



Flex4RES

Flexible Nordic Energy Systems



Barriers for flexibility in the district heating-electricity interface

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Nordic Energy Research

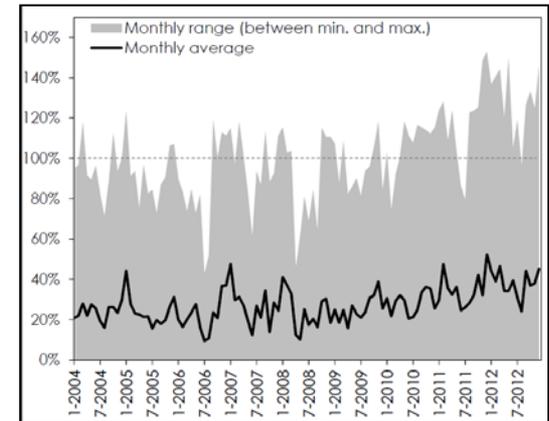
Motivation - Flex4RES



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- 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

Wind production share in DK-West





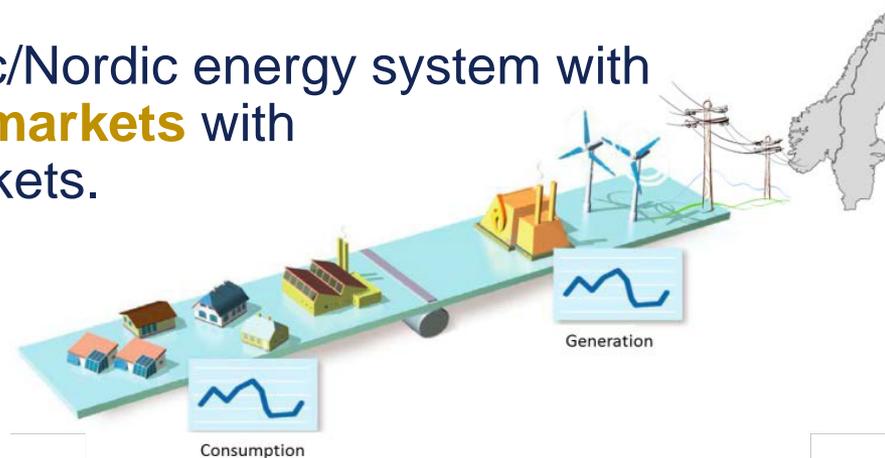
Hypotheses

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



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Ressource



The green battery icons  indicate storage capabilities.

System

International Denmark

International Denmark

Services



Transport

Intelligent Heating/Cooling

Intelligent/Flexible Buildings

Industrial Processes

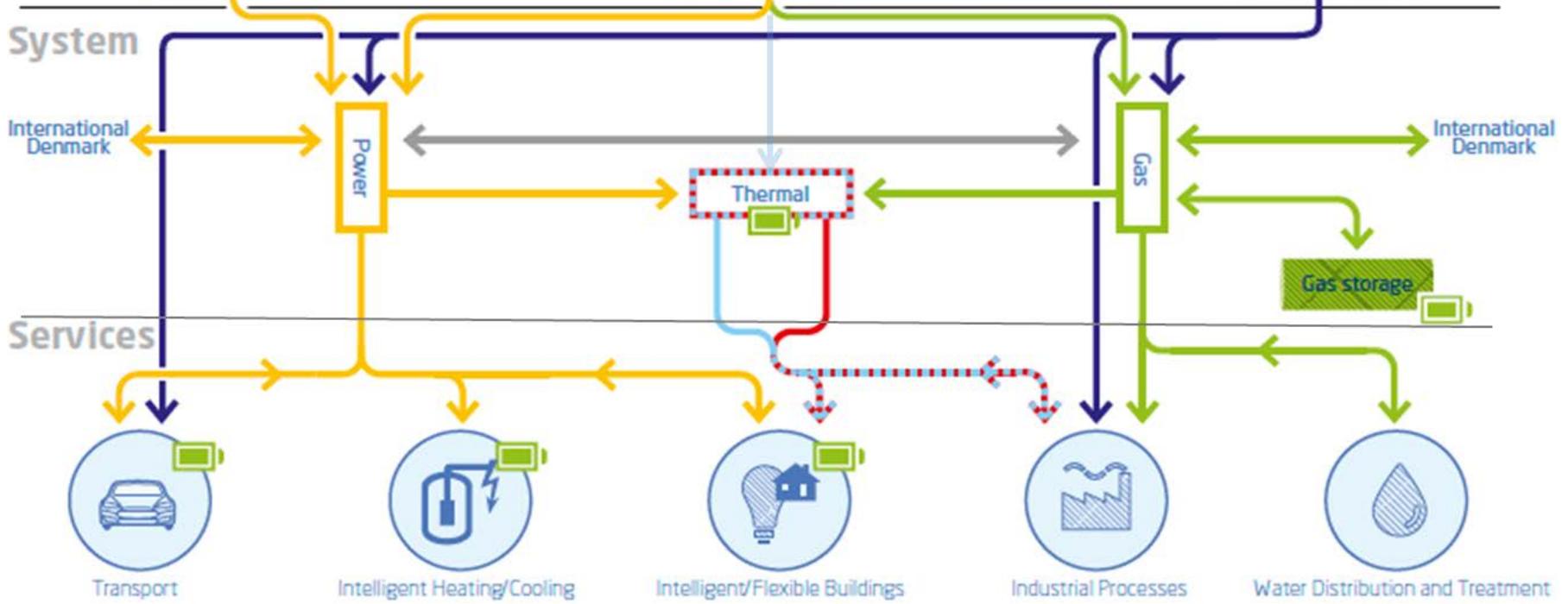
Water Distribution and Treatment

Power

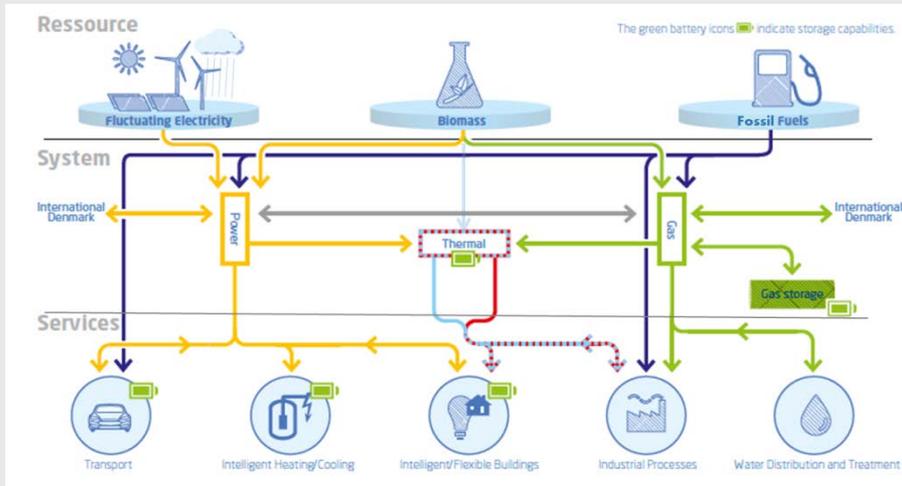
Thermal

Gas

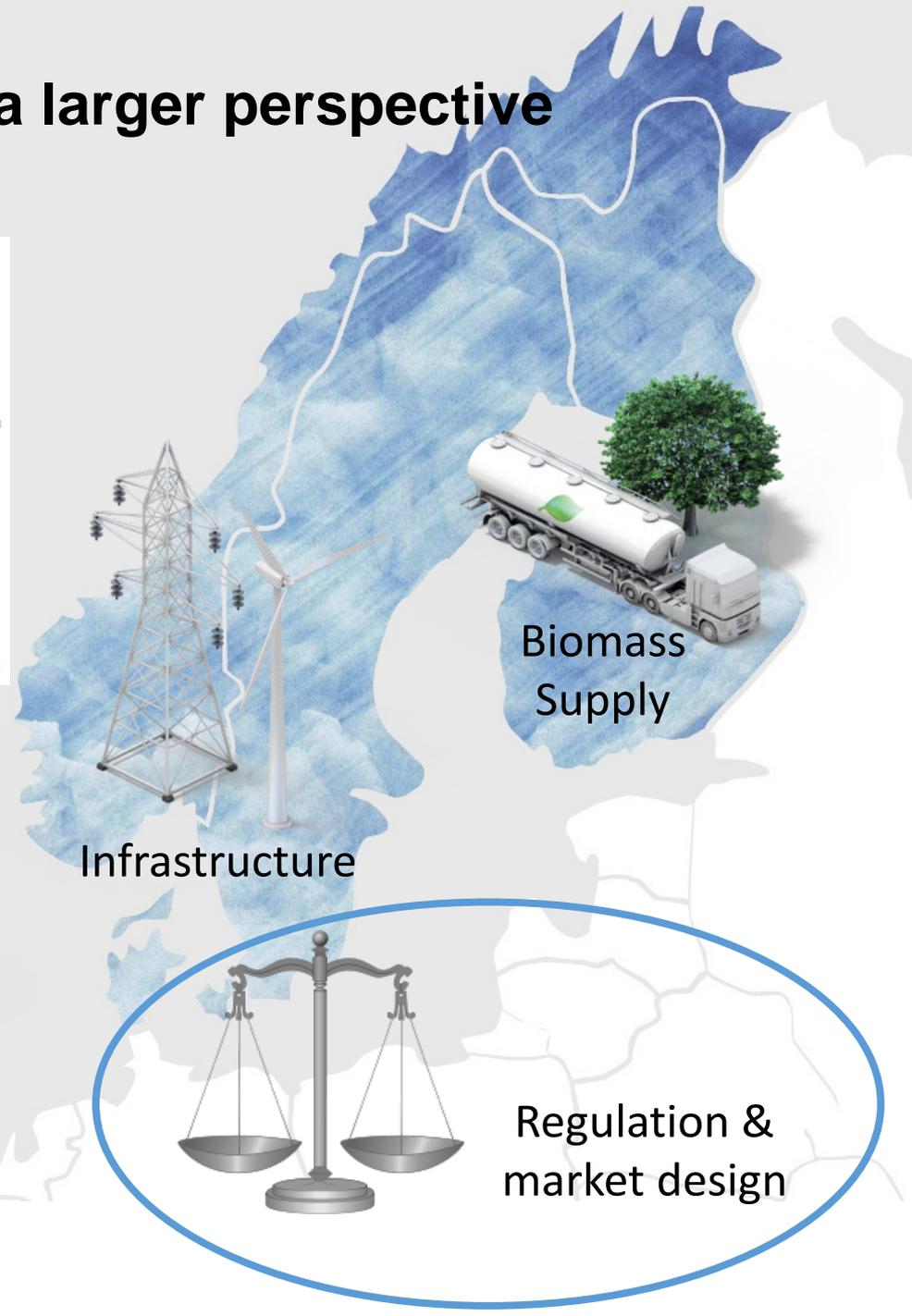
Gas storage



Challenges in a larger perspective



Energy system integration



Energy Efficiency



CCS



Regulation & market design

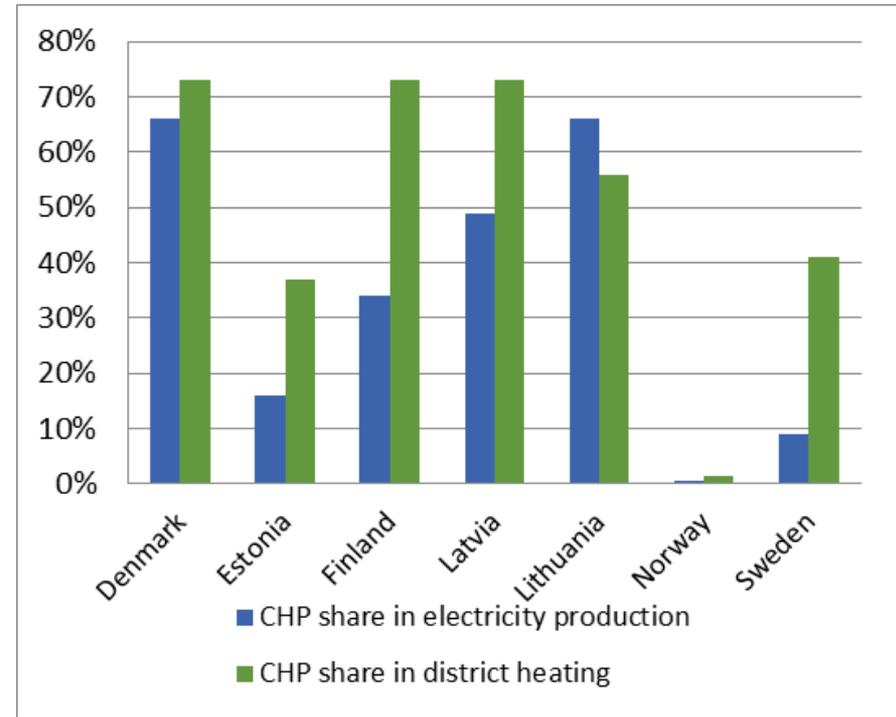
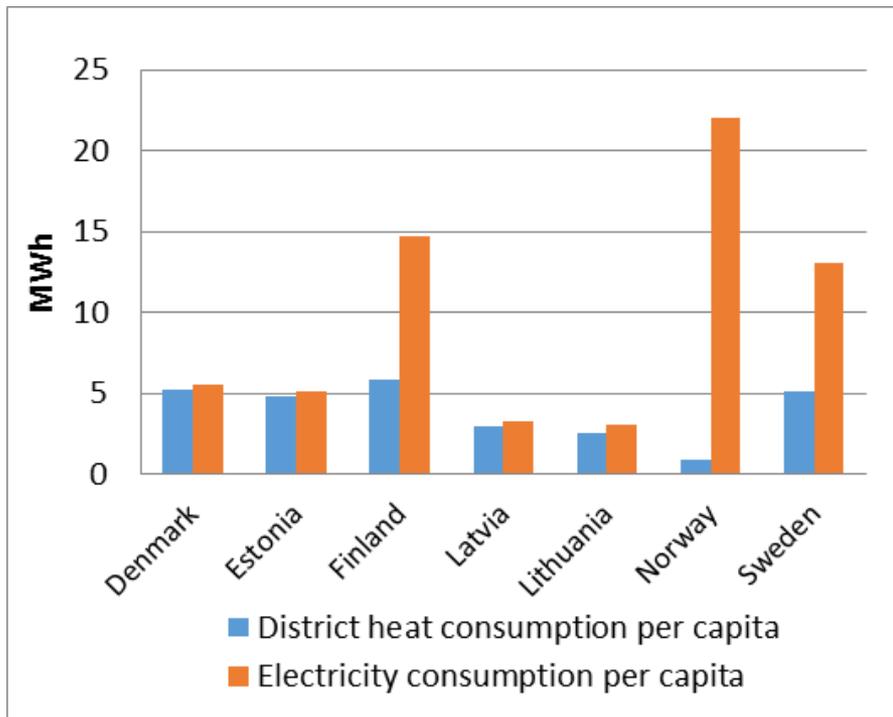


Outline of the talk today

- District heating-electricity interface
- Barriers for flexibility
- Discussion



District Heating in the Baltics/Nordics



Source: Euroheat, 2015

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



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

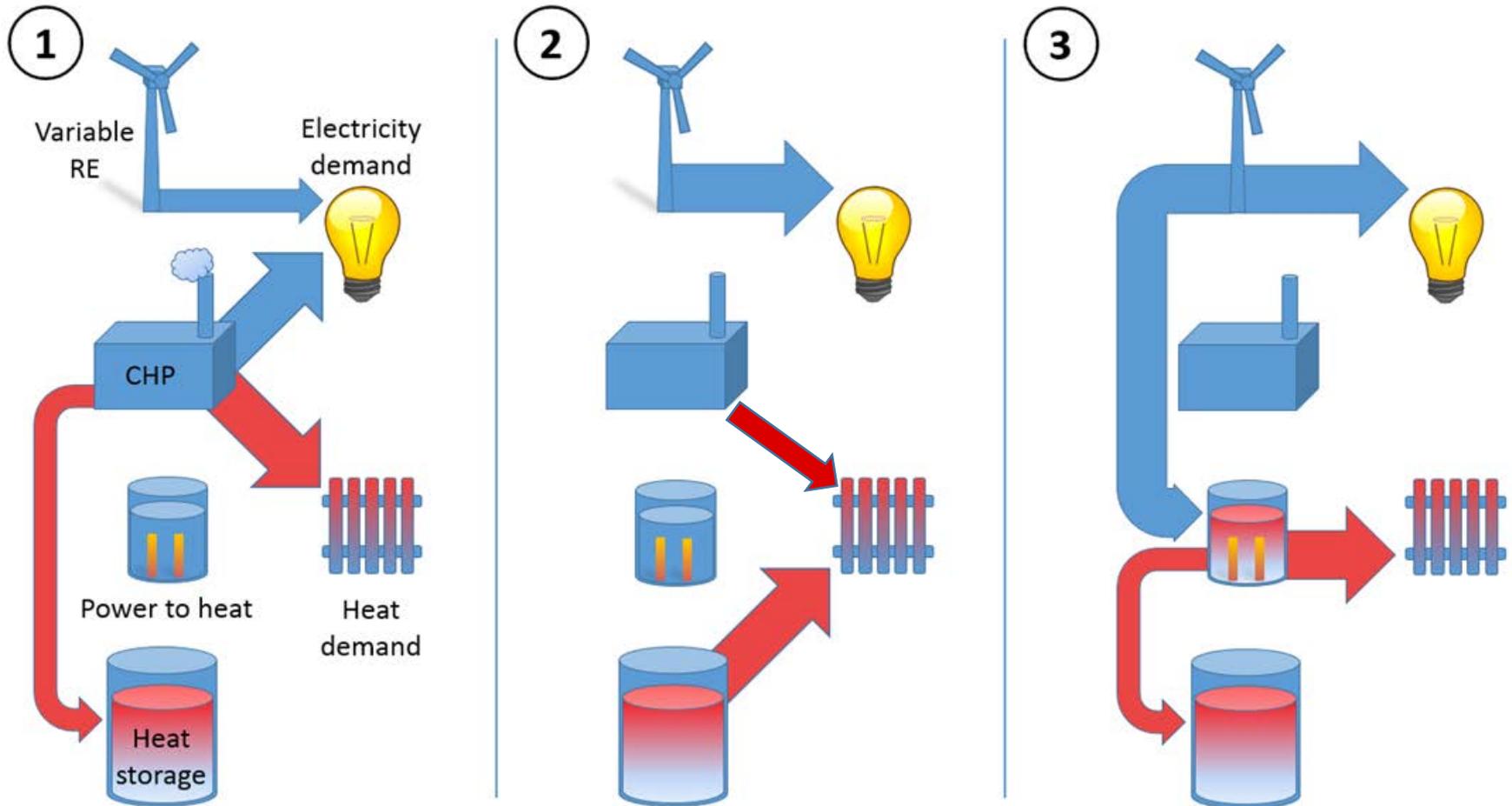
Electric boilers and large heat pumps

- Several barriers, e.g. existing taxation
- Consequently: very limited use in the Baltic/Nordic countries

District heating-electricity interface



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Power demand exceeds the VRE supply

No need for additional flexibility

VRE power supply exceeds the demand



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.

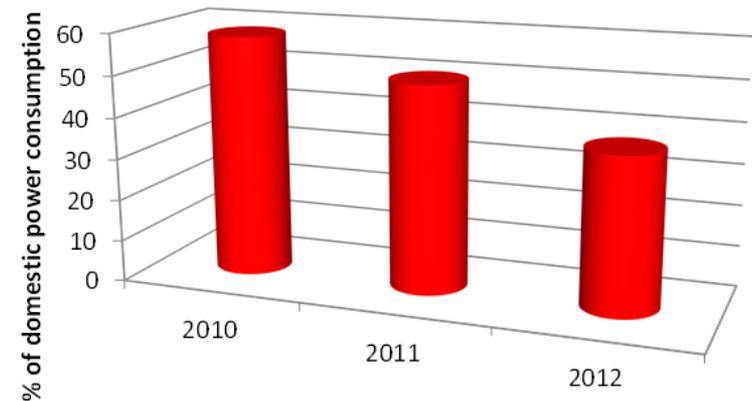
- grid tariffs and taxes on electricity use
- local DH utilities prefer to substitute gas-fired CHP by biomass heat-only boilers due to tax exemptions for biomass

Baltics:

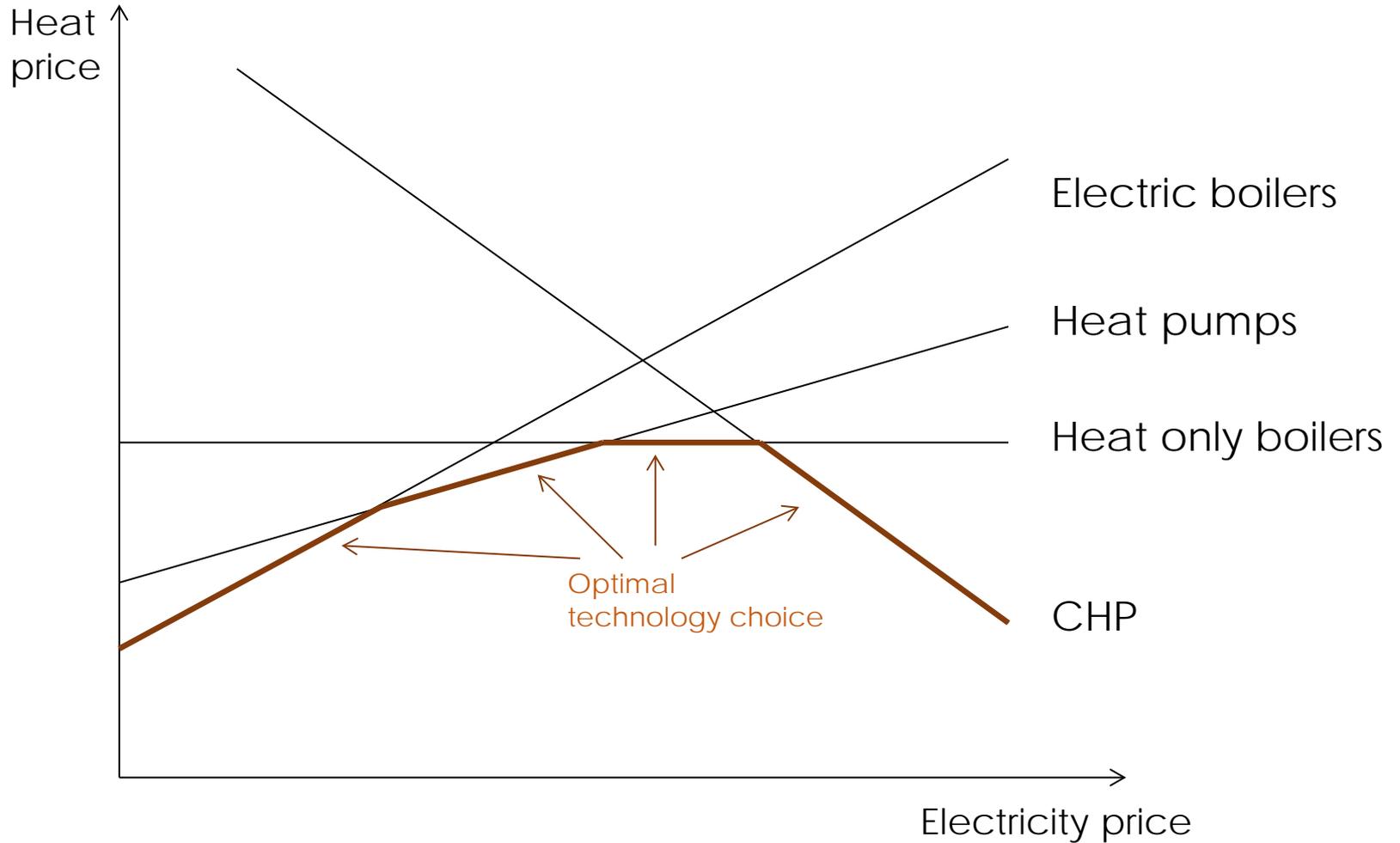
Limited use of

- market prices for CHP
- thermal storages/water tanks

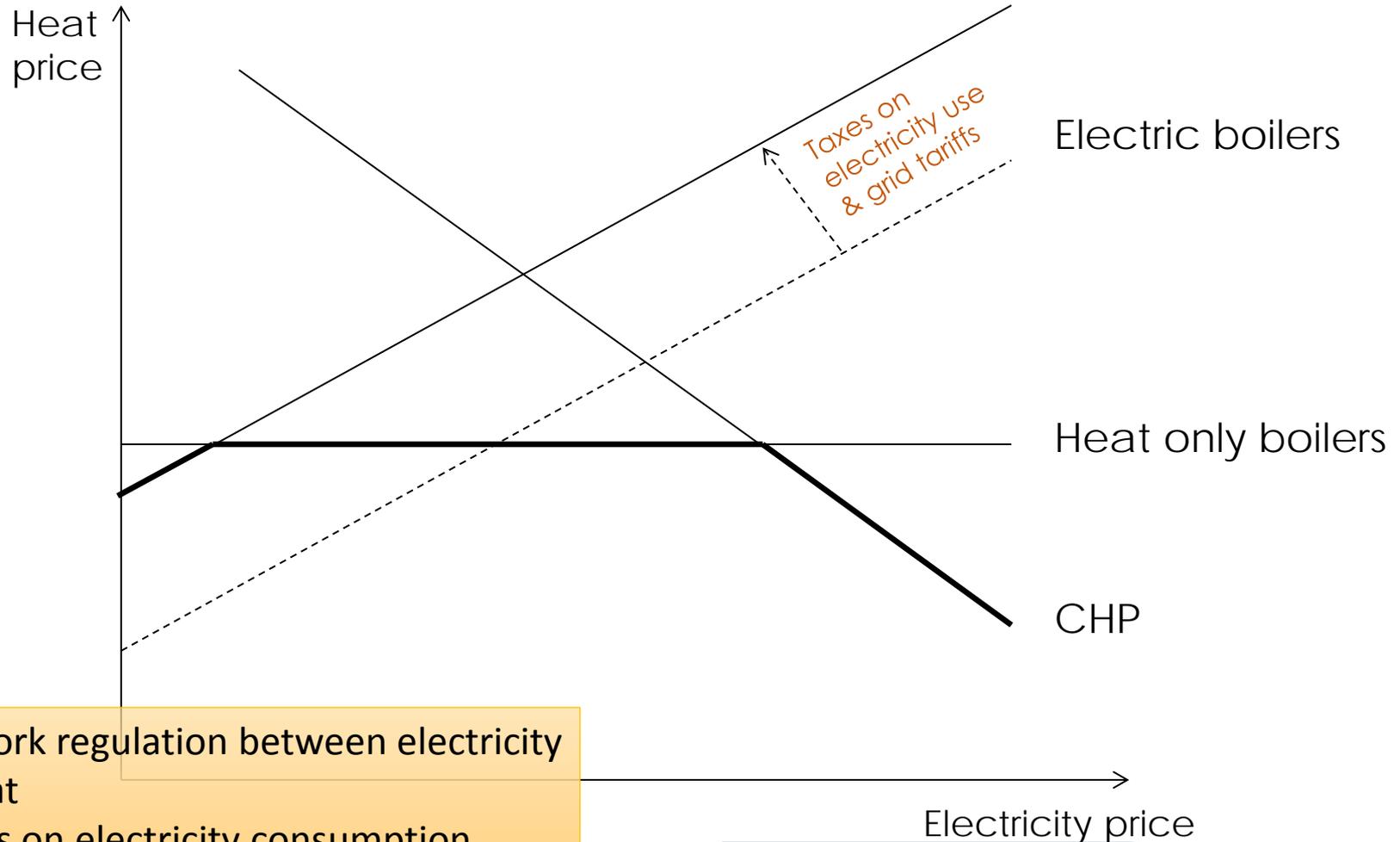
Central power plants' share of domestic power consumption



Choice of heat supply - different el prices net costs



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



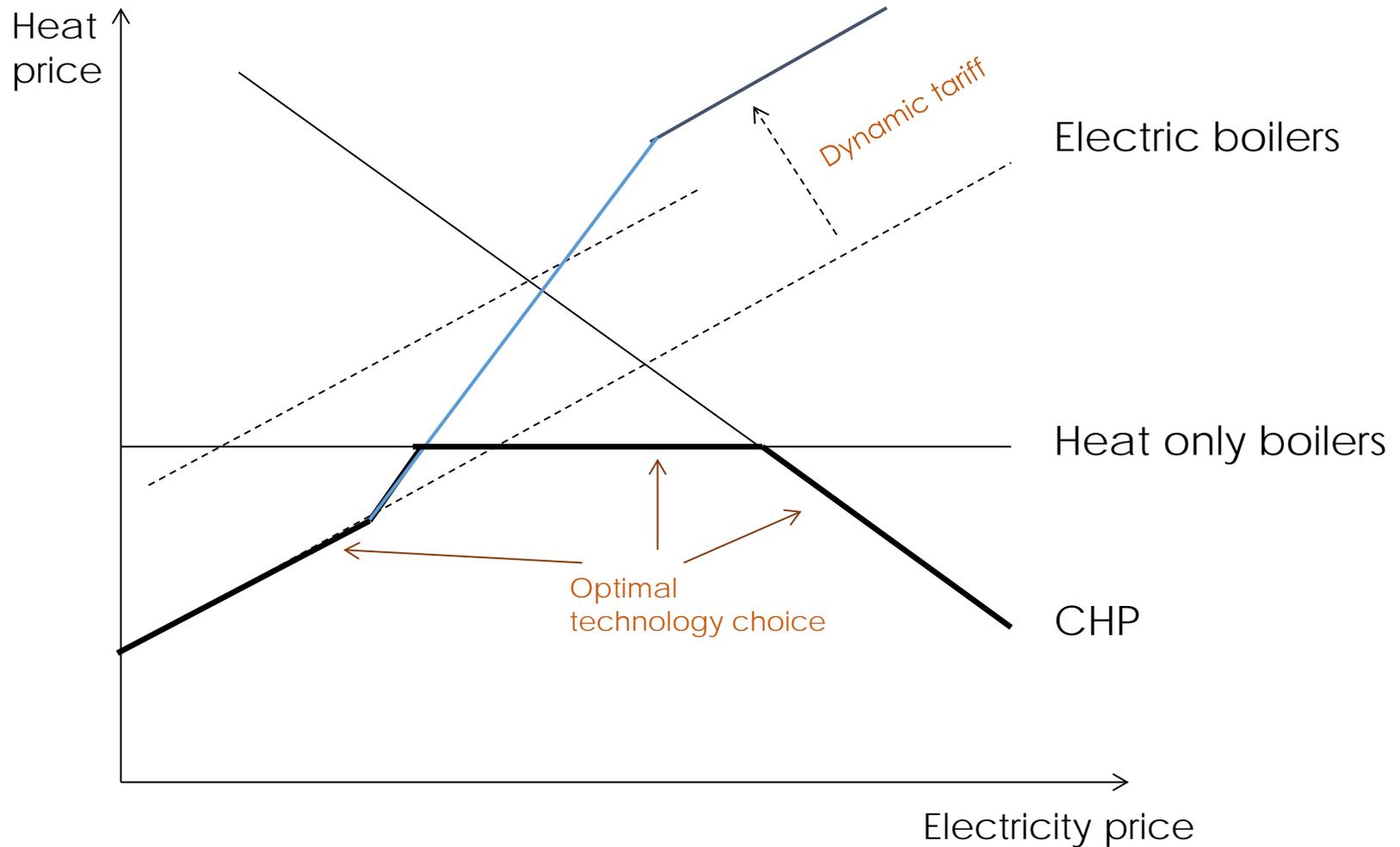
More heat only boilers.
Decoupling of electricity
and heat markets

Choice of heat supply

With dynamic tariffs



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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



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Questions ?



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