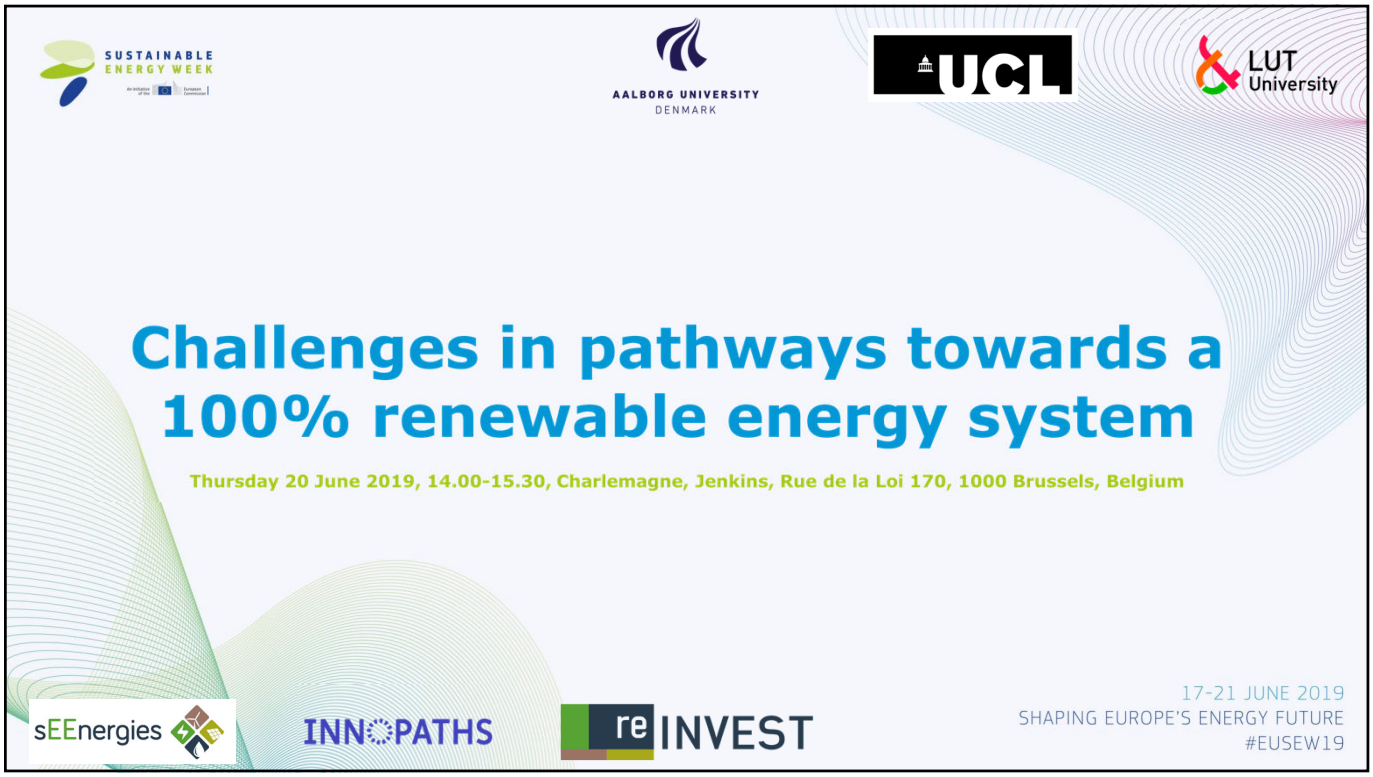
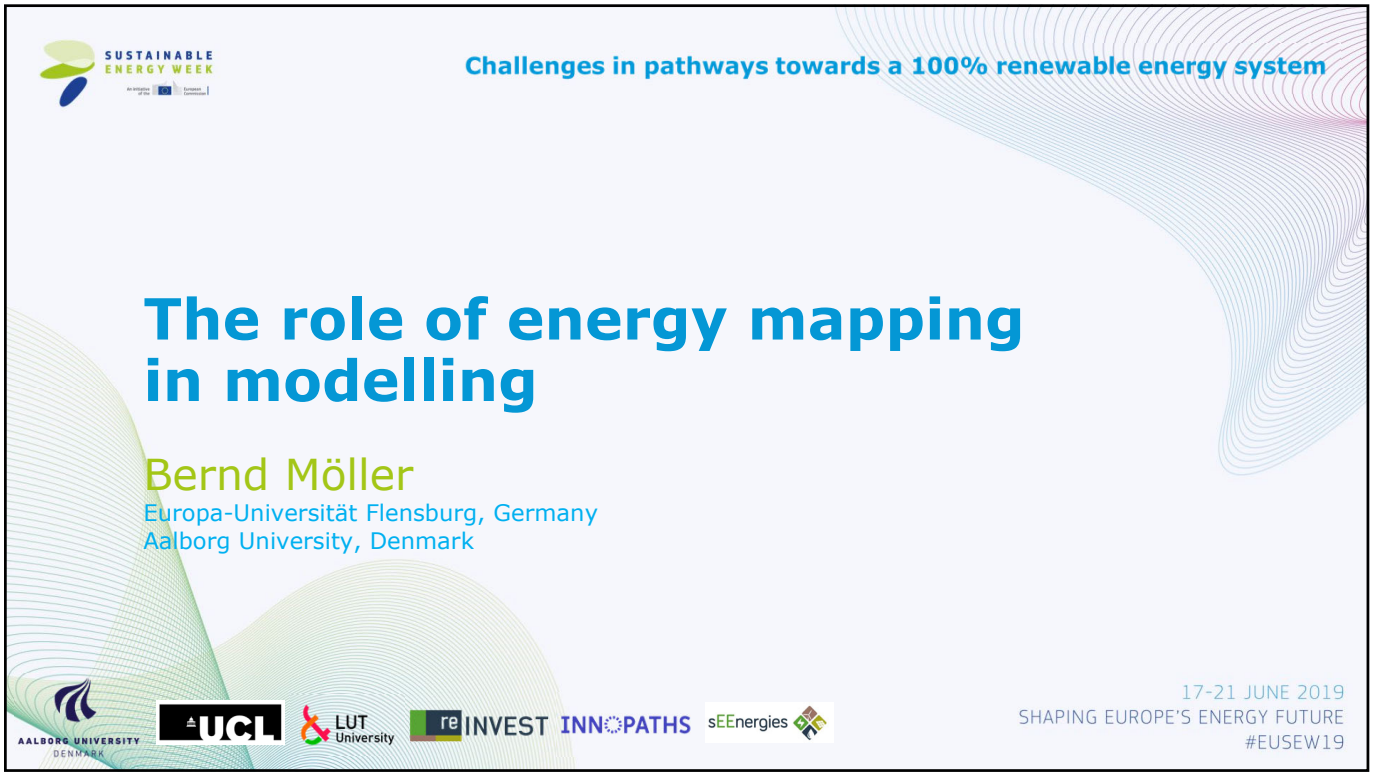

SUSTAINABLE ENERGY WEEK
AALBORG UNIVERSITY DENMARK
UCL
LUT University
Challenges in pathways towards a 100% renewable energy system
Thursday 20 June 2019, 14.00-15.30, Charlemagne, Jenkins, Rue de la Loi 170, 1000 Brussels, Belgium
sEEnergies
INNOPATHS
reINVEST
17-21 JUNE 2019
SHAPING EUROPE'S ENERGY FUTURE
#EUSEW19


SUSTAINABLE ENERGY WEEK
Challenges in pathways towards a 100% renewable energy system
The role of energy mapping in modelling
Bernd Möller
Europa-Universität Flensburg, Germany
Aalborg University, Denmark
AALBORG UNIVERSITY DENMARK
UCL
LUT University
reINVEST
INNOPATHS
sEEnergies
17-21 JUNE 2019
SHAPING EUROPE'S ENERGY FUTURE
#EUSEW19

## Why integrate mapping in modelling?

- Renewable energy sources are seemingly abundant. They are limited only by spatial and economic constraints
- Much of the currently available energy system data is aggregated to the macro level
- Spatially distributed energy processes require spatially explicit models



## Important questions to ask

- How can the quantitative basis for scenarios of energy system transition towards spatio-temportal processes be established?
- Geographically, what limits the economic potential of distributed resources like wind, biomass, district heating?
- How much of an energy source is within economic reach of potential and current infrastructures?

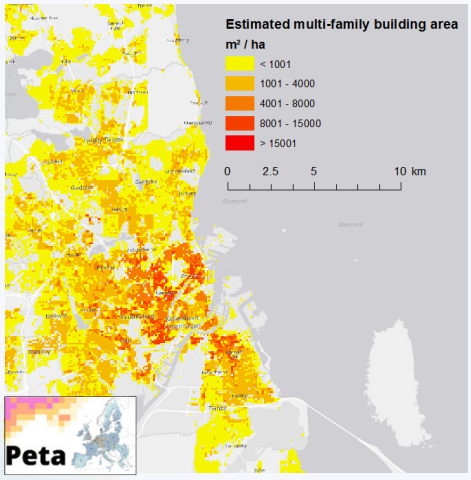
# Methods

- Three central methods allow for a spatially explicit modelling of distributed resources and their association to elements of energy systems
  - Spatial disaggregation: mapping the uncharted
  - Cost-supply modelling: to sort the wheat from the chaff
  - Spatial allocation: matching supply and demand locally



# Spatial disaggregation

## From aggregate figures to local distributions. Example: The built environment and heat demands across Europe

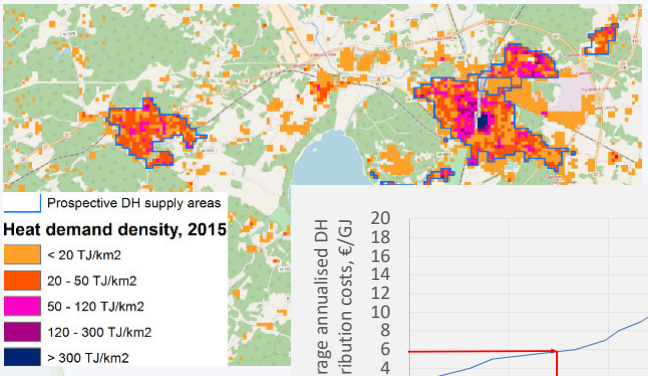



The Pan-European Thermal Atlas

- More than often the quantitative basis of energy modelling does not exist at local levels.
- Regression techniques allow for a model of spatially distributed phenomena, based on already mapped items.
- Here, the distribution of floor space is modelled using built-up intensity and population density.

# Cost-supply modelling

Specifying how much of a spatially distributed resource is within reach, economically. Example: potential for district heat







Peta

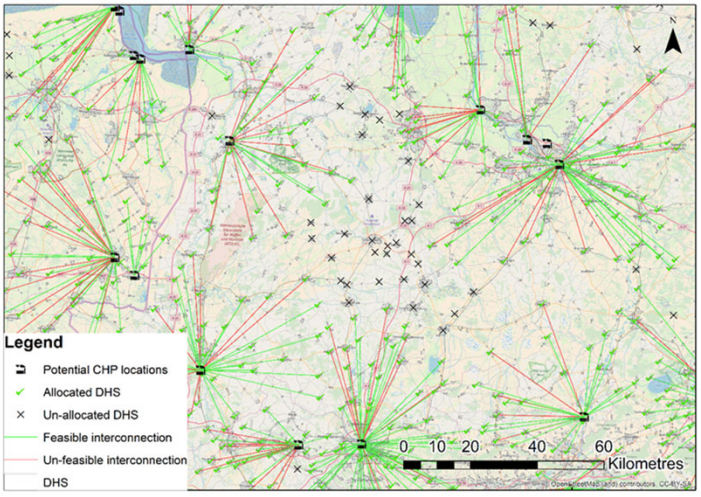
The Pan-European Thermal Atlas

- Not all what is technically possible is economically, socially and environmentally feasible.
- Potentials, costs and zoning of distributed resources are mapped to produce the basis for cost-supply analysis.
- Spatial cost supply curves of investments in heat distribution grids make local economic potentials of district energy explicit.

17-21 JUNE 2019
SHAPING EUROPE'S ENERGY FUTURE
#EUSEW19

# Spatial allocation

Specifying how local supplies and local demands overlap.
Example: allocation of excess heat to prospective district heating systems




- Local geography limits how demand and supply can be matched.
- Methods from operations research are used to allocate constrained resources to the nearest consumers in a least cost manner.

Peta

The Pan-European Thermal Atlas

17-21 JUNE 2019
SHAPING EUROPE'S ENERGY FUTURE
#EUSEW19

# Therefore: mapping

- Renewable energies and their infrastructures require a thorough mapping of local energy demands, infrastructure and resource costs
- Resources, costs and planning constraints need to be combined locally to locate and quantify sustainable solutions
- In the transition from centralised, fossil energy to distributed, sustainable solutions we need to remap the energy system.

17-21 JUNE 2019
SHAPING EUROPE'S ENERGY FUTURE
#EUSEW19


SUSTAINABLE
ENERGY WEEK
EUSEW.EU
EUENERGYWEEK
@EUENERGYWEEK
17-21 JUNE 2019
SHAPING EUROPE'S ENERGY FUTURE
#EUSEW19