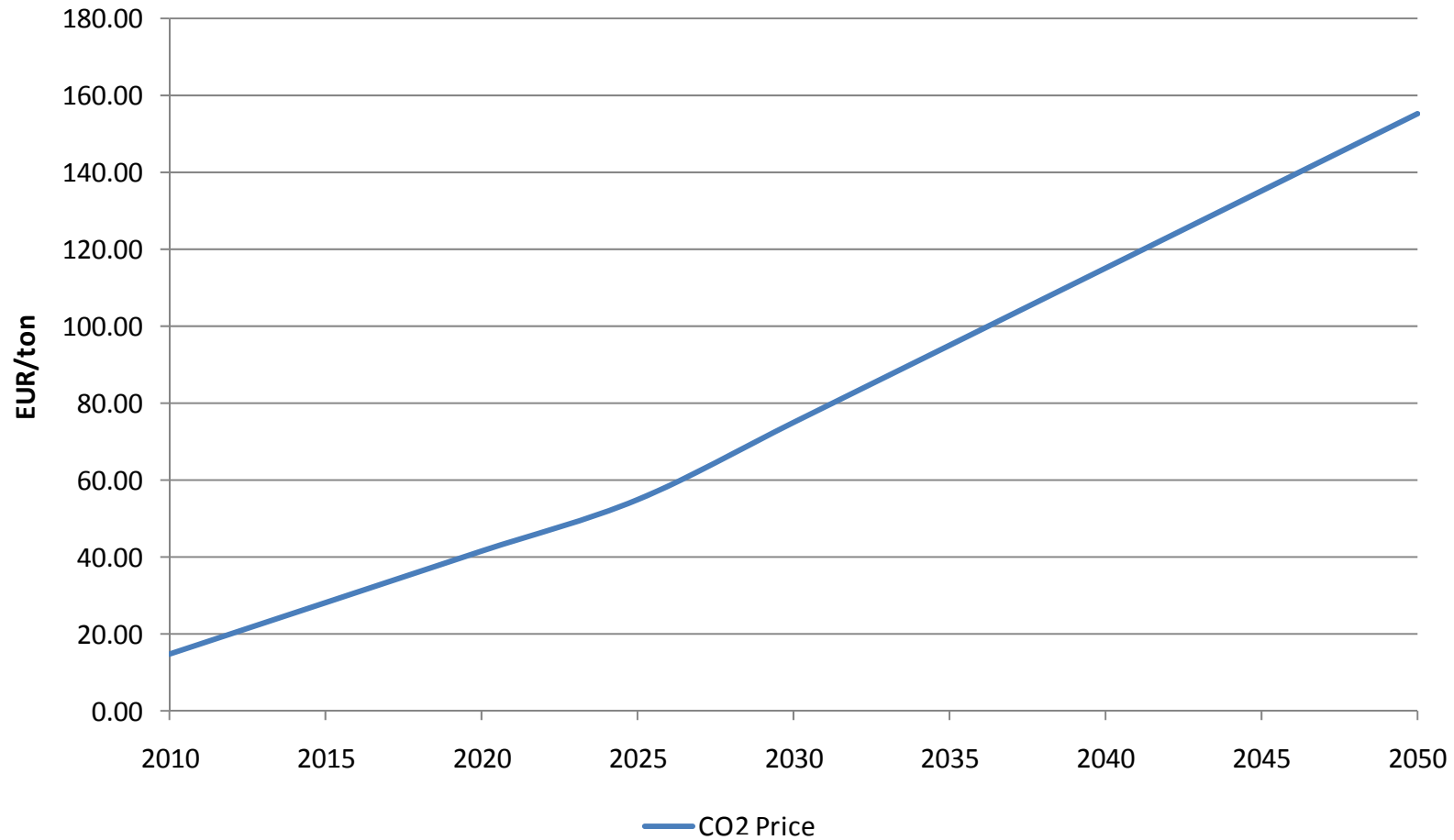
Policy-free scenarios

- "Base"-scenario includes health costs and
- "No-Health" do not include health costs

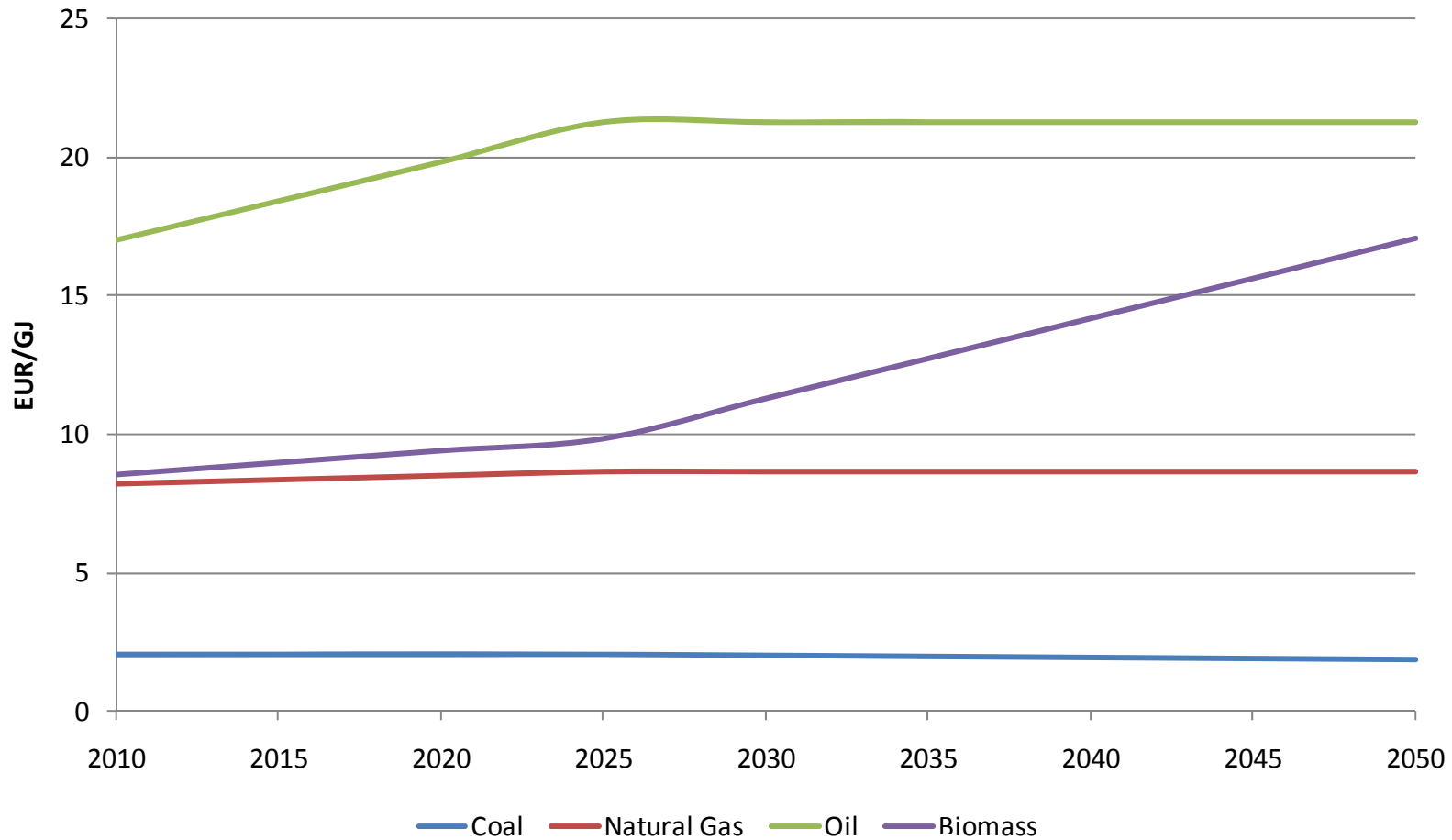
A full year in the simulation is currently represented by four weeks

The results are preliminary and still needs further investigation and interpretation !

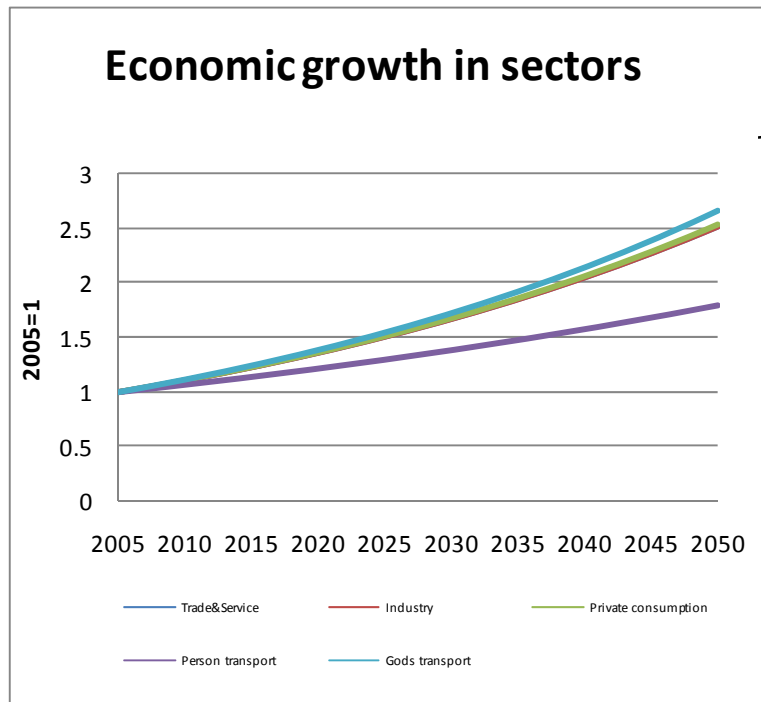
Assumptions I: CO2 Price Development



Assumptions II: Fuel Price Development



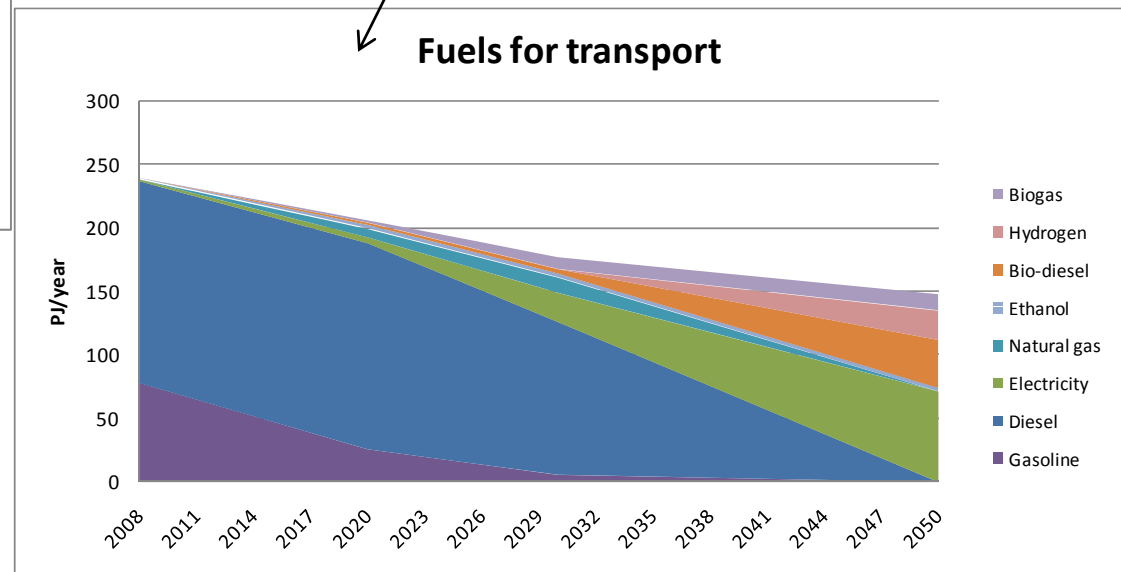
Demand inputs



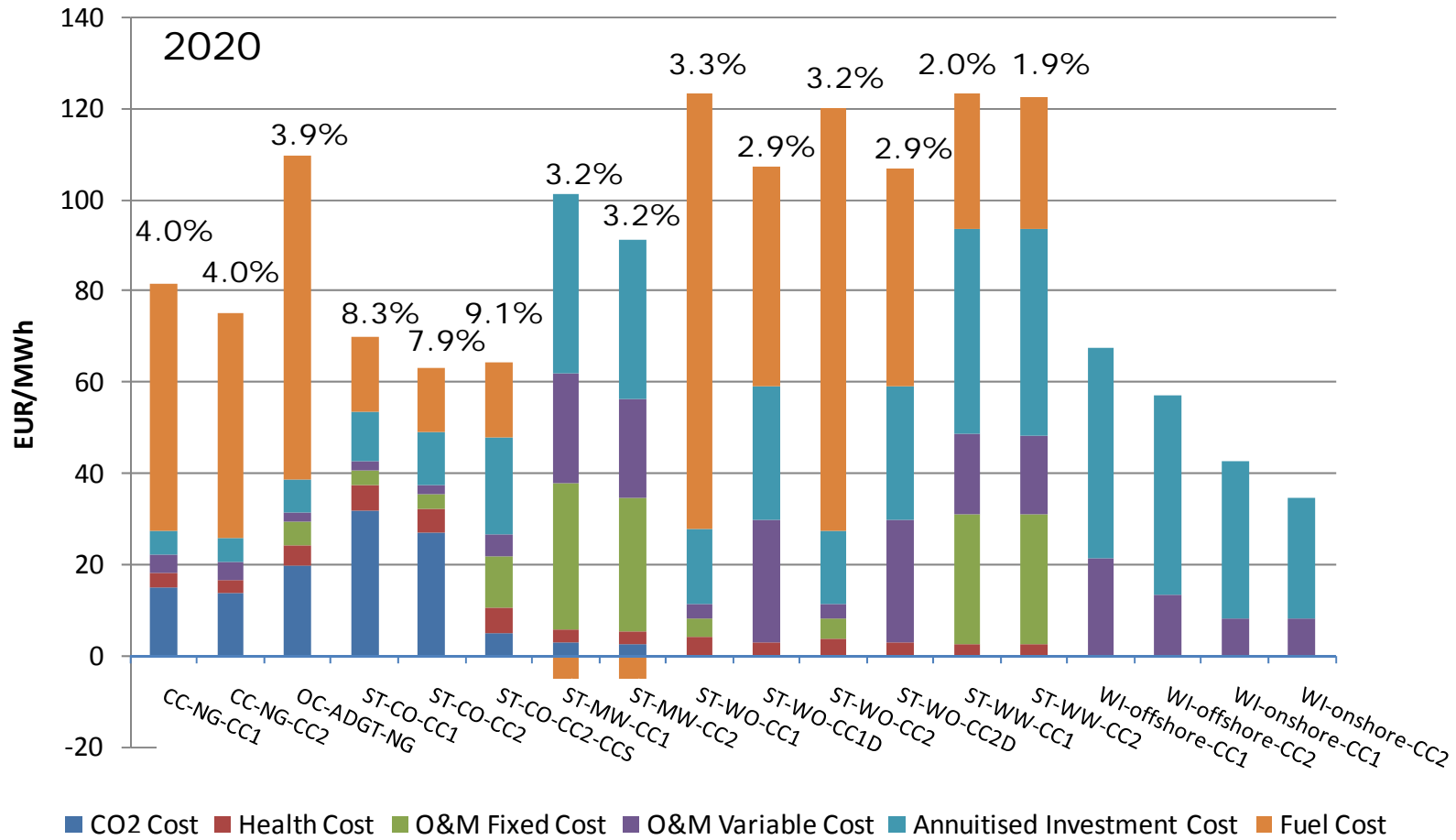
Electricity and heat demand in Denmark, Norway, Sweden, Finland and Germany

Include electricity savings in the input, but not heat savings.

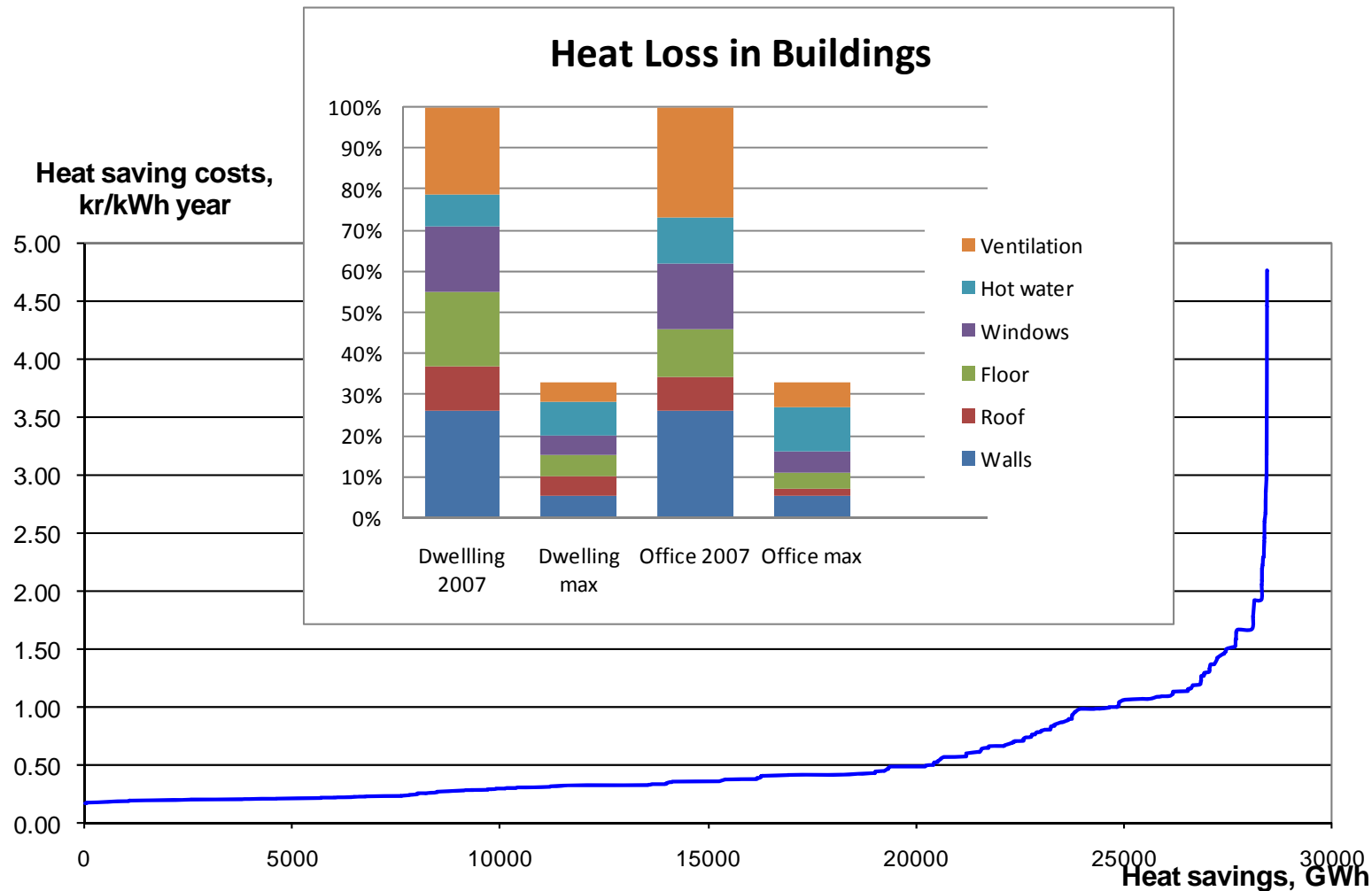
The transport fuel scenario is created exogenous



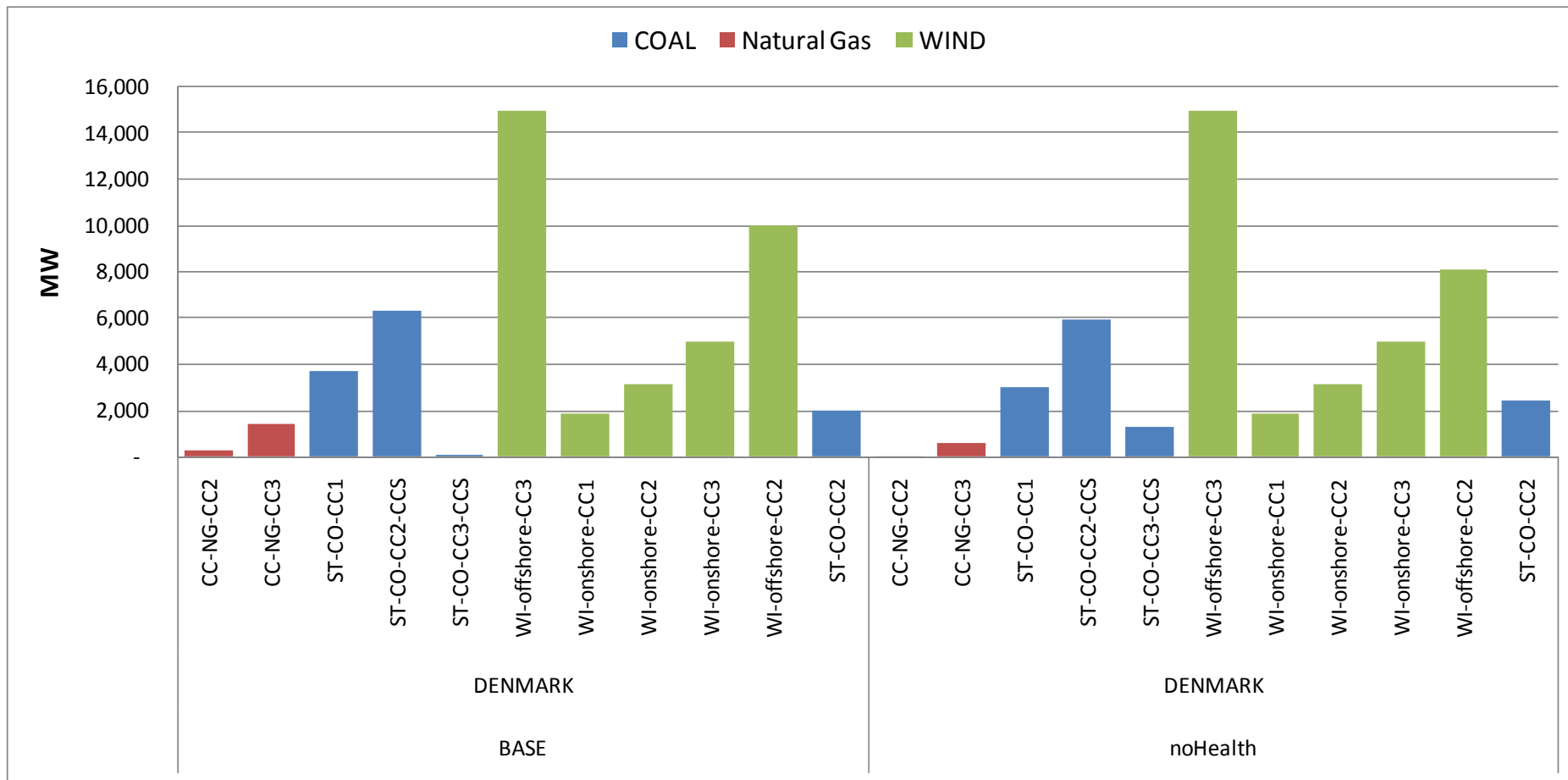
Technology Competitiveness: Electricity



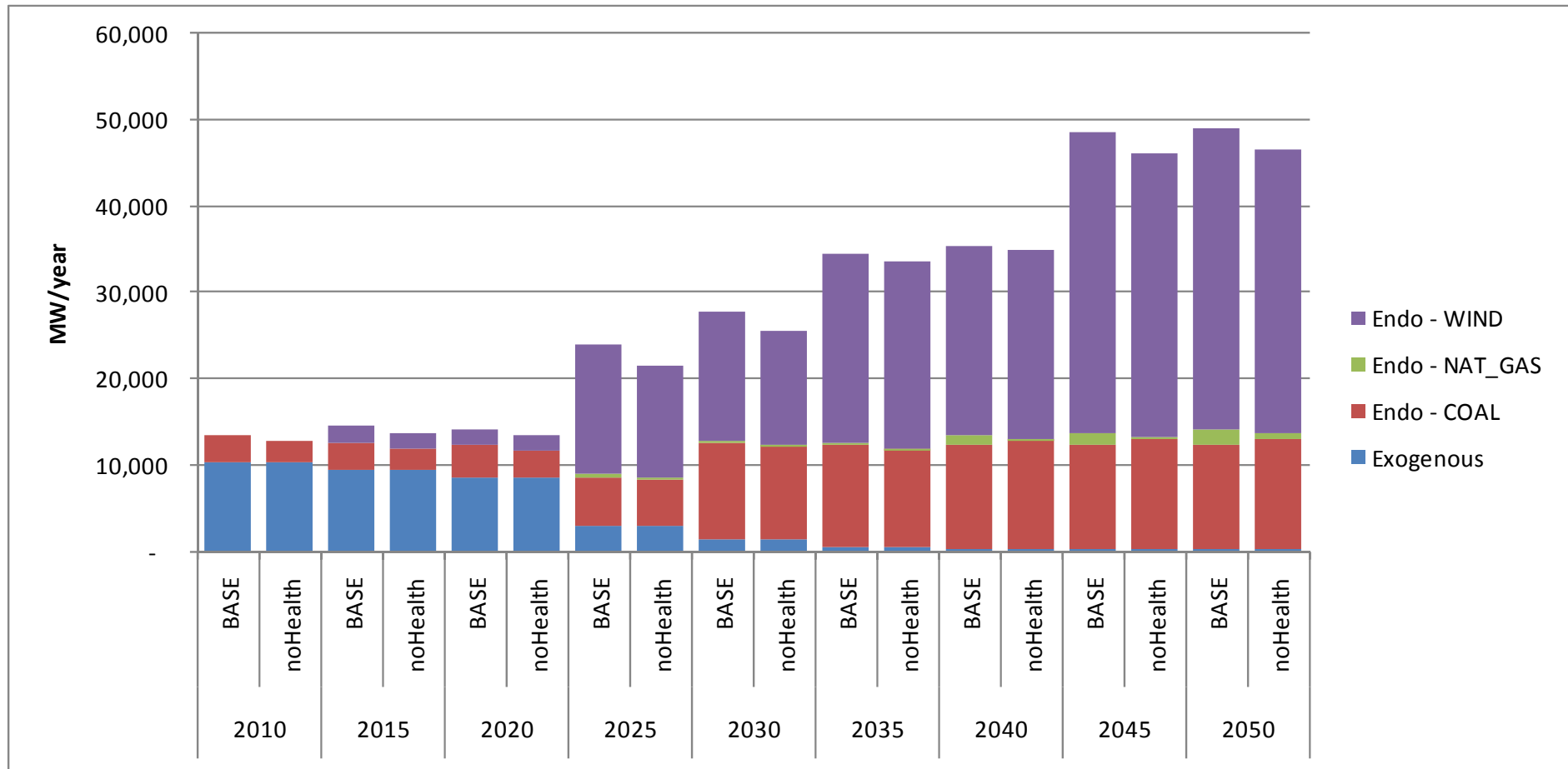
Heat saving potential (Ref.: Erika Zvingilaite, Risø DTU)



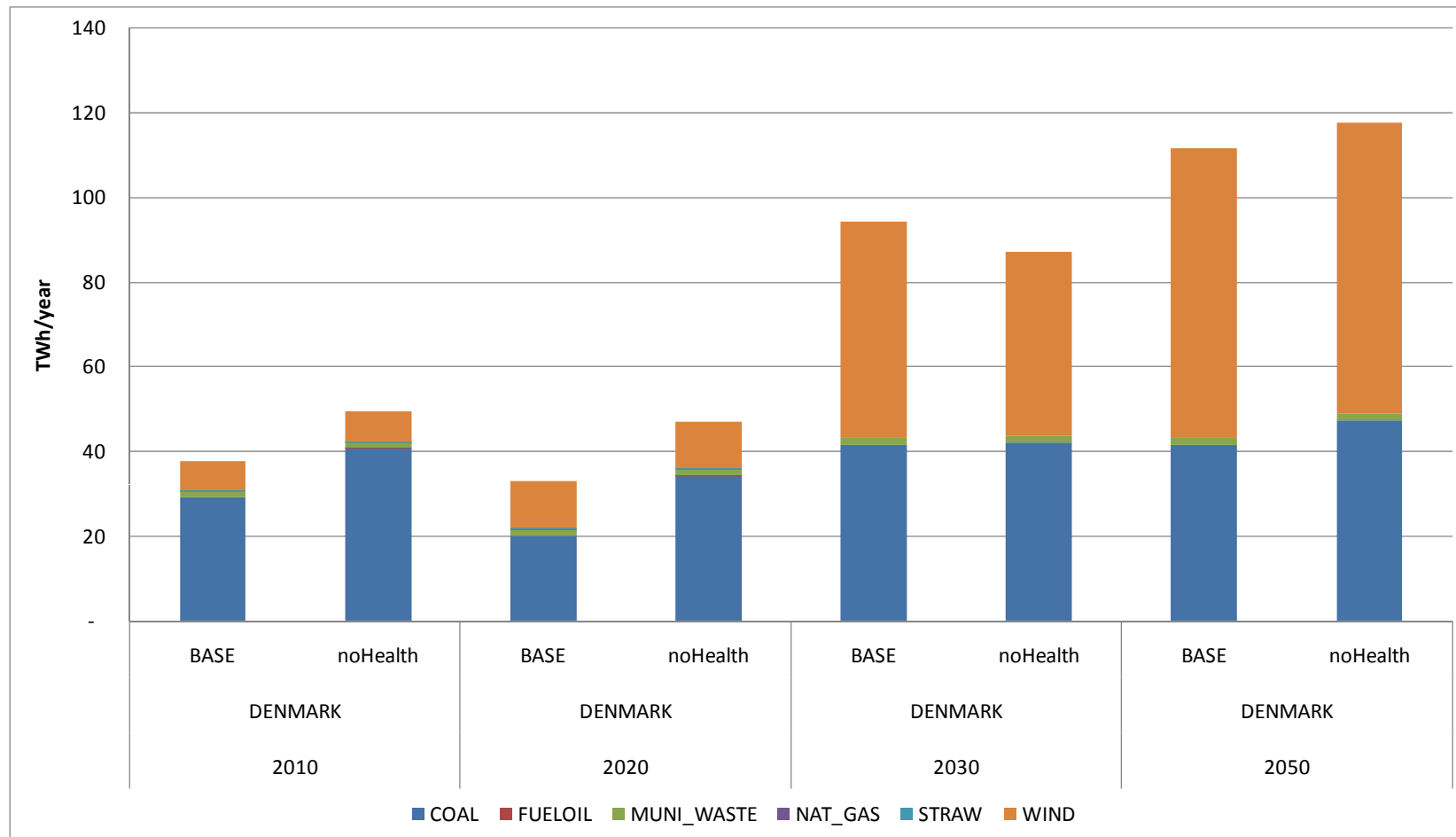
New power capacity in Denmark until 2050



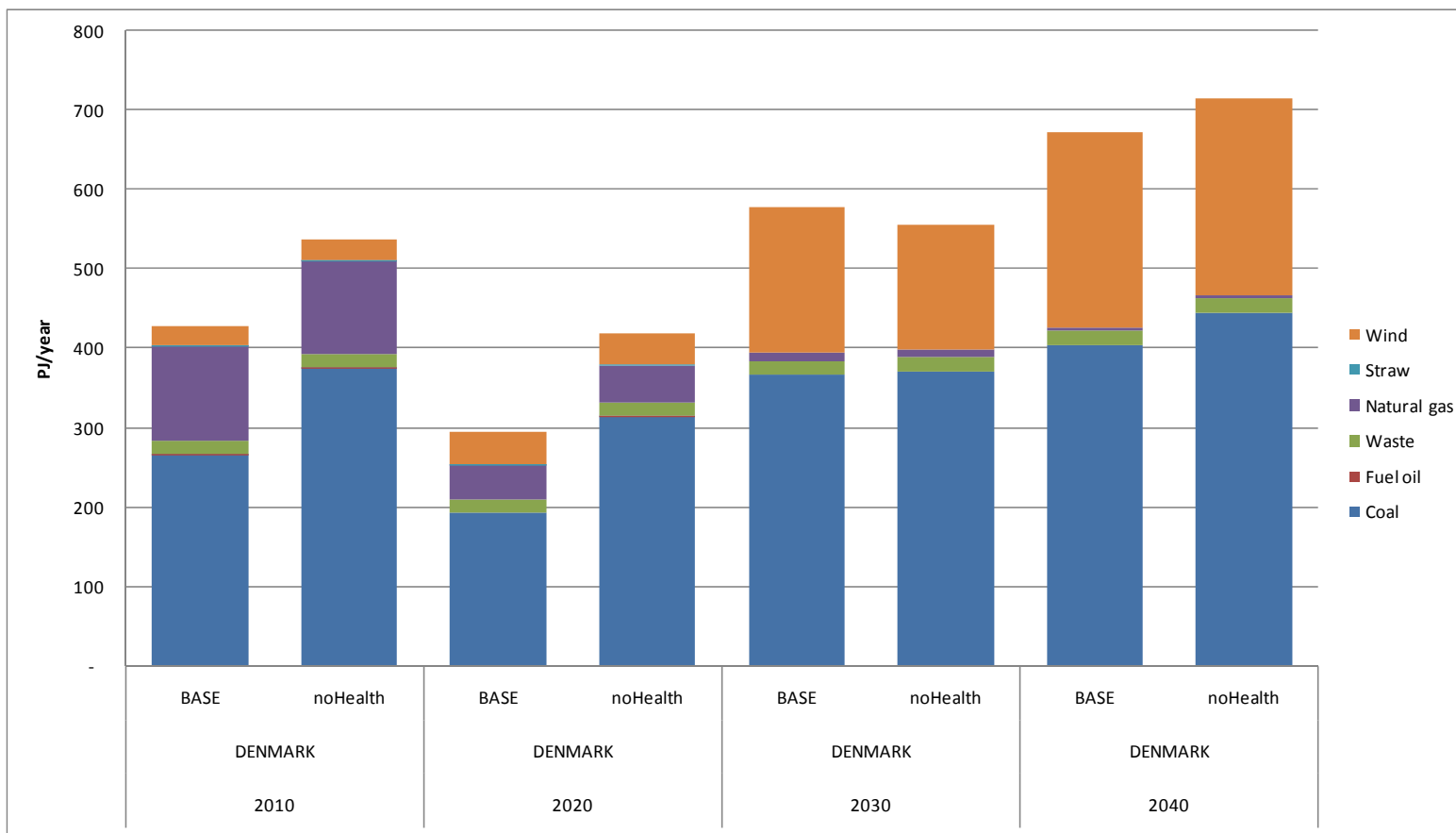
Power capacity in Denmark



Electricity production in Denmark

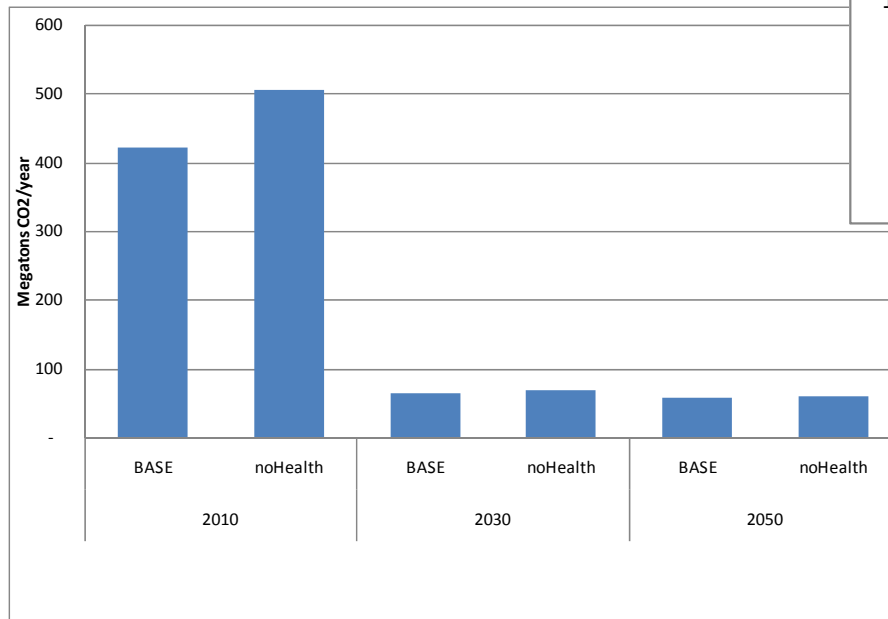


Total fuel consumption in the power sector in Denmark

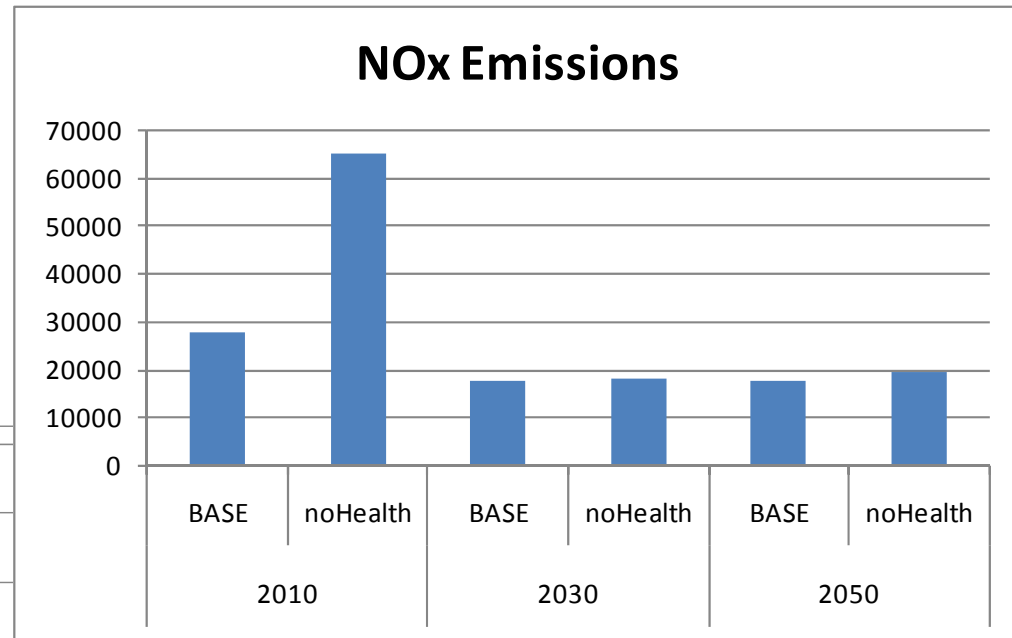


Emissions

CO2 emissions

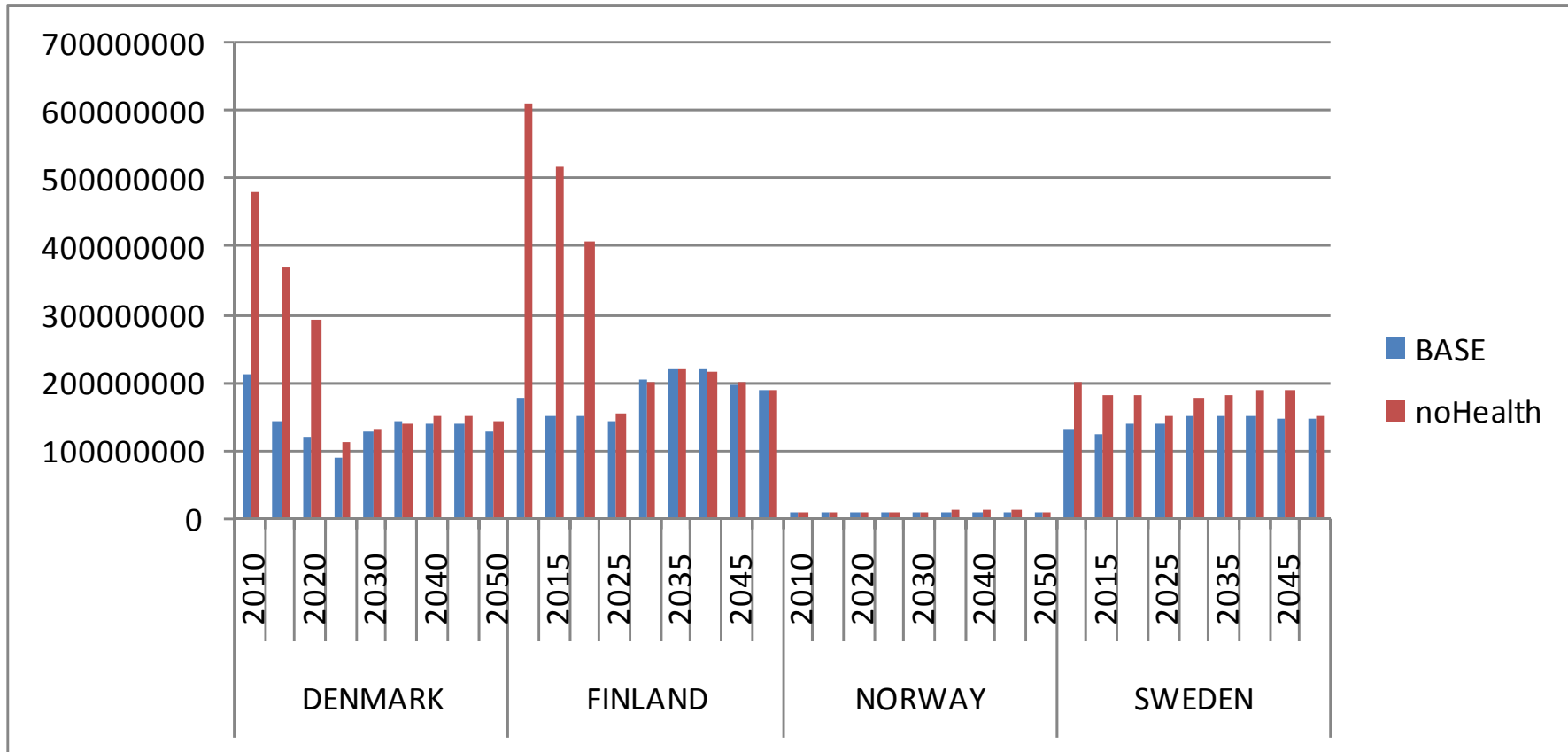


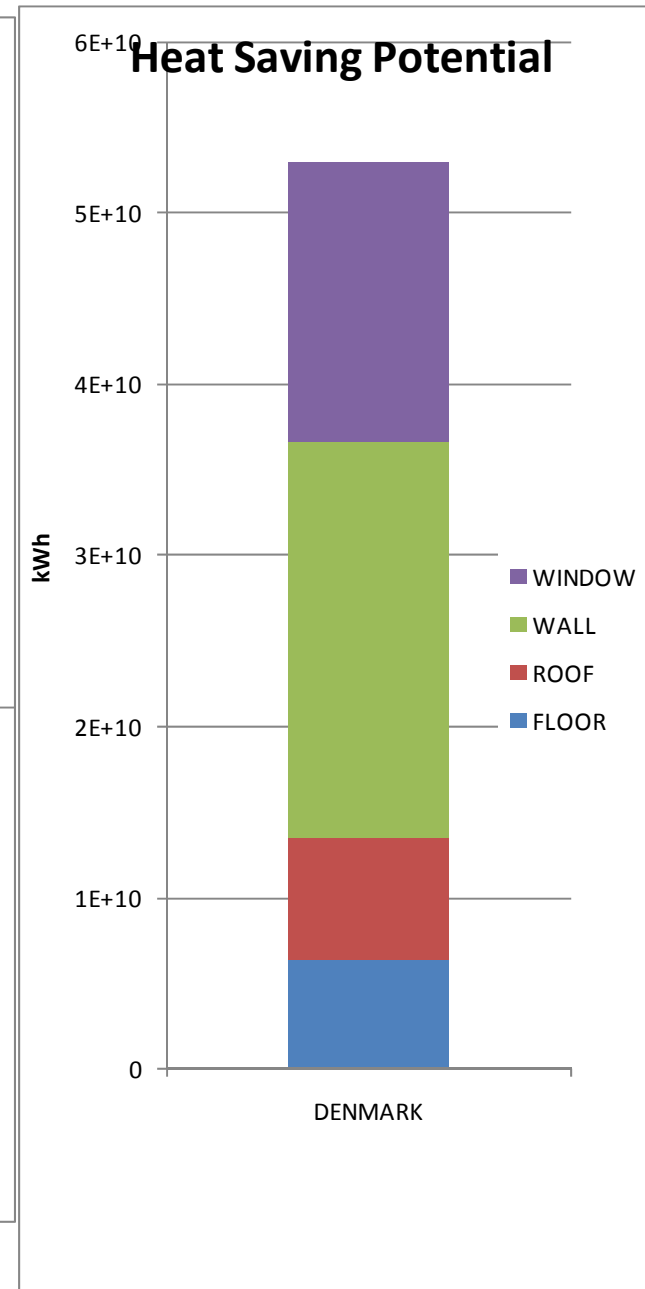
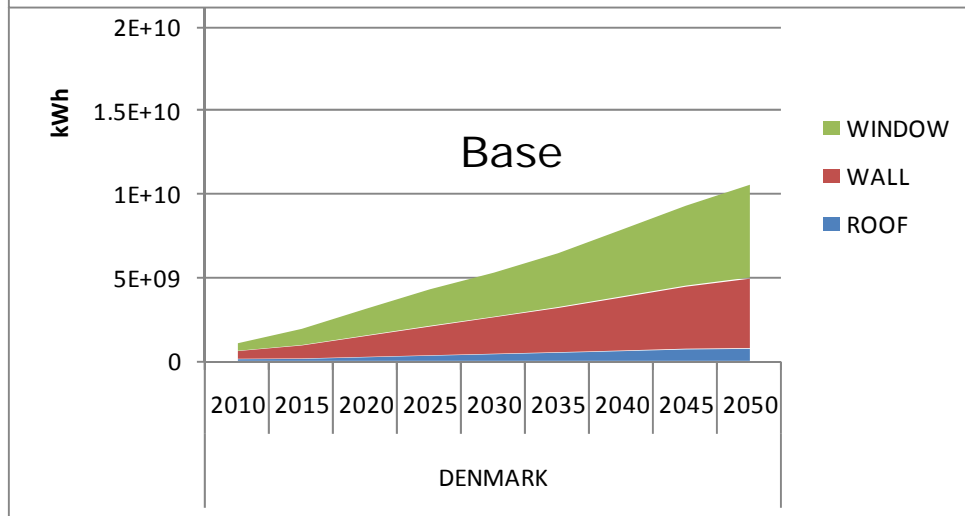
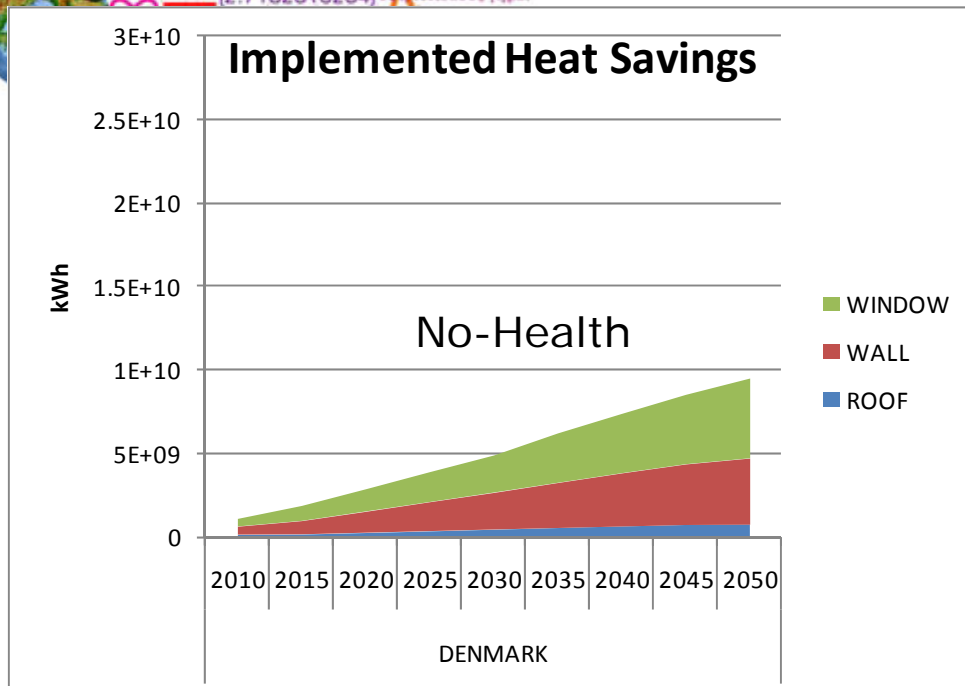
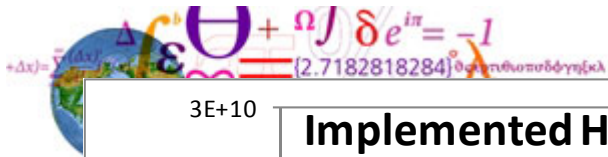
NOx Emissions



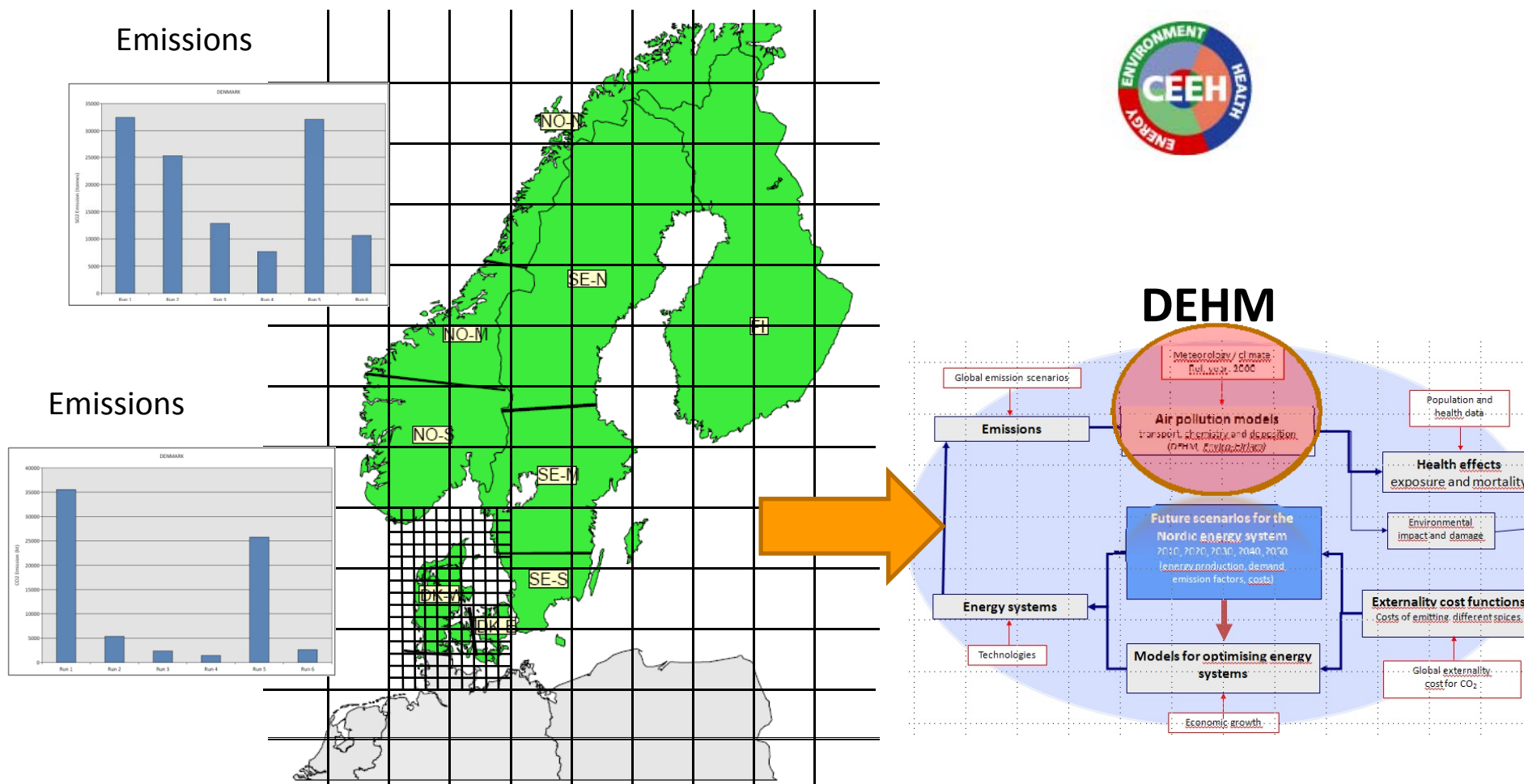
Health costs of Nox emissions

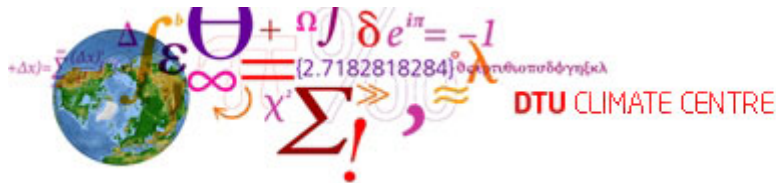
Mio. €/year





Returning revised emissions to the air emission model





**THANK YOU FOR YOUR ATTENTION
AND AN INTERESTING CONFERENCE!**



Centre of Energy,
Environment
and Health

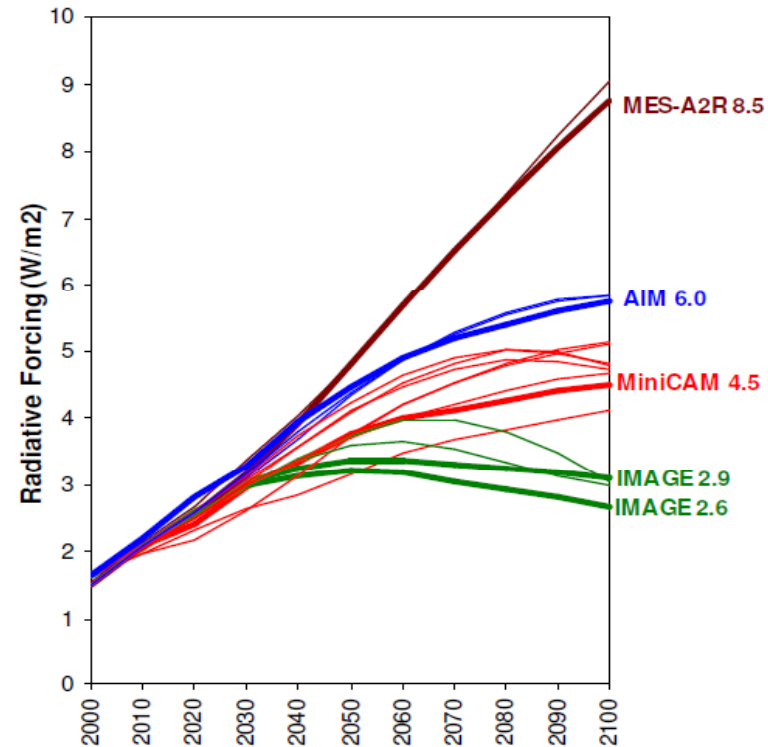
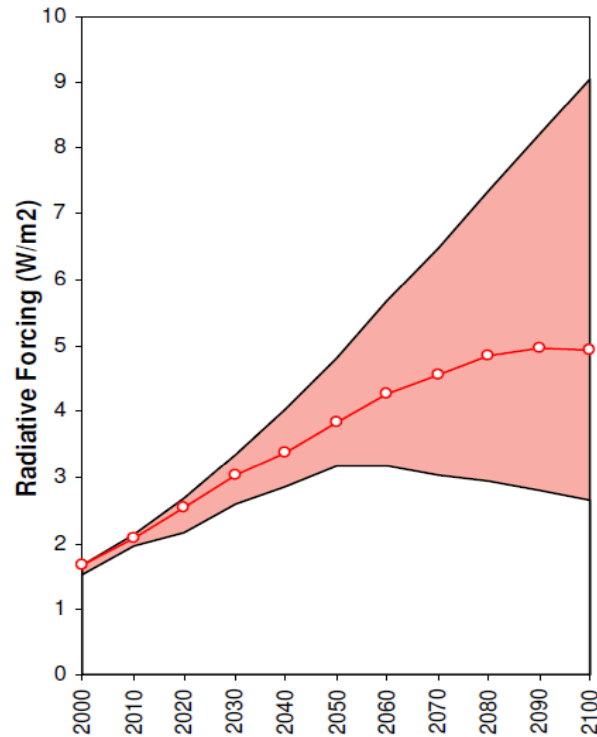
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DTU Climate Centre:

<http://www.dtu.dk/centre/klimacenter/english>

Four RCP IPCC Scenarios



Name	Radiative Forcing	Concentration	Pathways Shape
RCP8.5	8.5W/m ² (in 2100)	<= ~1370 CO ₂ -eq	Rising
RCP6.0	~6.0W/m ² (stabilization after 2100)	~850 CO ₂ -eq	Stabilization without overshoot
RCP4.5	~4.5W/m ² (stabilization after 2100)	~650 CO ₂ -eq	Stabilization without overshoot
RCP3-PD	< 3W/m ² (peak and decline) ⇒ 2.6W/m ²	< ~490 CO ₂ -eq	Peak & decline