Achieving flexible and sustainable energy systems

Skytte, Klaus

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Klaus Skytte
Klsk@dtu.dk
Energy Economics and Regulation
DTU Management Engineering, Denmark
DTU Management Engineering

Systems Analysis division

• Energy Systems Analysis (ESY)
  • Global and regional energy system optimisation models (all sectors)
  • Integration of intermittent renewables in energy systems
  • GIS prepossessing tools
  • Quantitative scenario analysis

• Energy Economics and Regulation (EER)
  • Analyses of regulatory frameworks and market designs that facilitate the transition towards larger share of renewable energy in the energy system, energy savings, and climate change
  • Policy analysis and economic assessment
  • Economic and social aspects of wind integration, coupling of markets, and flexibility options
  • Demand behaviour based on technical/economic or econometric models

• Climate Change and Sustainable Development
  • Modelling of climate Change mitigation, renewable energy, and smart cities;
  • Decision making tools for climate change impacts and adaptation

• Transport Economics
Denmark - The Country of Wind and District Heating

Wind 42% share (2015).

Political targets:

• **2020**: 50% of traditional electricity consumption covered by wind power

• **2035**: All electricity and heat based on renewable energy
  (Obs. the previous governmental position)

• **2050**: The total* energy supply based on renewable energy
  *Total energy system incl. heat, gas, transport, industry, etc.

District heating:

• 50% share of total heat supply, with 69% CHP and <1% P2H
Current electricity system

The trichotomy of energy policy

Decarbonised energy systems

- Market design
- Sector coupling
- Flexibility

Cost effectiveness

Reliability

Sustainability

- Centralised fossil-intensive supply
- Electricity market only

- Decentralised
- Variable renewable energy
- Phase-out of fossil peakers

System integration
Flexibility Resources/Market Actors

Electrification/sector coupling - Finding ramping capabilities
Sector coupling
Electrification as source of flexibility

Distribution of EU energy consumption
(Source: EU Heating and Cooling strategy)

Large flexibility potentials in electrification of the energy sectors

Hindered by regulatory barriers

Remove barriers

From technical to realisable potentials

Framework conditions

Market design
Direct regulation
Fiscal policies
Support schemes
Grid regulation

Remove barriers
Choice of heat supply - at different electricity prices

Patchwork regulation between electricity and heat
- Taxes on electricity consumption
- Heat is taxed at the fuel input
- Biomass exempted for taxes

More heat only boilers.
Decoupling of electricity and heat markets
Flexibility for Variable Renewable Energy Integration in the Nordic Energy System

Integrating a high share of variable renewable energy through enhanced energy market interaction

Identify and assess regulatory and technical pathways towards coherent Nordic energy systems in 2050 based on strong interaction between different energy markets that ensure resilience, sustainability and efficiency.

Nordic Energy Research Flagship project
September 2015 - March 2019
Thank you for your interest

Klaus Skytte
Head of Energy Economics and Regulation
System Analysis Division
DTU Management Engineering
Technical University of Denmark
klsk@dtu.dk,
http://www.sys.man.dtu.dk/