

Using data from ETSAP models in a hemispheric pollution model

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Centre for Energy, Environment and Health (CEEH)



A new Danish research center
Establishing an
interdisciplinary based system
to support optimal future
planning of energy production
and usage in Denmark

Including costs related to the
natural environment and
human health

Focusing on Denmark and the
Nordic countries



Centre Partners – 7 different Danish institutes

Earth and Planetary physics (Niels Bohr Institute, University of Copenhagen)
Danish Meteorological Institute (DMI)
National Environment Research Institute (NERI) (University of Aarhus)
National Institute of Public Health (NIPH) (University of Southern Denmark)
Risø National Laboratory (Technical University of Denmark)
Centre for Applied Health Services Research and Technology Assessment (CAST)
(University of Southern Denmark)
Institute for Public Health (University of Aarhus)

Scientific disciplines in the centre

**Systemanalysis
science**

**Medical
science**

Statistics

**Meteorology
(physics,
chemistry)**



Collaboration partners

Dong Energy (Denmark)
University of Queensland (Australia)
Freie Universität Berlin (Germany)
Finnish Meteorological Institute
International Institute for Applied Systems Analysis (Laxenburg, Austria)
CEREA (Marne la Vallée, France)
Los Alamos Laboratory (New Mexico, USA)
University of Cologne (Germany)
Energy Research Centre of the Netherlands
University of Leicester (UK)
VITO (Boeretang, Belgium)
ENEA (Rome, Italy)
ICMMG (Novosibirsk, Russia)
Vienna University of Technology (Austria)
RIVM (Bilthoven, Netherlands)
Institute of North Ecology problems (Russia)
University Medical Centre, ERASMUS MC, (Netherlands)



Components

Energy-system models

(e.g. Balmorel and MARKAL-TIMES / TIAM)

Danish Atmospheric Chemical Transport models

(DEHM, Enviro-Hirlam, and more)

Physiological relationships (dose-response functions)

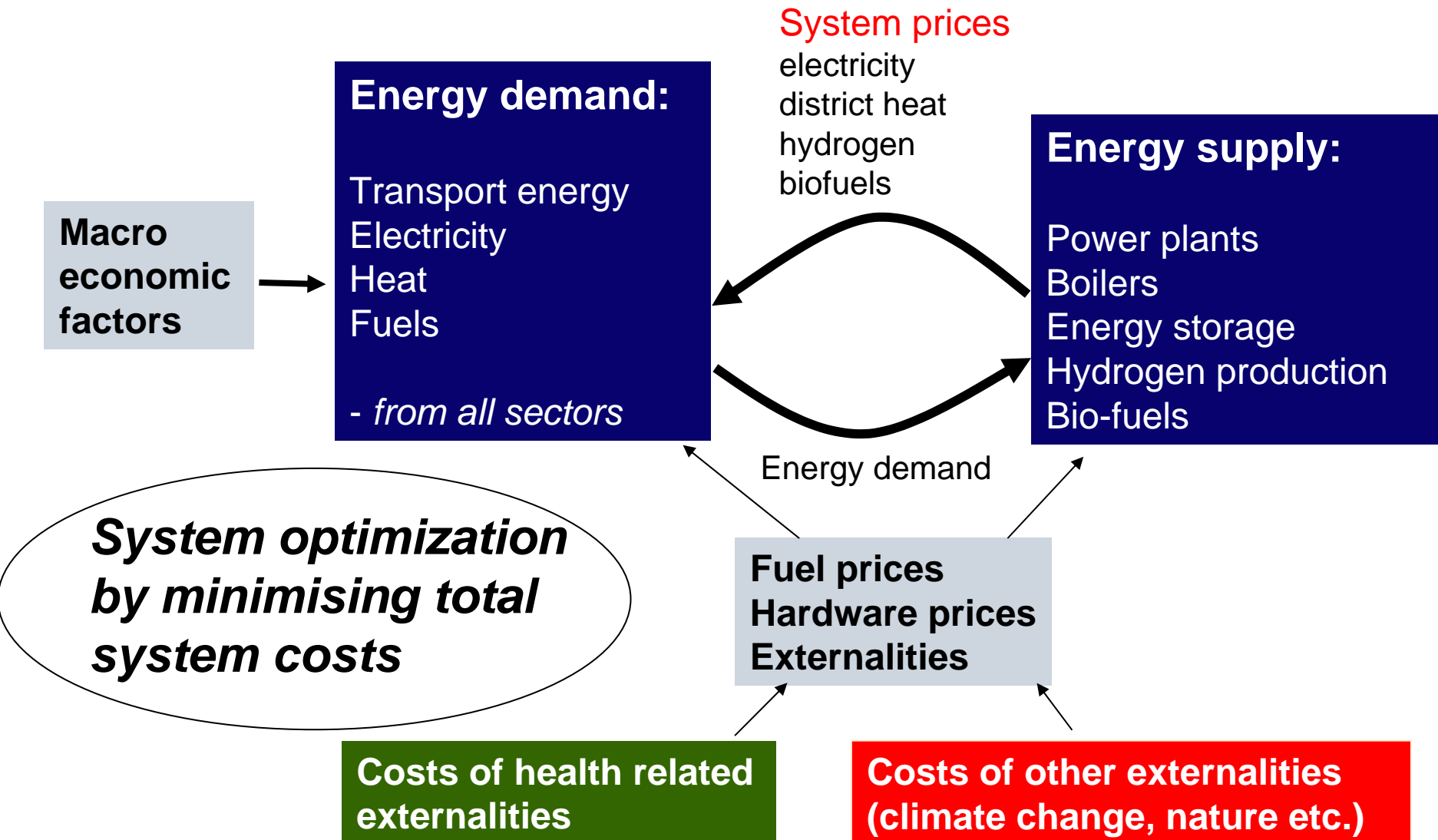
Statistical models

(exposure vs frequency of decease and environmental effects)

Health cost models (e.g. prizes for one life-year)

Modelsystems (e.g. EVA = Economic Value of Air pollution)

Energy System Modelling – 2005 to 2050



Assessments of air pollution related damages on human health - and the subsequent costs

Based on ExternE

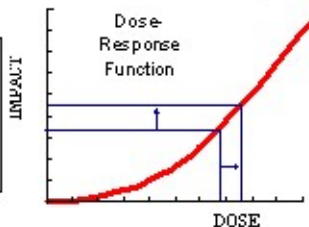
SOURCE
(specification of site and technology)
⇒ **emission**
(e.g., kg/yr of particulates)



DISPERSION
(e.g. atmospheric dispersion model)
⇒ **increase in concentration at receptor sites**
(e.g., $\mu\text{g}/\text{m}^3$ of particulates in all affected regions)



DOSE-RESPONSE FUNCTION
(or concentration-response function)
⇒ **impact**
(e.g., cases of asthma due to ambient concentration of particulates)



MONETARY VALUATION
⇒ **cost**
(e.g., cost of asthma)



In CEEH

Geographical distributions of all emissions including traffic

Using advanced Atmospheric Chemical Transport models

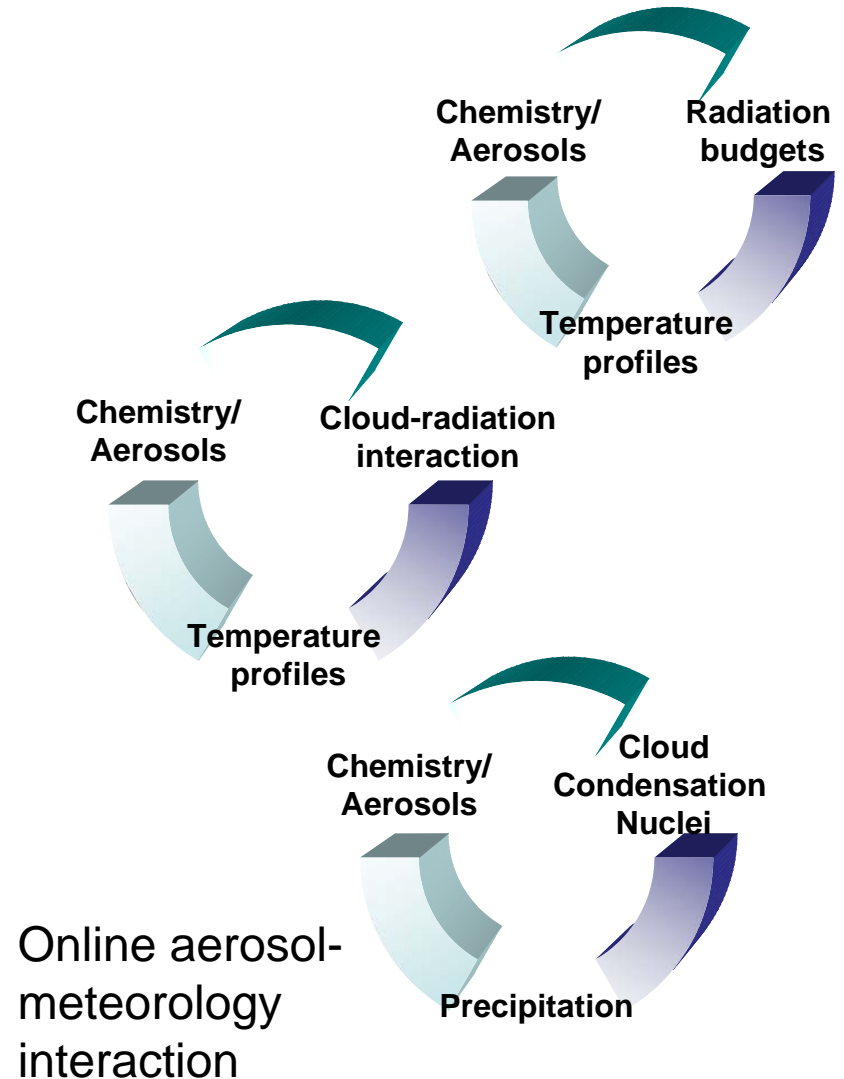
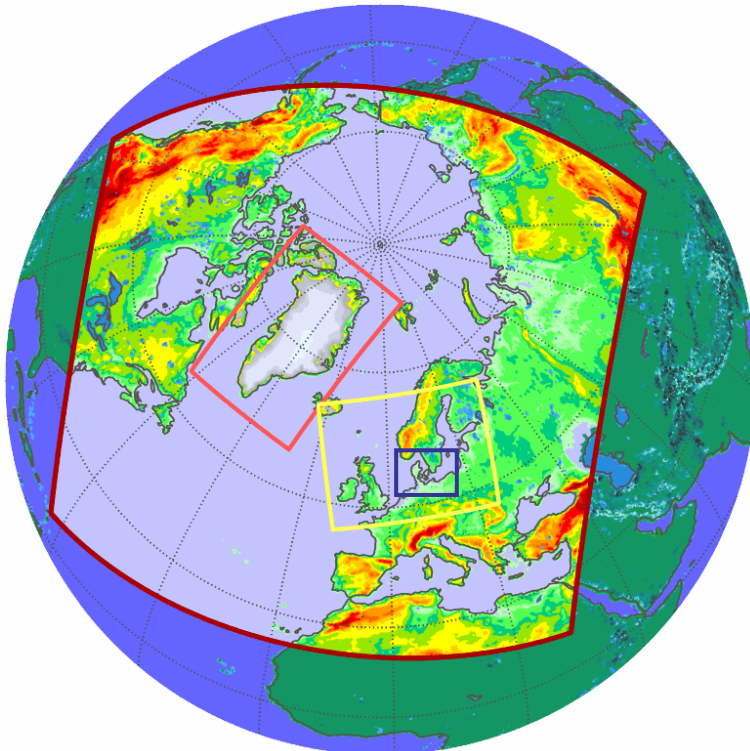
Quantifying toxicological effects

Using registers of the population and health

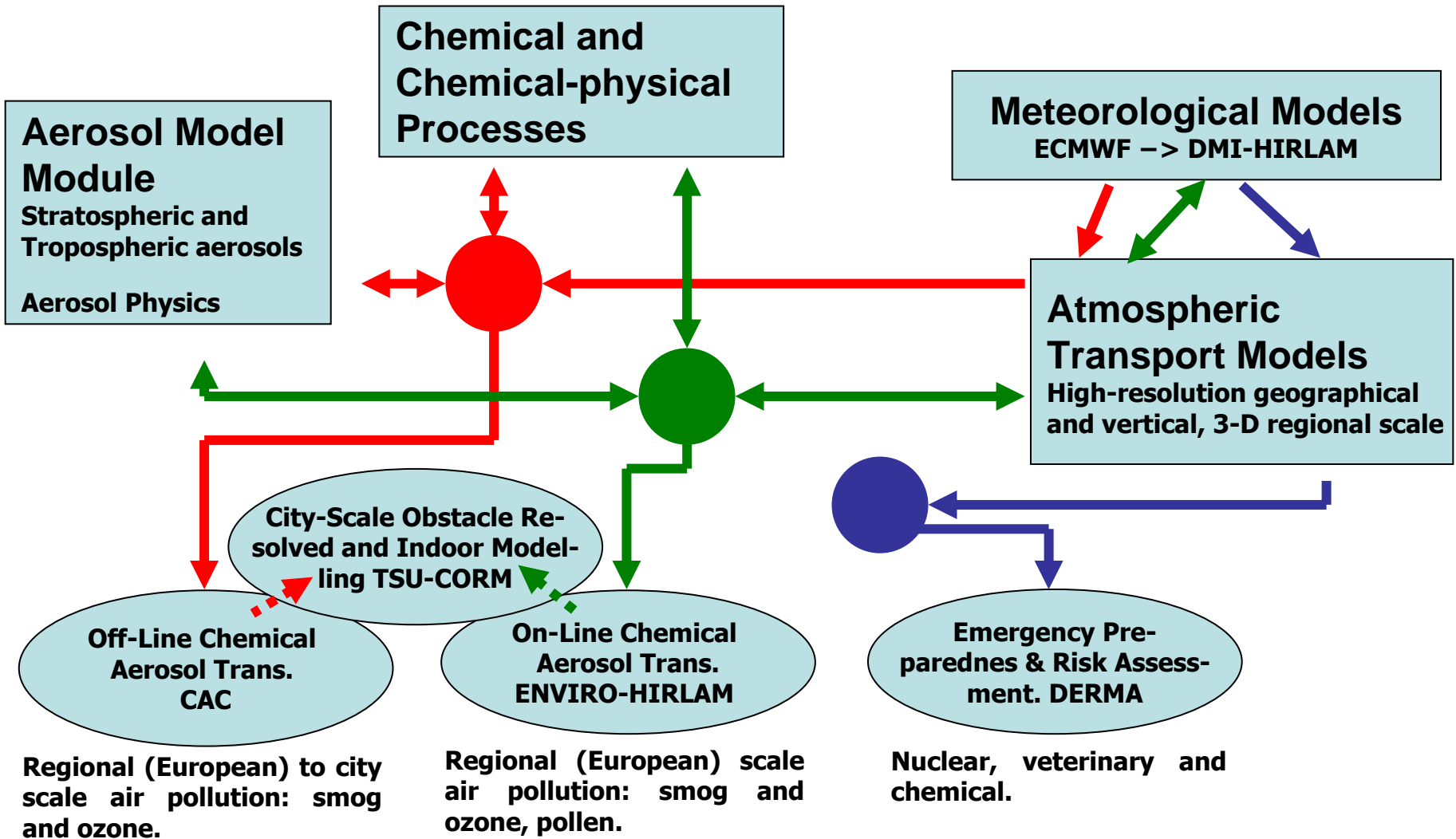
Quantifying the health impact of pollutants on a macro-scale level to set up health cost functions

Enviro – HIRLAM air pollution modelling

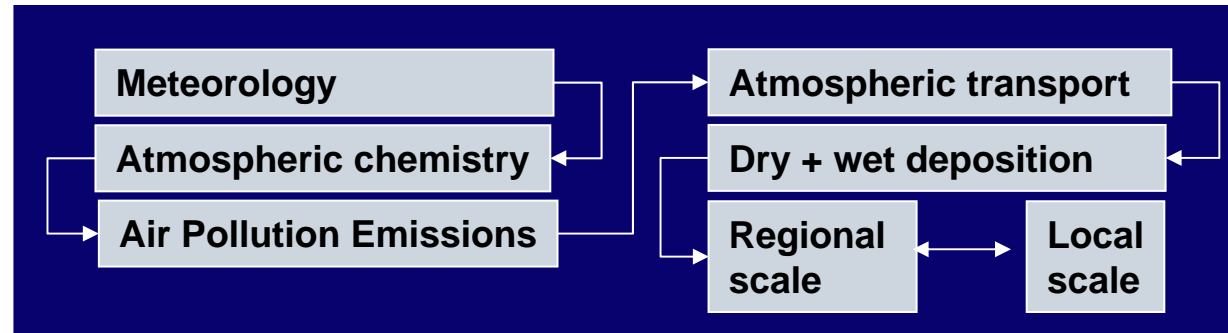
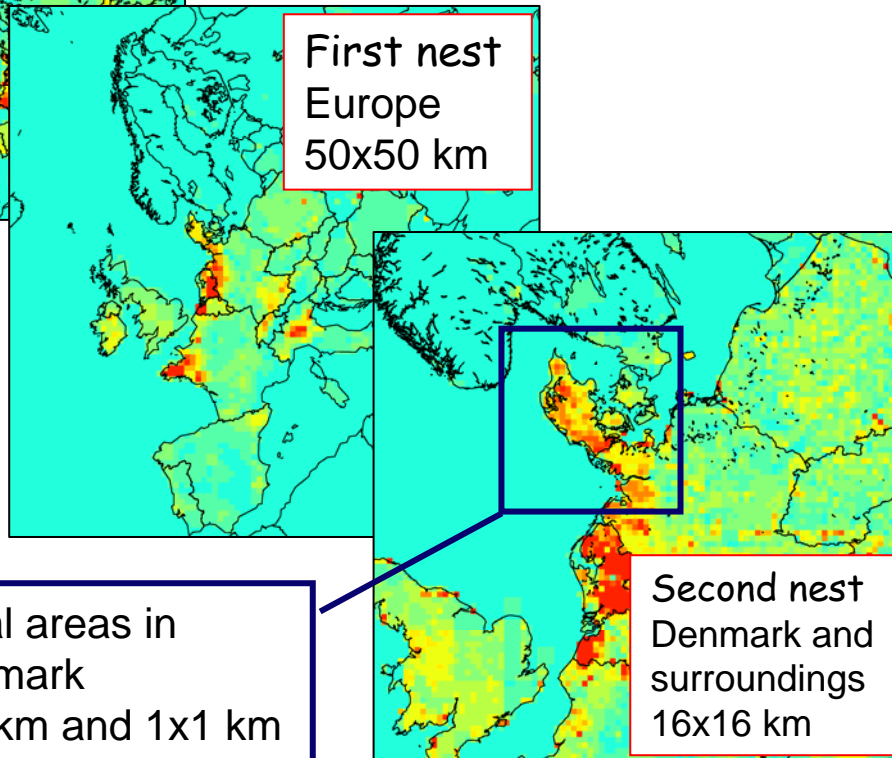
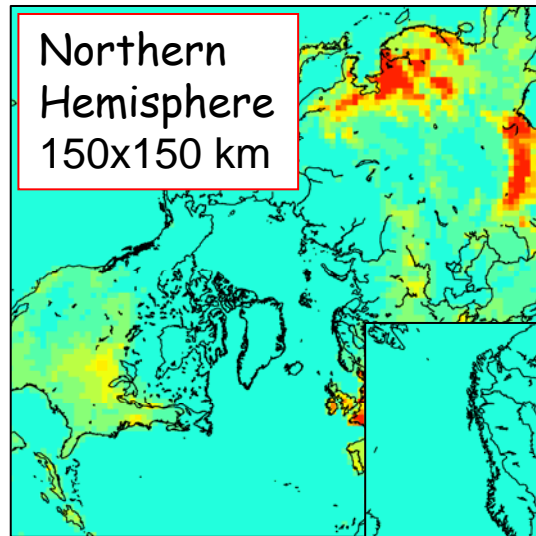
Operational areas covered by the Enviro – HIRLAM system today:
50x50km horizontal down to 1.4x1.4km for Denmark.
Vertically it goes into the stratosphere



Air Pollution Modeling scheme



Danish Eulerian Hemispheric Model System (DEHM)



- Full 3D advection/diffusion
- 63 chemical species
- 130 chemical reactions
- Two-way nested modelling over Europe

Economic Value of Air pollution (EVA)

A new integrated model system

Uses the DEHM air-pollution model on a regional scale

Local modeling based on a smoke-fan model

Estimating local concentrations

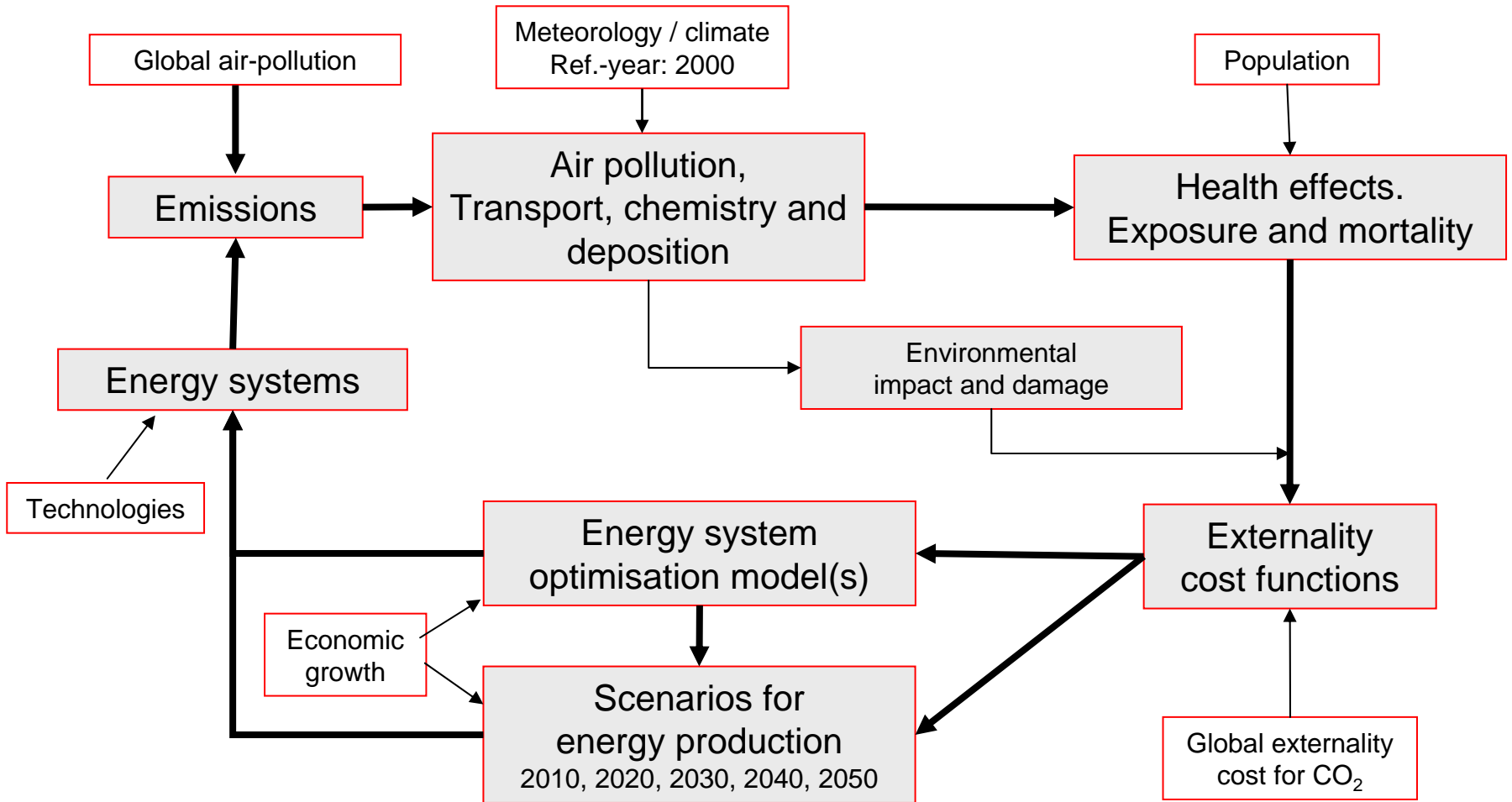
Uses meteorological data, population data, dose response functions, cost functions

Can run with various emission scenarios and for different years

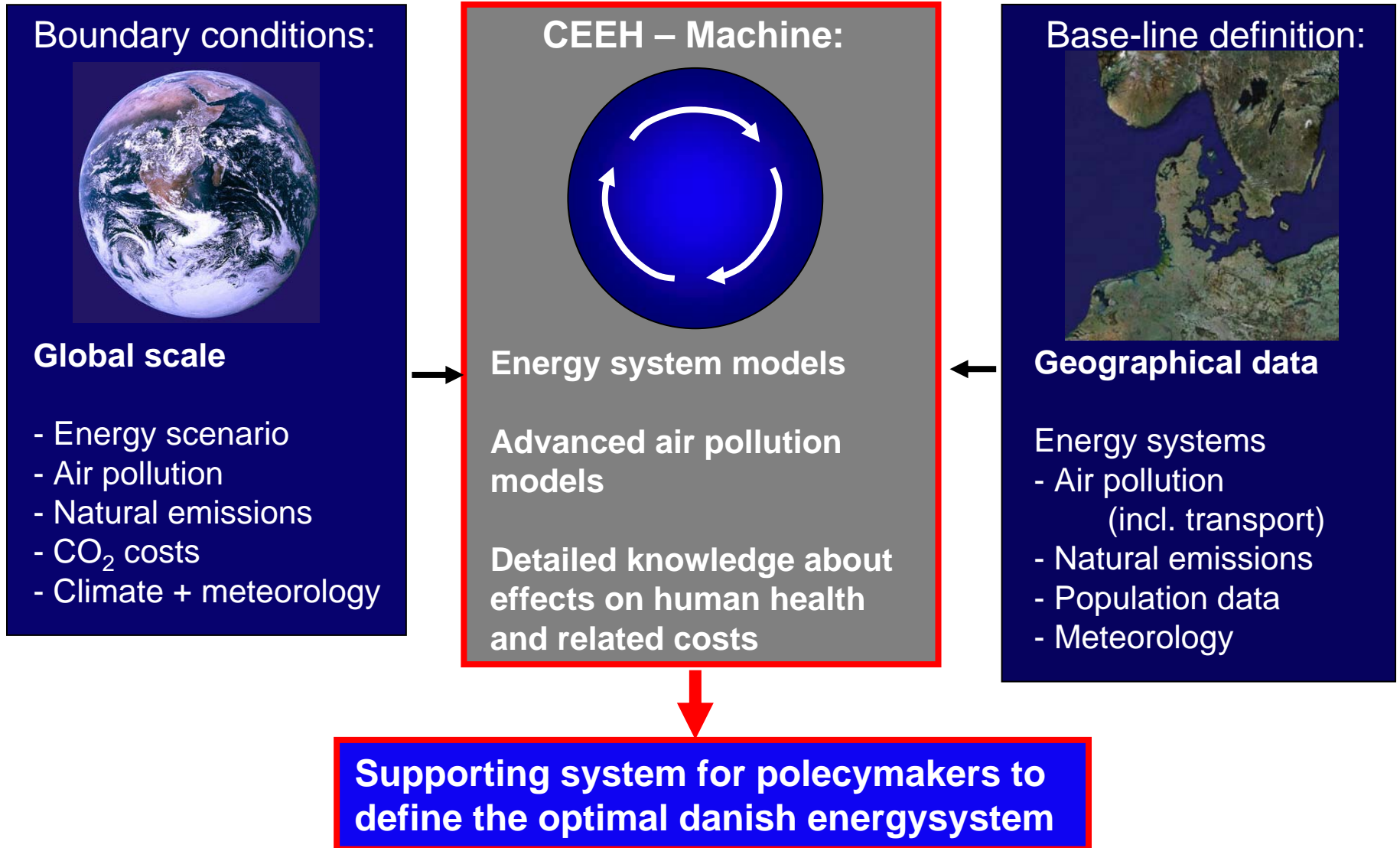
Enables changes/additions of dose-response functions and cost functions without repetition of transport/chemistry modelling



CEEH Model flow diagram



To summarize



Thank you for listening

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