

The background features a hand-drawn illustration in light blue and green tones. It includes a wind turbine, a battery with a lightning bolt symbol, a solar panel, a water tap with a bucket, a green car, a factory, and various pipes and wires connecting these elements, suggesting a complex energy and environmental system.

THE COST OF GREEN TRANSITION IS NOTHING COMPARED TO OUR HEALTH AND ENVIRONMENTAL COSTS

A study on Danish environmental effects, by Energy Modelling Lab ApS (EML), Aarhus University (AU), Aalborg University hospital (AAU) and Copenhagen University (CU)

Mikkel Bosack Simonsen

WHY EVEN LOOK INTO HEALTH
IMPACTS FROM AIR POLLUTION?

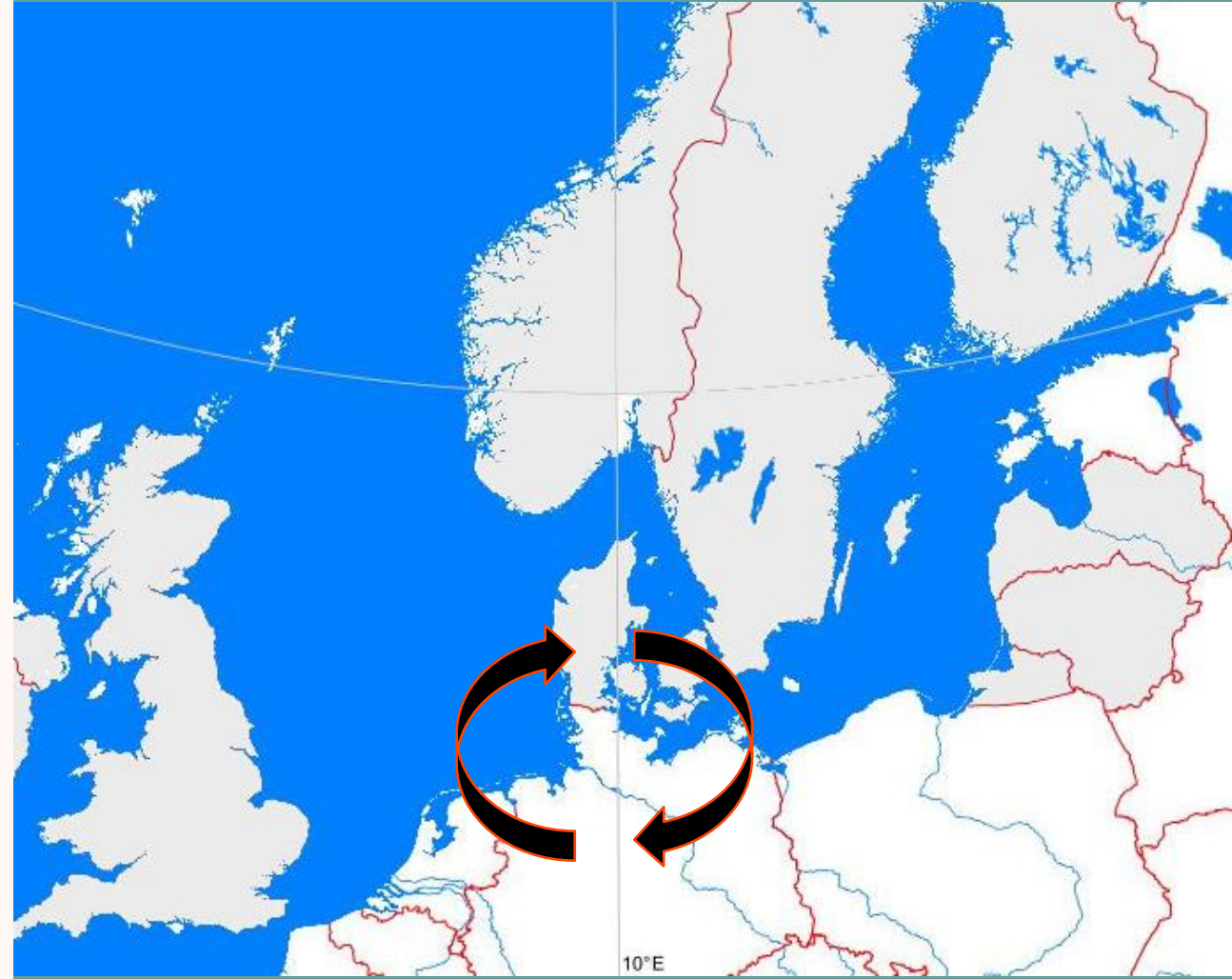


EMISSIONS KNOWS NO BOUNDARIES

Only 30 % of health costs in Denmark relates to Danish emissions

20 billion DKK annually from Danish emissions

Navigation in the North sea and Baltic sea is estimated to have a socioeconomic cost of more than 1000 bill DKK every year



BACKGROUND FOR LINKING AIR POLLUTION AND ENERGY SYSTEM MODELS

- The team who has developed the linking of air pollution modelling and energy system modelling to include health impacts in the evaluation of future scenarios is originally from the CEEH project - Centre for Energy, Environment and Health headed by Prof. Eigil Kaas, KU
- Development of the method for linking was mainly done by Prof. Jørgen Brandt, Aarhus University and PhD Kenneth Karlsson now EML and IVL (formally DTU)
- In the recent EU H2020 project REEEM – a similarly linking was done including the same Danish teams
- Based on this methodology a couple of “real world” analysis has been carried out: “Klimakommissionen.....” + Notat I “Husk Helbredomkostningerne”

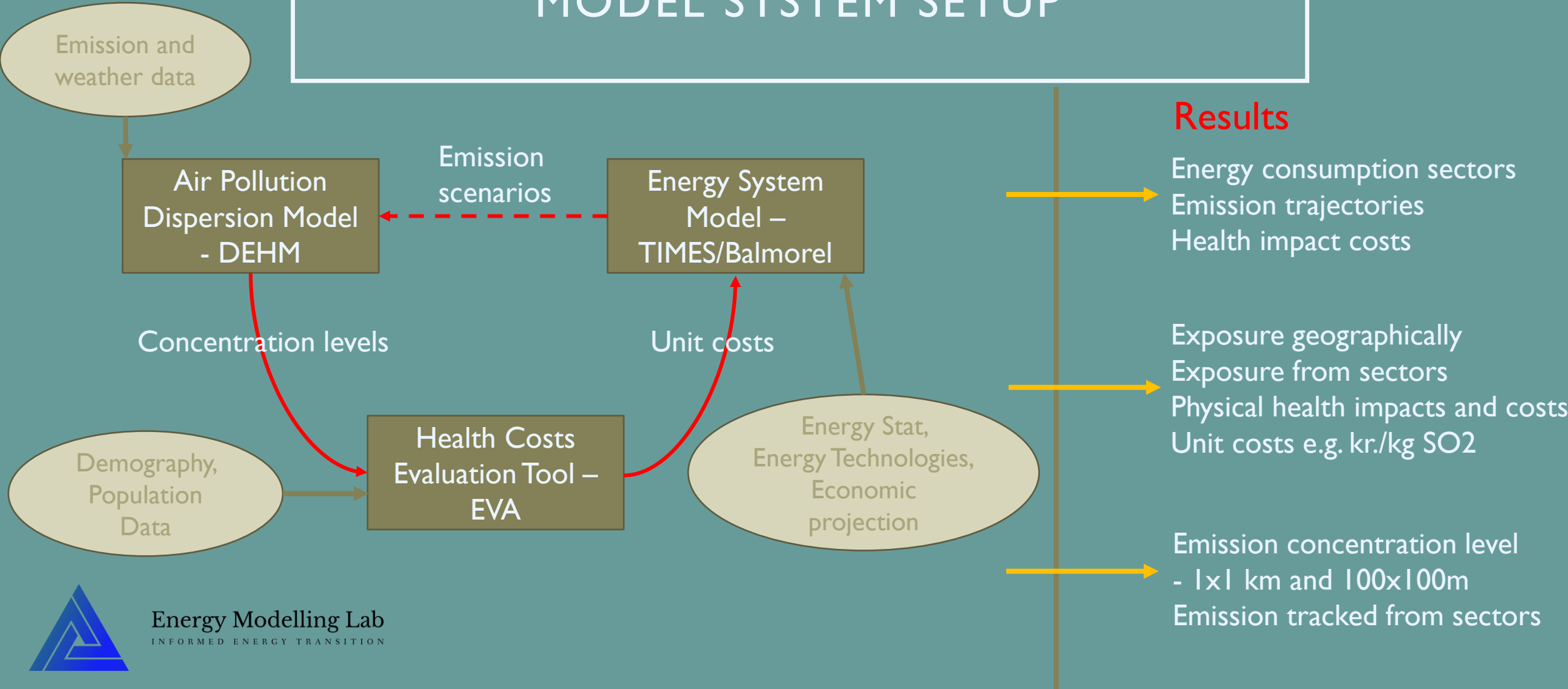




MODELLING SETUP



MODEL SYSTEM SETUP



POST CALCULATION OF HEALTH COSTS

Energy consumption sector level

Energy System Model – TIMES/Balmorel

Scenario:	COMETS_CCS	Fuel (PJ/year)			
Sektor	Brændsel	2015	2020	2030	2050
Power and Heat	ElectroFuel	-	-	-	-
Power and Heat	Coal	71.53	61.99	-	0
Power and Heat	Natural Gas	36.52	32.89	0.22	0
Power and Heat	GasOil	1.69	1.32	-	0
Power and Heat	LPG	0.04	-	-	0
Power and Heat	BioOil	-	-	-	0
Power and Heat	Biogas	0.92	7.00	0.85	0
Power and Heat	BioNatGas	0.44	-	-	0
Power and Heat	Wood chips	43.38	52.82	47.93	0
Power and Heat	Wood Pellets	23.51	36.61	1.63	0
Power and Heat	Straw	14.87	20.84	12.37	0
Power and Heat	Wind	55.85	65.27	142.35	174.95
Power and Heat	Solar	1.11	5.45	51.65	100.42
Waste	MunWaste	17.06	32.55	32.55	32.55
Industry	Electricity	72.85	66.06	77.86	98.61013
Industry	District heating	35.34	53.48	59.21	77.5877
Industry	ElectroFuel	-	-	-	-
Industry	Coal	11.00	19.10	0.66	1.105524
Industry	Natural Gas	35.28	36.49	6.53	0
Industry	GasOil	1.85	28.31	4.97	0
Industry	LPG	1.55	-	0.13	0.803993
Industry	BioOil	-	-	15.53	29.46544
Industry	Biogas	0.96	-	0.06	-
Industry	BioNatGas	0.36	7.68	-	5.88
Industry	Wood chips	6.09	3.16	17.06	105.8046
Industry	Wood Pellets	-	14.69	78.53	-
Industry	Straw	1.97	-	-	-
Industry	MunWaste	-	1.05	0.30	-
Residential	Electricity	38.64	29.68	32.44	33.97521
Residential	District heating	67.83	74.48	78.13	79.95902
Residential	Coal	-	-	-	-
Residential	Natural Gas	24.90	23.94	7.69	0
Residential	GasOil	9.32	6.90	2.50	0
Residential	LPG	-	-	-	-

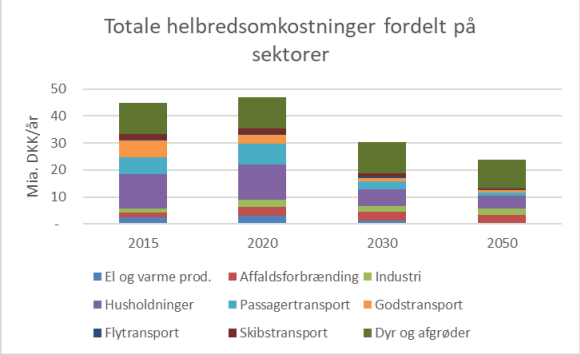
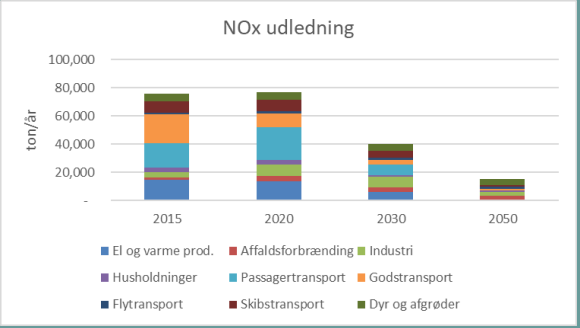


Emission factors and unit costs

Emission Factors Sektor	Brændsel	CO2 kg/GJ			
		2015	2020	2030	2050
Power and Heat	ElectroFuel	-	-	-	-
Power and Heat	Coal	94.04	94.04	94.04	94.04
Power and Heat	Natural Gas	56.89	56.89	56.89	56.89
Power and Heat	GasOil	74.10	74.10	74.10	74.10
Power and Heat	LPG	63.10	63.10	63.10	63.10
Power and Heat	BioOil	-	-	-	-
Power and Heat	Biogas	-	-	-	-
Power and Heat	BioNatGas	-	-	-	-
Power and Heat	Wood chips	-	-	-	-
Power and Heat	Wood Pellets	-	-	-	-
Power and Heat	Straw	-	-	-	-
Power and Heat	Wind	-	-	-	-
Power and Heat	Solar	-	-	-	-
Waste	MunWaste	42.50	42.50	42.50	42.50
Industry	Electricity	-	-	-	-
Industry	District heating	-	-	-	-
Industry	ElectroFuel	-	-	-	-
Industry	Coal	94.04	94.04	94.04	94.04
Industry	Natural Gas	56.89	56.89	56.89	56.89
Industry	GasOil	74.10	74.10	74.10	74.10
Industry	LPG	63.10	63.10	63.10	63.10
Industry	BioOil	-	-	-	-
Industry	Biogas	-	-	-	-
Industry	BioNatGas	-	-	-	-
Industry	Wood chips	-	-	-	-
Industry	Wood Pellets	-	-	-	-
Industry	Straw	-	-	-	-
Industry	MunWaste	42.20	42.20	42.20	42.20
Residential	Electricity	-	-	-	-
Residential	District heating	-	-	-	-
Residential	ElectroFuel	-	-	-	-



Emissions and health impact costs



Emission Factors Sektor	Brændsel	CO2 kg/GJ				Unit Costs (Mio. DKK/GJ)			
		2015	2020	2030	2050	2015	2020	2030	2050
Power and Heat	ElectroFuel	-	-	-	-	-	-	-	-
Power and Heat	Coal	94.04	94.04	94.04	94.04	1.40	1.40	1.40	1.40
Power and Heat	Natural Gas	56.89	56.89	56.89	56.89	1.40	1.40	1.40	1.40
Power and Heat	GasOil	74.10	74.10	74.10	74.10	1.40	1.40	1.40	1.40
Power and Heat	LPG	63.10	63.10	63.10	63.10	1.40	1.40	1.40	1.40
Power and Heat	BioOil	-	-	-	-	-	-	-	-
Power and Heat	Biogas	-	-	-	-	-	-	-	-
Power and Heat	BioNatGas	-	-	-	-	-	-	-	-
Power and Heat	Wood chips	-	-	-	-	-	-	-	-
Power and Heat	Wood Pellets	-	-	-	-	-	-	-	-
Power and Heat	Straw	-	-	-	-	-	-	-	-
Power and Heat	Wind	-	-	-	-	-	-	-	-
Power and Heat	Solar	-	-	-	-	-	-	-	-
Waste	MunWaste	42.50	42.50	42.50	42.50	1.40	1.40	1.40	1.40
Industry	Electricity	-	-	-	-	-	-	-	-
Industry	District heating	-	-	-	-	-	-	-	-
Industry	ElectroFuel	-	-	-	-	-	-	-	-
Industry	Coal	94.04	94.04	94.04	94.04	1.40	1.40	1.40	1.40
Industry	Natural Gas	56.89	56.89	56.89	56.89	1.40	1.40	1.40	1.40
Industry	GasOil	74.10	74.10	74.10	74.10	1.40	1.40	1.40	1.40
Industry	LPG	63.10	63.10	63.10	63.10	1.40	1.40	1.40	1.40
Industry	BioOil	-	-	-	-	-	-	-	-
Industry	Biogas	-	-	-	-	-	-	-	-
Industry	BioNatGas	-	-	-	-	-	-	-	-
Industry	Wood chips	-	-	-	-	-	-	-	-
Industry	Wood Pellets	-	-	-	-	-	-	-	-
Industry	Straw	-	-	-	-	-	-	-	-
Industry	MunWaste	42.20	42.20	42.20	42.20	1.40	1.40	1.40	1.40
Residential	Electricity	-	-	-	-	-	-	-	-
Residential	District heating	-	-	-	-	-	-	-	-
Residential	ElectroFuel	-	-	-	-	-	-	-	-

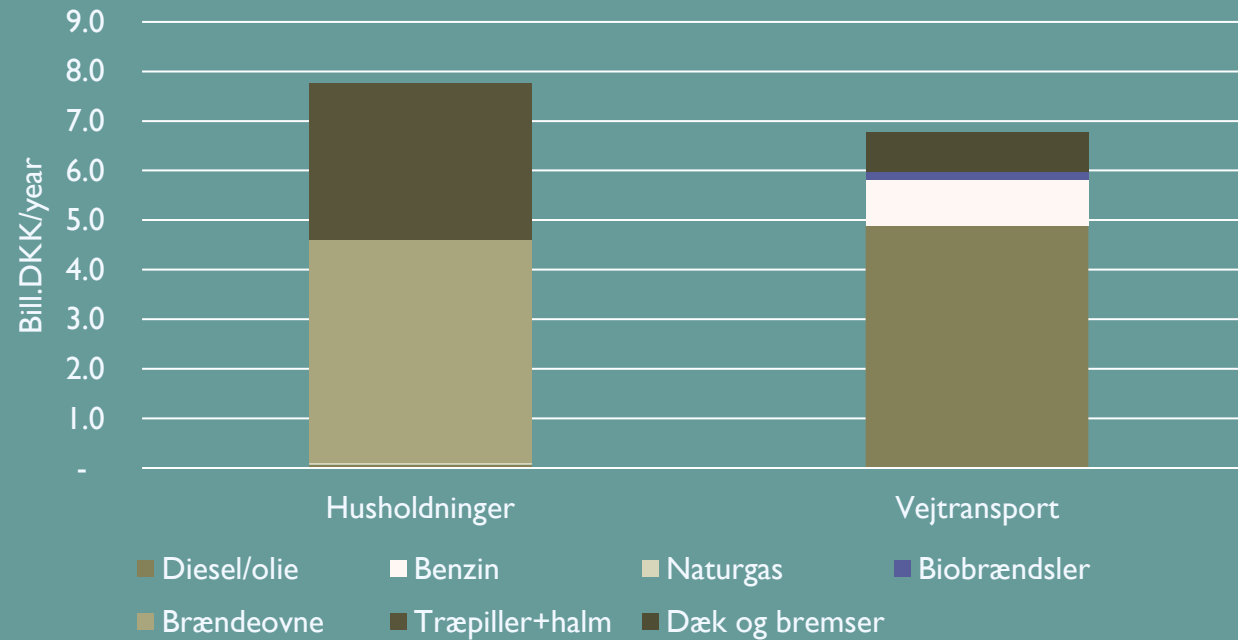


RESULTS

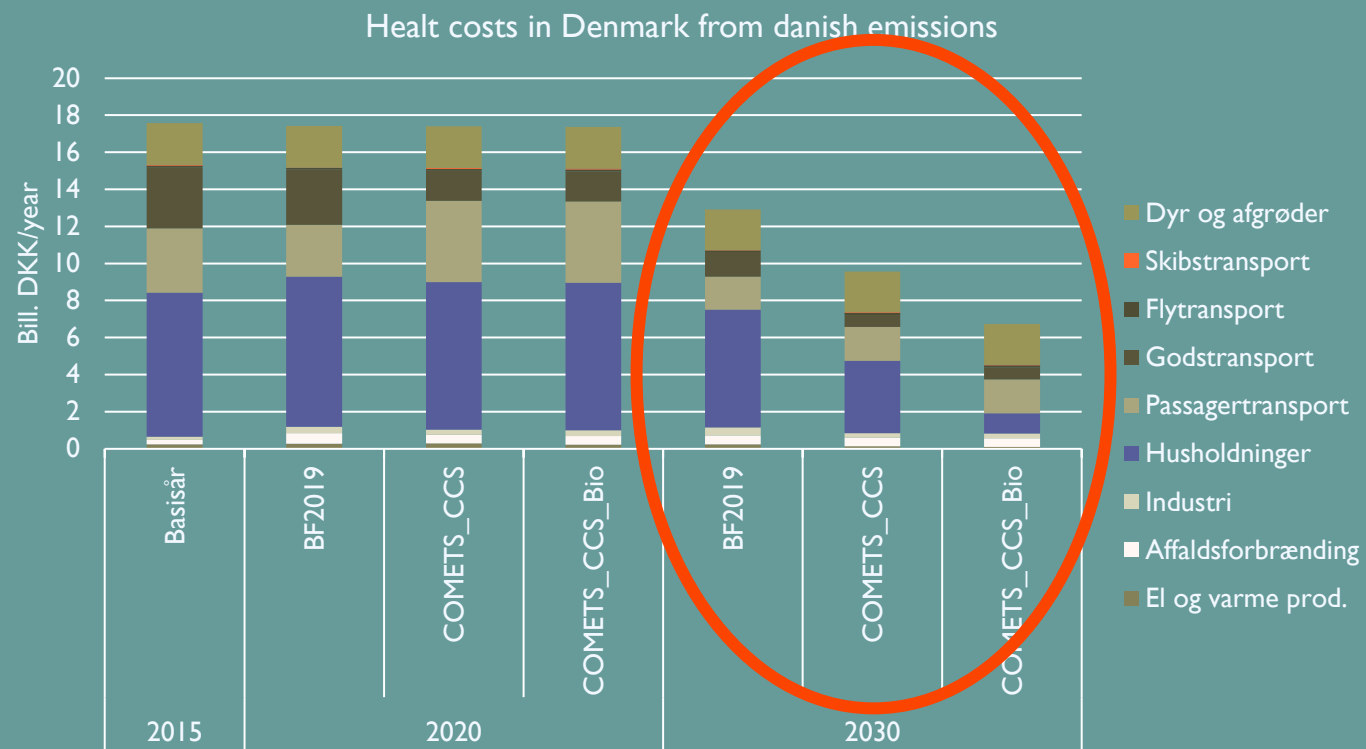


DANISH POLLUTION IN DENMARK

Health cost i Denmark today from Danish emissions in residential and road transport



FUTURE PROJECTIONS



ESTIMATED COSTS OF ENERGY SECTORS
THE GREEN TRANSITIONS IN DENMARK TO
ACHIVE A 70 % GHG REDUCTION IN 2030

TIMES-DK scenarios	CEPOS	EA energianalyse	Climate partnerships (Danish industrial collaboration)
10-15 Bill DKK/year	27 Bill DKK/year	13 Bill DKK/year	15 Bill DKK/year



CONCLUSION

- Danish air pollution costs in Denmark **only** is estimated today to cost approx. 19 billion DKK annually
 - Saving potential is between 10 and 14 billion DKK depending on biomass consumption
- Global cost from Danish emissions is approx. 45 billion today
 - Global saving potential is between **15** and **20** billion DKK depending on biomass consumption
- Cost of the Danish 2030 target is estimated to be approx. **15** billion in 2030





THANK YOU FOR YOUR TIME

Mikkel Bosack Simonsen
Energy Modelling Lab

www.energymodellinglab.com



Energy Modelling Lab
INFORMED ENERGY TRANSITION

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