



## Including Health Cost in the CEEH version of the Energy System Optimisation Model Balmorel

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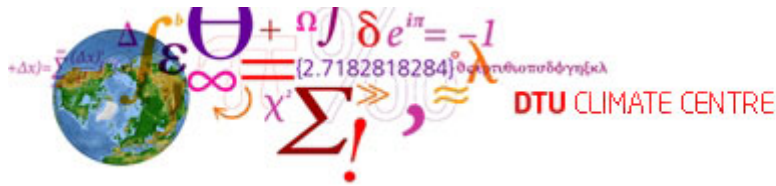
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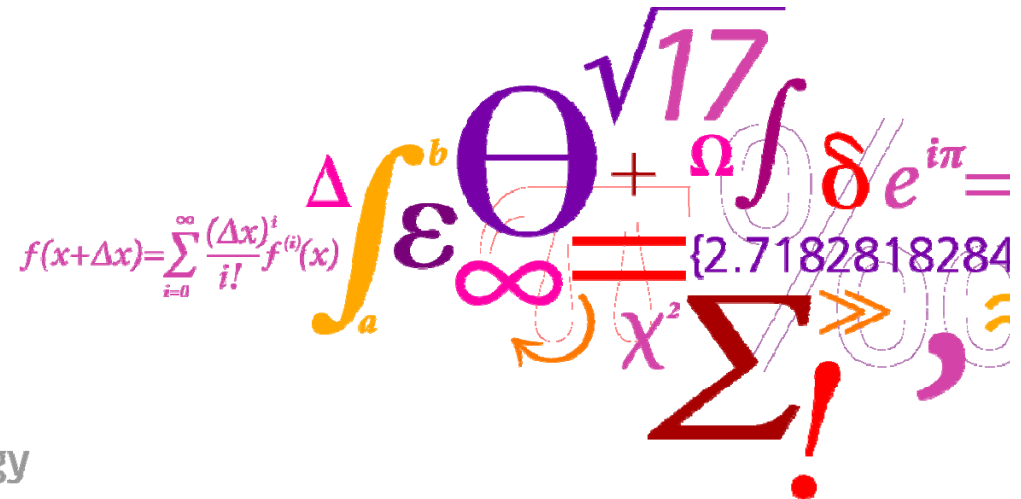
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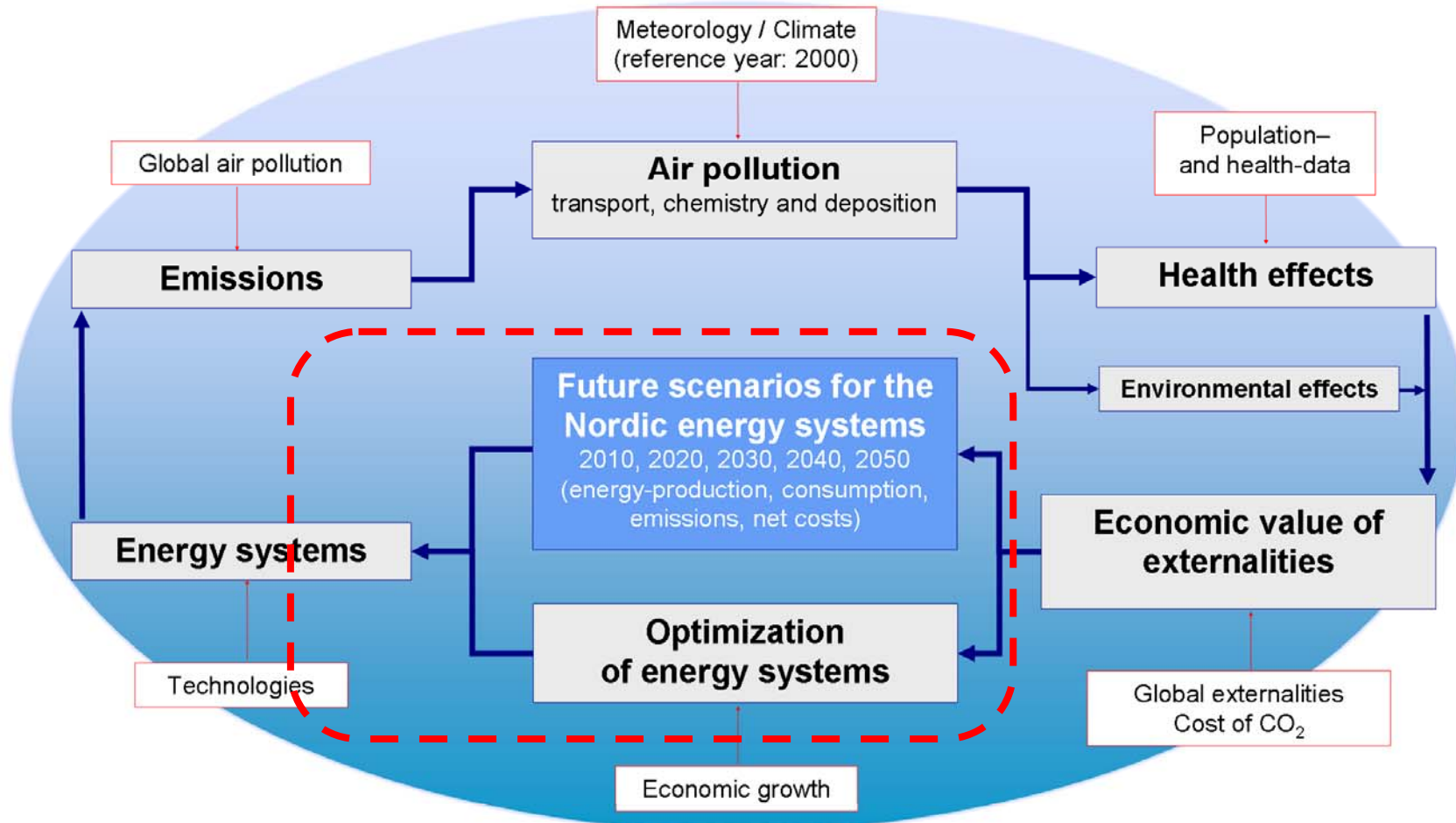
# Including Health Cost in the CEEH version of the Energy System Optimisation Model Balmorel

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# CEEH Modelling Framework



# Balmorel in Brief

## Model:

Multi region linear optimisation model,  
 Interregional power market,  
 Regional district heat markets

## Exogenous input:

Energy prices,  
 Electricity demand in regions,  
 Heat demand in heat areas

## Results:

Prices on traded energy,  
 Investments in power plants,  
 Investments in transmission lines,  
 Emissions from each region



## Balmorel: Additional Features

### Health Costs

Mechanism to take into account damage arising from emission of SO<sub>2</sub>, CO, PM<sub>2.5</sub>, and NO<sub>x</sub>.

Possible to take into account factors like population density, meteorology by varying cost depending on an area.

### Heat Savings (E. Zvingilaite)

Possibility to invest in heat saving measures and thereby reduce heat demand. Dependent upon renovation rate, building type, potential.

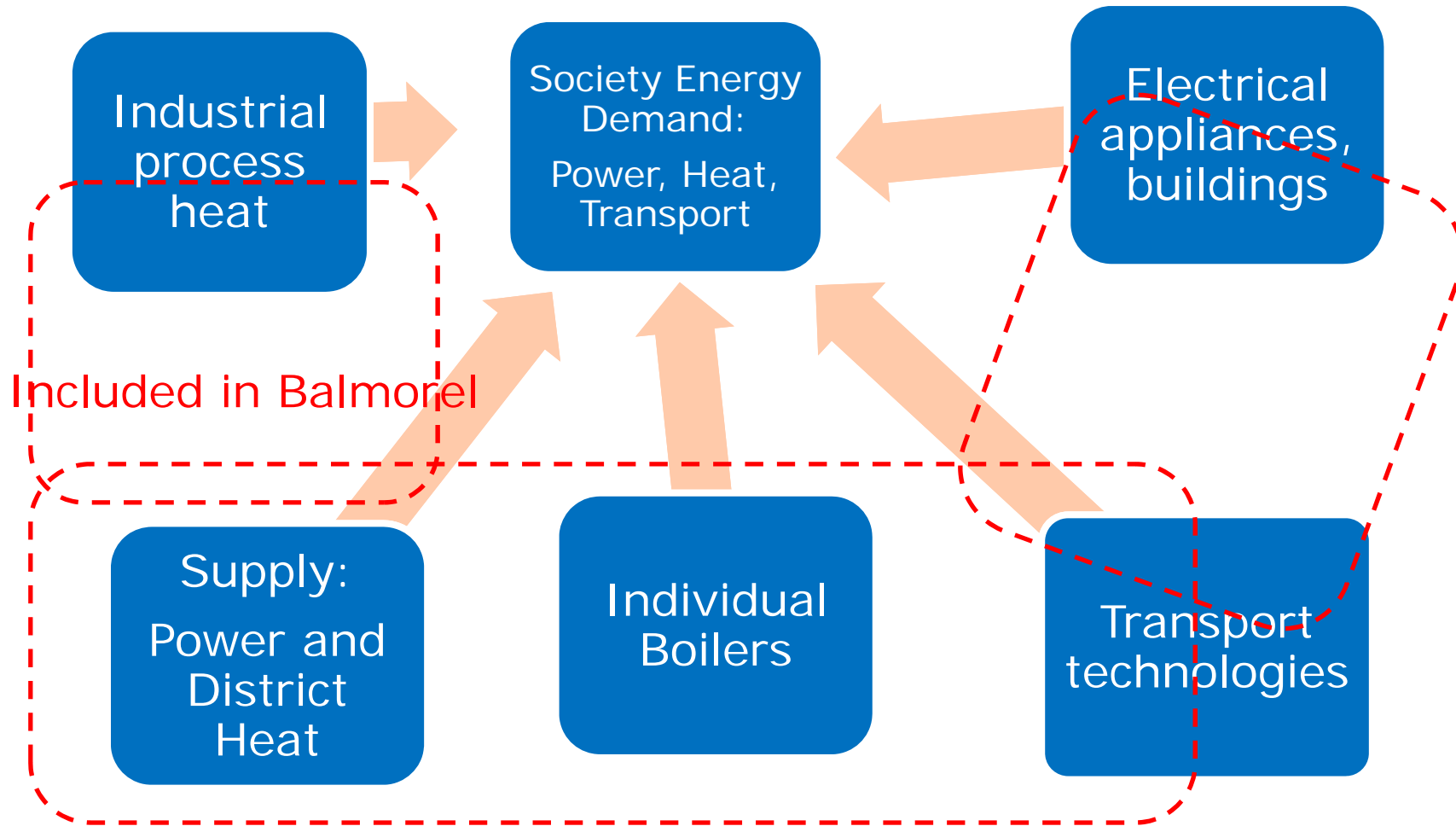
### Individual Heating (E. Zvingilaite)

Handling individual heating investment options, related emissions etc.

### Hydrogen (K. Karlsson and P. Meibom)

Utilisation of hydrogen-based technologies for transport and electricity storage.

# Energy System

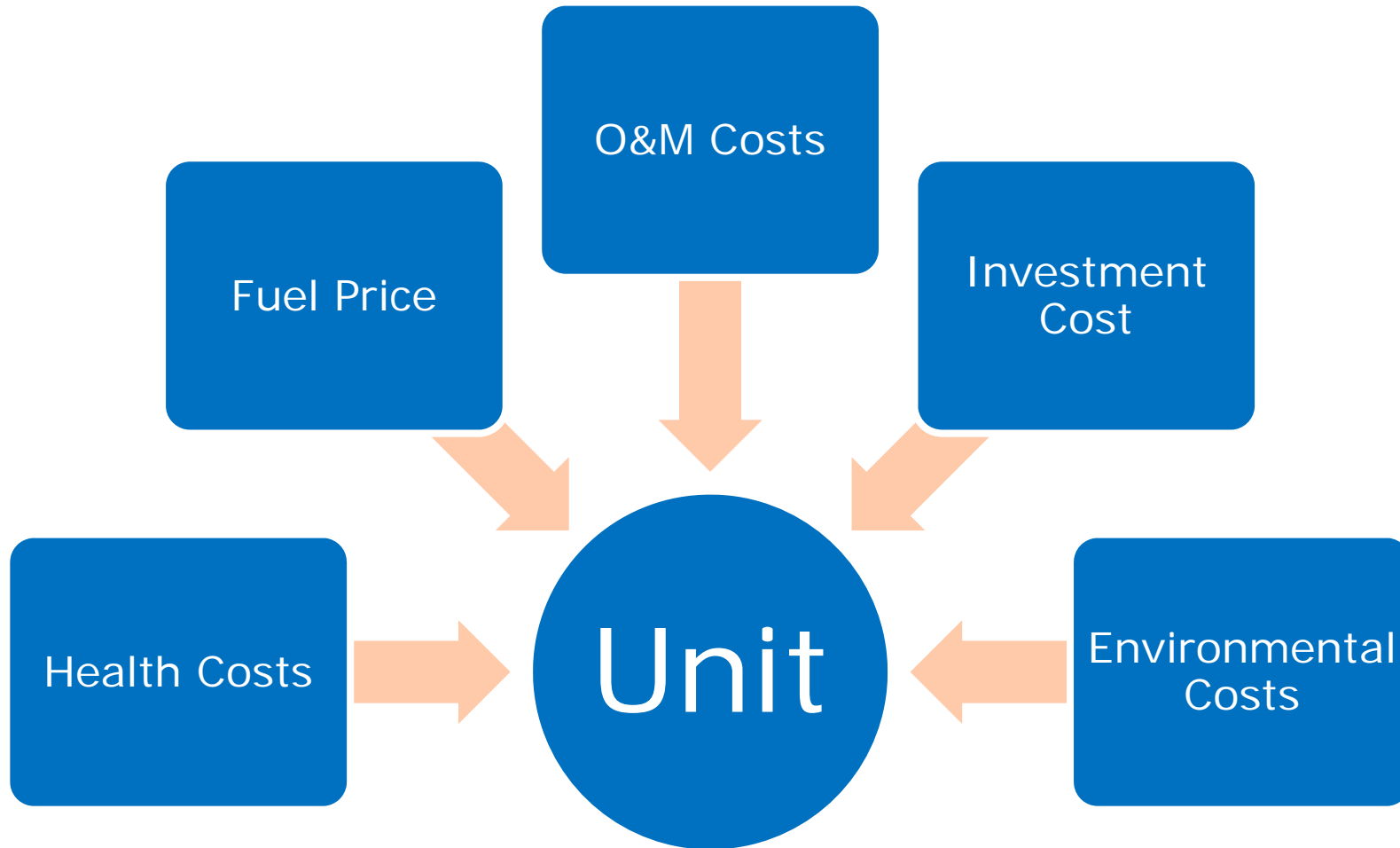


# Health Costs

| Sector                                  | Emission year | CO [C] | S [S] | N [N] | PM25 |
|---|---------------|--------|-------|-------|------|
| Combustion in energy and transformation | 2000          | 0,001  | 22,2  | 23,9  | 19,2 |
| Non-industrial combustion plants        | 2000          | 0,002  | 32,7  | 33,8  | 28,4 |
| Combustion in manufacturing industry    | 2000          | 0,001  | 27,0  | 27,6  | 19,8 |
| Production processes                    | 2000          | 0,014  | 44,9  | 110,5 | 41,2 |
| Road transport                          | 2000          | 0,003  | 188,5 | 33,3  | 44,4 |
| International ship traffic              | 2000          | 0,000  | 26,7  | 26,3  | 22,1 |

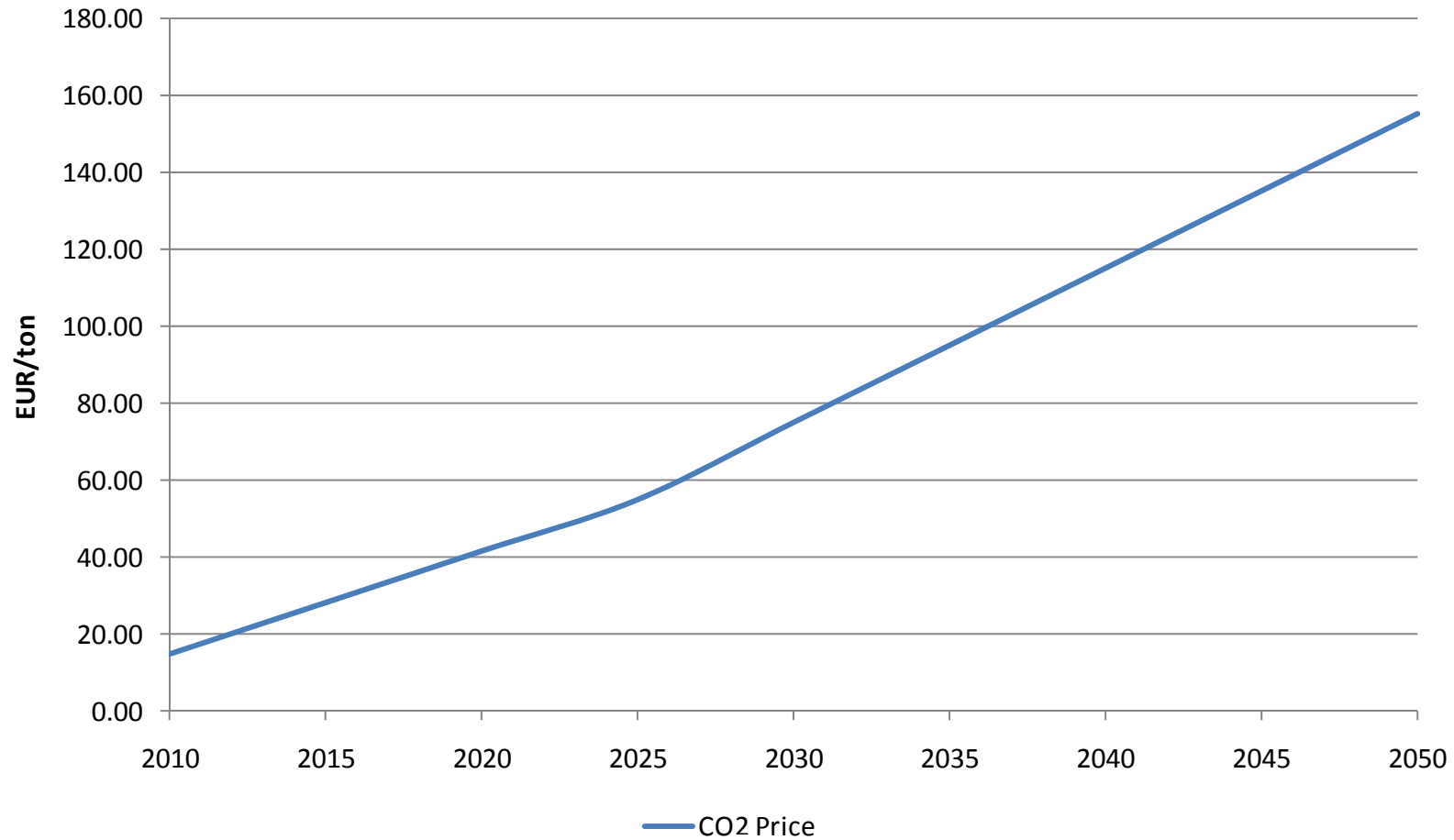
Cost in EUR/kg

# Energy System Modelling: Cost of Running a Unit in an Energy System

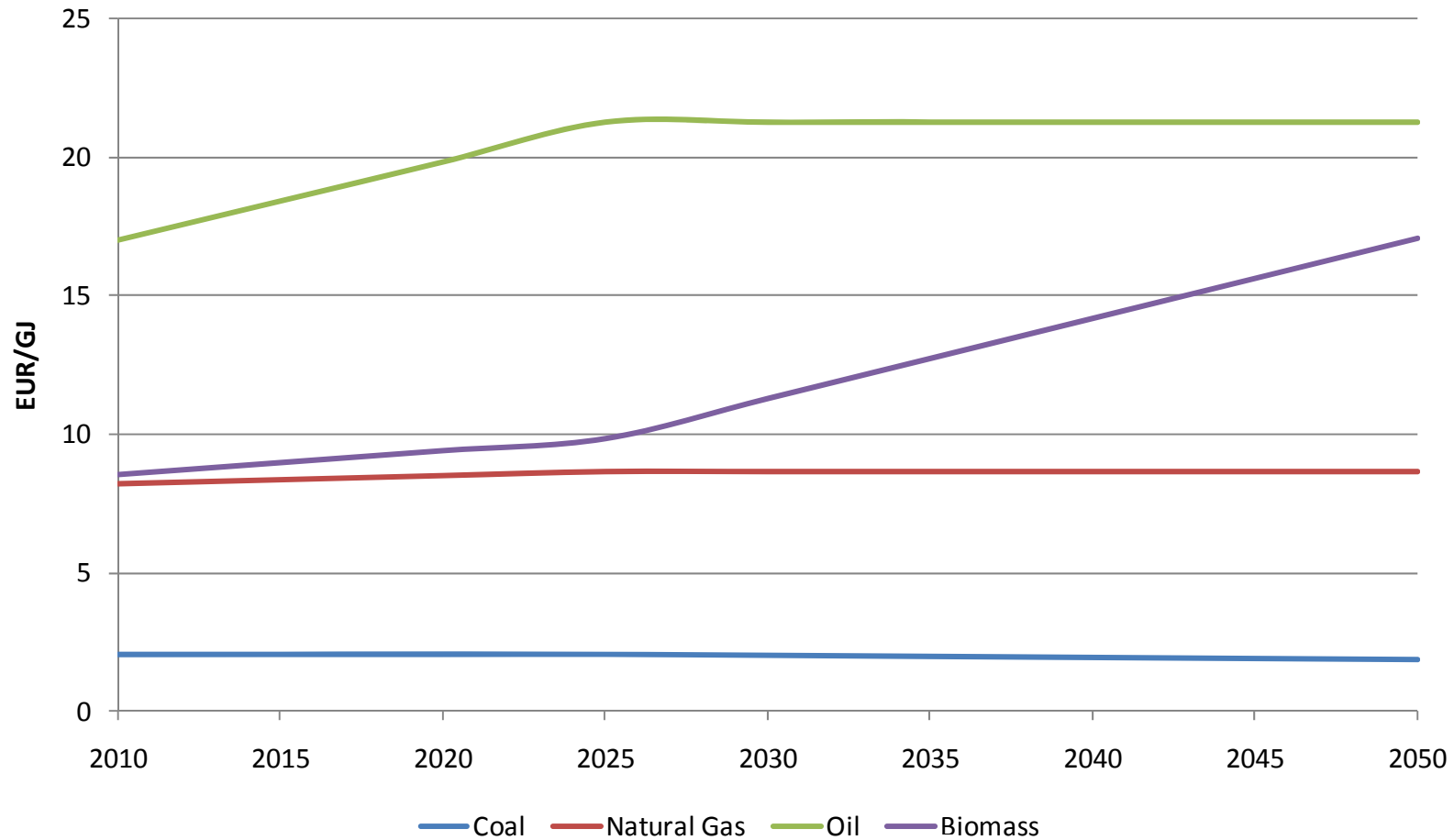




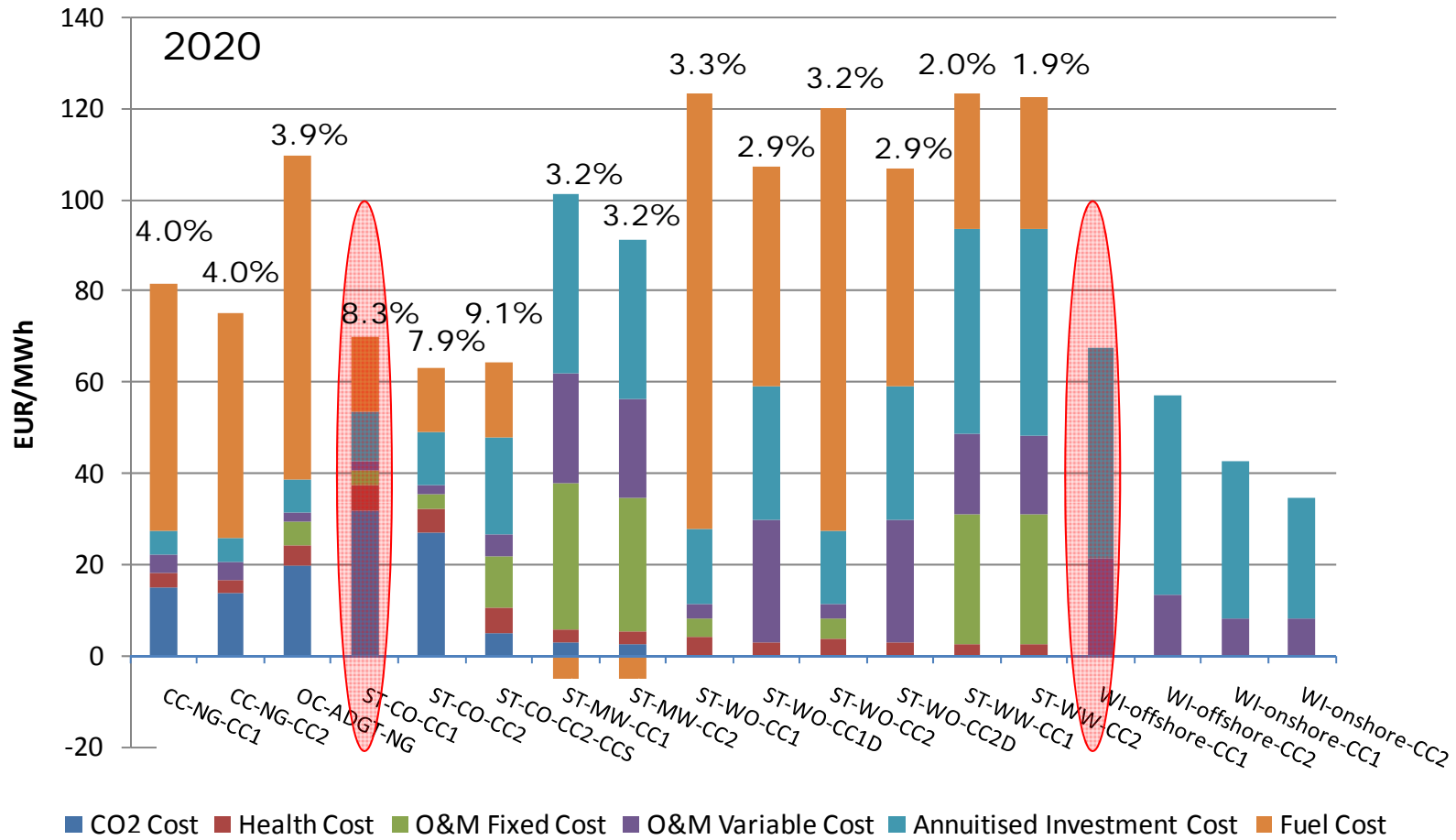
# Assumptions I: CO2 Price Development



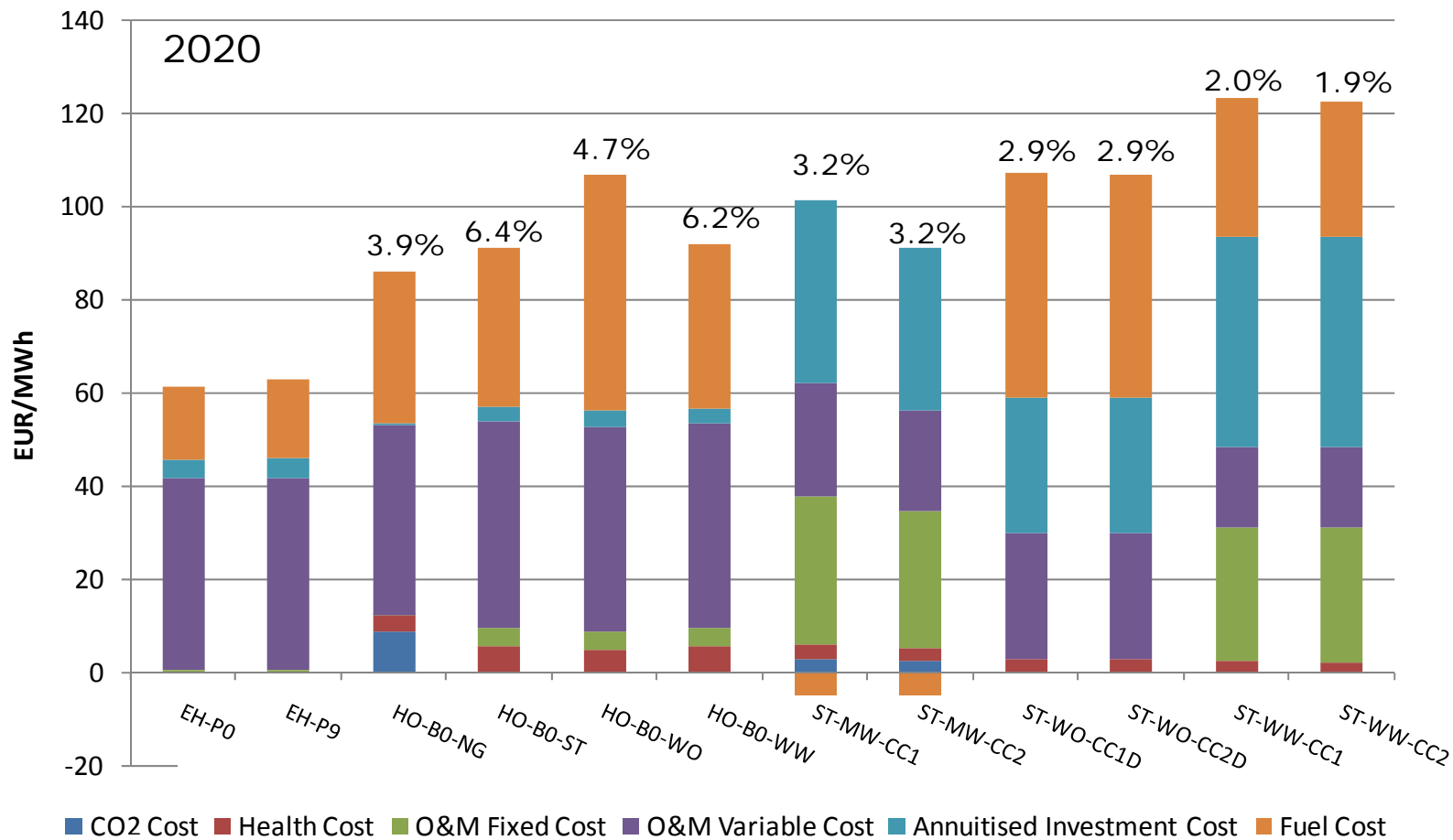
## Assumptions II: Fuel Price Development



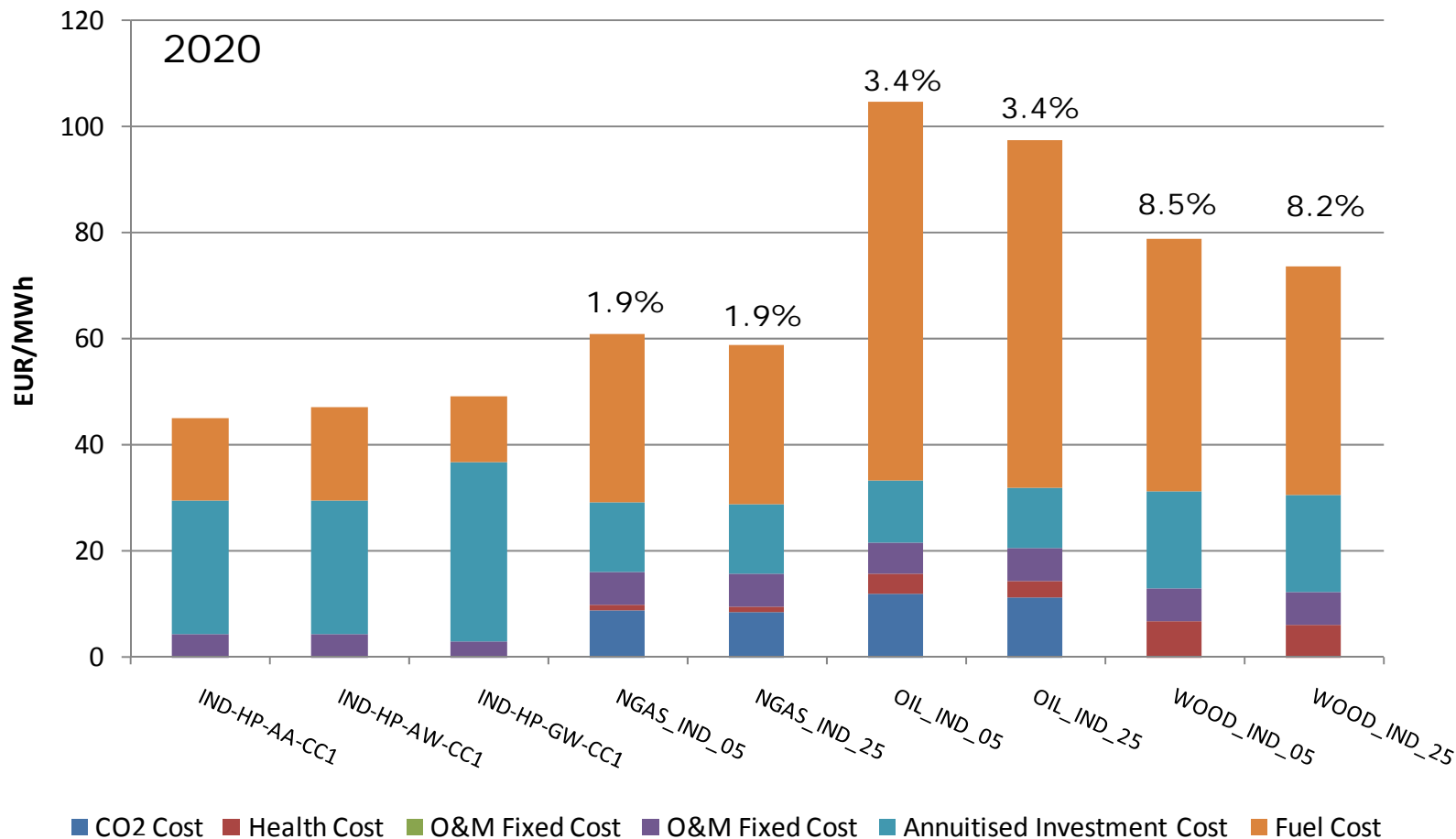
# Technology Competitiveness I: Electricity



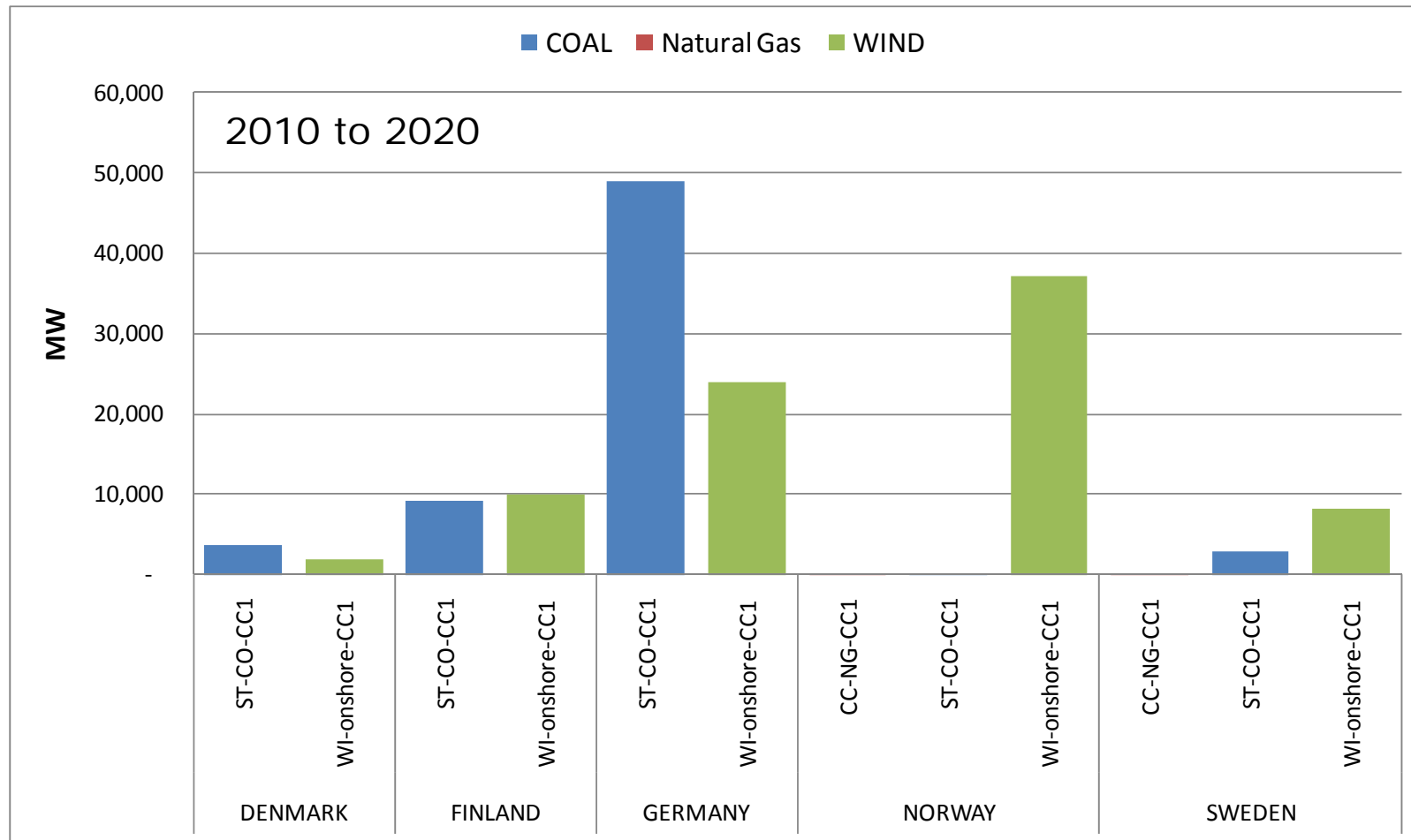
# Technology Competitiveness II: District Heating

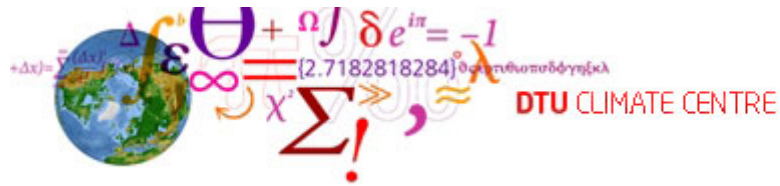


# Technology Competitiveness III: Individual Heating



## Example of Results: New Power Capacity





# Way Forward

## Inclusion of transportation

Possibility of investing in car fleet

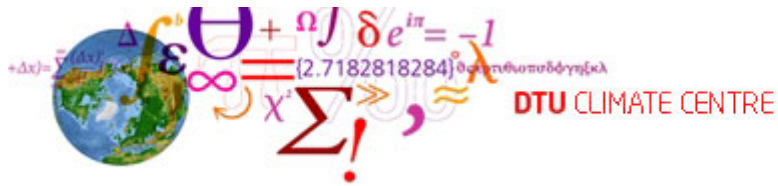
Competition between different technologies, e.g. electric, gasoline.

## Inclusion of industrial processes

Possibility of fuel substitution

## Electricity Savings

Possibility of investing in more efficient appliances



# THANK YOU FOR YOUR ATTENTION!

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