Integrated and Intelligent Energy Systems

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Driver for changes - Demand by Society

ENERGY POLICIES

The government’s energy policy milestones up to 2050

In order to secure 100% renewable energy in 2050, the government has several energy policy milestones in the years 2020, 2030, and 2035. These milestones are each a step in the right direction, securing progress towards 2050.

2020
- Half of the traditional consumptions of electricity is covered by wind power

2030
- Coal is phased out from Danish power plants
- Oil burners phased out

2035
- The electricity and heat supply covered by renewable energy

2050
- All energy supply - electricity, heat, industry and transport - is covered by renewable energy

The initiatives up to 2020 will result in a greenhouse gas reduction by 35% in relation to 1990.


100% share of RE in the heating sector by 2035
Solution – Renewable Energy Sources
Resulting challenge – Fluctuations
The proposed solution – Smart Grid

- Electrification
- From centralized to decentralized production

- But still demand for stabilization

Therefore the CITIES Research Centre
The Concept of Integration in CITIES

... for operation and planning for future energy systems
The Concept of Scale of CITIES

Focus on Cities where all grids are close, demand is large

Integration

IT-Intelligence
Why the Scale of Cities?
City = Hub of networks/Grids

Energy System – District Heating (A network)
- Electricity
City + Network Hub + IT-Intelligence

= 

CITIES
Examples
Buildings deliver Flexibility to the Thermal System

Flexibility from buildings (single and aggregation)

Integration

From non-responsive to responsive

Prediction, forecast and control

Intelligence

Flexibility though

• heat pumps in district heating
• through storage (expensive, additional costs)
Sewages Systems integrates with the Electrical System
Sewages Systems produces bio-energy

Waste water treatment

Example

Resources

- Electricity
- Waste water

WWTP Energy Hub

- Treatment Process
- Digester
- Storage tank
- CHP
- Gas storage

Energy service

- Gas
- Electricity
- Heating

Alfred Heller
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The complete CITIES solution

Integration across grids and scales
Even more Grids ...

There is much more

+ Organisations + Humans
“... and they all lived happily ever after.”
Smart City = Complexity

We cannot handle this complexity to find sustainable and robust solutions.

We need Science that can manage these complexities.
From Smart City → To Smart Society

✓ We handle the big grids individually quite well
✓ We are on the way to handle "big data" (as shown at this event)

We need to master
✓ Integration
✓ Intelligence

We don’t know how-to:

- combine models, methods and tools
- do science in this complexity
  - where theories are to be combined in valid ways
  - where numerical methods are scalable
  - etc.

We need to advance science in it’s own right
DTU inviterer til præsentation af DTU International Energy Report 2016:

THE ENERGY-WATER-FOOD NEXUS – FROM LOCAL TO GLOBAL ASPECTS

**DATO OG TID:** 6. december 2016, 13:00 – 17:30

**STED:** DTU, mødelokale 1, Bygning 101 A, Anker Engelunds Vej 1, 2800 Lyngby

THANK YOU