Barriers for flexibility in the district heating-electricity interface

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Motivation - Flex4RES

- The new electricity systems: From centralised and fossil-intensive systems to sustainable and integrated
- Increasing shares of variable renewable energies (VRE)
- Integration costs expected to increase
  Need of more flexibility

- **Potentials and technological solutions exist** - both
  - locally in the power market,
  - from other regions through the transmission lines, or
  - by coupling to the **heat**, gas or transport sectors, or even storage facilities.

- Need for
  - **REthinking of the framework conditions**

  Why are the potentials not used today? Barriers/drivers
Hypotheses

Comparative advantages of combining different energy markets, both with respect to flexibility, but also with respect to synergy and economics.

The Baltic/Nordic power market is well functioning despite a few technical challenges.

With the right coupling to the underlying national and local energy markets for heat, gas, and transport fuels, enough flexibility can be generated in a cost efficient way and so embrace a larger amount of VRE.

Holistic system approach to the Baltic/Nordic energy system with flexibility obtained across energy markets with respect to flexibility at the power markets.
Integrated Coherent Energy Systems
Challenges in a larger perspective

Energy system integration

Biomass Supply

Infrastructure

Regulation & market design

Energy Efficiency

CCS
Outline of the talk today

- District heating-electricity interface
- Barriers for flexibility
- Discussion
District Heating in the Baltics/Nordics

District heating is widely used in most Baltic/Nordic countries and thus represents a flexibility source of considerable magnitude which is only partly exploited today by the power market.

Source: Euroheat, 2015
Which technologies can provide flexibility?

Today flexibility is mainly provided by CHP combined with heat storages (water tanks)
• Water tanks are widely installed and used in Denmark, Finland and Sweden

Electric boilers and large heat pumps
• Several barriers, e.g. existing taxation
• Consequently: very limited use in the Baltic/Nordic countries
District heating-electricity interface

1. Variable RE → Electricity demand
   - CHP
   - Power to heat
   - Heat storage
   - Heat demand

2. VRE power supply exceeds the demand
   - No need for additional flexibility

3. VRE power supply exceeds the demand
   - Power demand exceeds the VRE supply
Different market frameworks

The Baltic/Nordic power market is an integrated competitive market

DH is supplied by local monopolies regulated by national rules and authorities

• Not designed to provide integration with the power market
• National rules sometimes work against DH providing flexibility services to the power market
Barriers to flexibility

Market development, e.g.
- Large central power plants run fewer and fewer hours due to low electricity prices
- No incentives to investment in flexible capacity

Regulatory set up, e.g.
- grid tariffs and taxes on electricity use
- local DH utilities prefer to substitute gas-fired CHP by biomass heat-only boilers due to tax exemptions for biomass

Baltics:
Limited use of
- market prices for CHP
- thermal storages/water tanks
Choice of heat supply - different el prices net costs

- Electric boilers
- Heat pumps
- Heat only boilers
- CHP

Optimal technology choice
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
Choice of heat supply
With dynamic tariffs

- Electric boilers
- Heat only boilers
- CHP

Heat price vs. Electricity price graph

Optimal technology choice
Dynamic tariff
Summing up

• Trend towards more *market integration* and need for more *flexibility*
• Large potentials in district heating

• Need for a holistic system approach in order to identify and assess *regulatory and technical pathways* towards coherent energy systems

REthink market designs and regulation
• Make RE market ready & Markets RE ready

• Coherent changes in market designs, regulatory framework condition, and coupling of markets
• Dynamic tariffs and taxes?
Thank you for your interest

Questions?

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