



Flex4RES

Flexible Nordic Energy Systems



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Flexibility for Variable Renewable Energy Integration in the Nordic Energy System

Nordic Energy Research Flagship project
Riga 08 December 2017

RTU partner

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Riga Technical University

project coordinator:

Klaus Skytte Energy Economics and Regulation
DTU Management Engineering, Denmark



Nordic Energy Research
Nordic Council of Ministers



The FLeX4RES partners

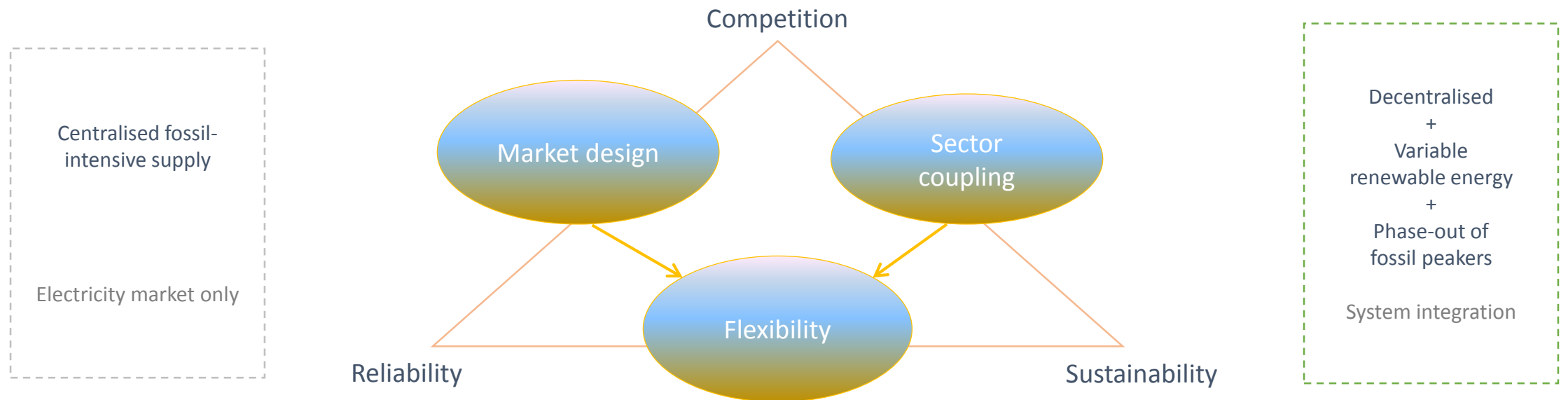
- DTU, Denmark
- NMBU, Norway
- KTH , Sweden
- Alto University, Finland
- RTU, Latvia
- RAM-lose edb. Denmark
- NIFU, Norway
- SSE, Sweden
- TUT, Estonia

The Future Energy System

Goals and RE-thinking of the Nordic Energy Co-Operation



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Objectives



The primary objective of Flex4RES is to

Identify and assess regulatory and technical pathways towards coherent Nordic energy systems

The secondary objectives are to:

- a) **Estimate the potentials and costs of flexibility** in the Nordic power market created by the coupling of and increased interaction between different energy markets (electricity, heat, gas and transportation).
Estimate the need for flexibility in the future Nordic power market.

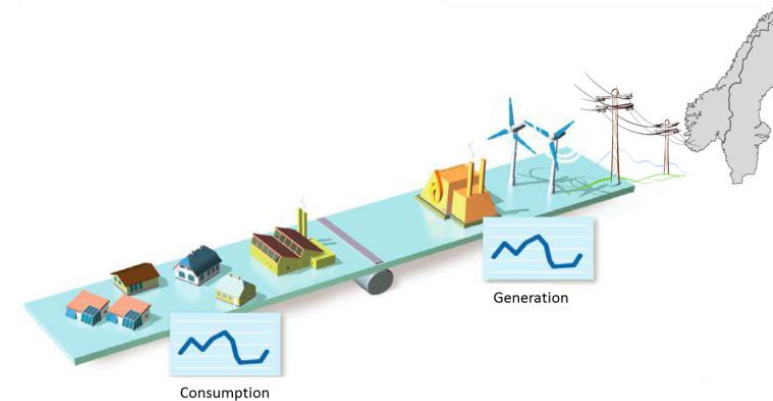
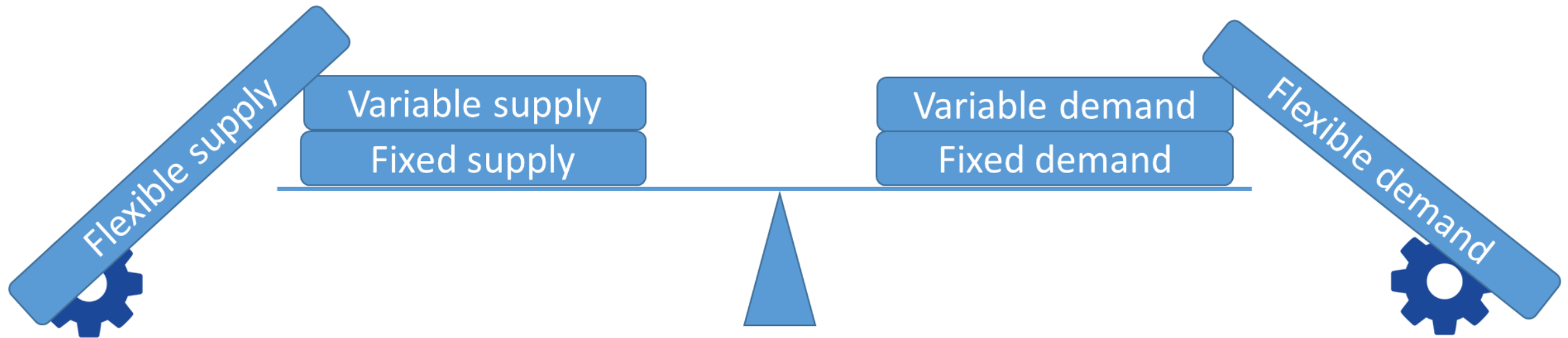
- a) **Identify regulatory and technological barriers.**
- b) **Develop coherent regulatory frameworks and market designs** that facilitate energy market couplings that are optimal for the Nordic conditions in an EU context.

- a) **Adapt a high-resolution Nordic energy market model** covering heat, power and transport for quantification of the impacts of different market couplings, regulatory frameworks and market designs.
Estimate the cost and benefits of a coherent energy system framework.

Flexibility definition



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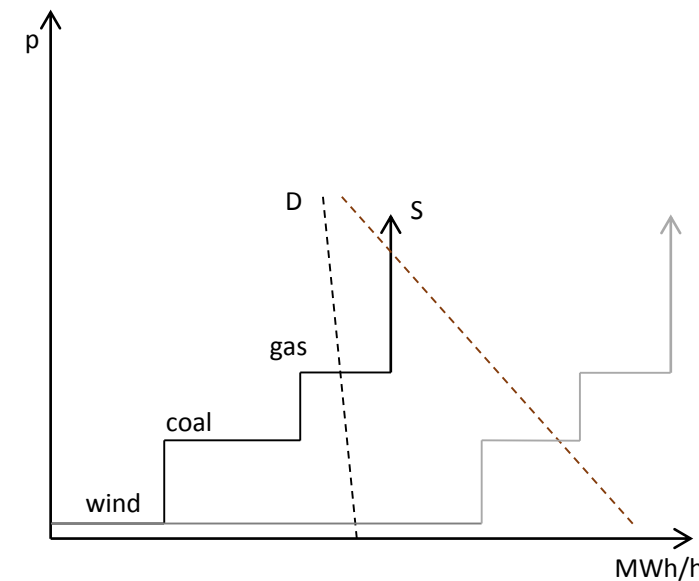
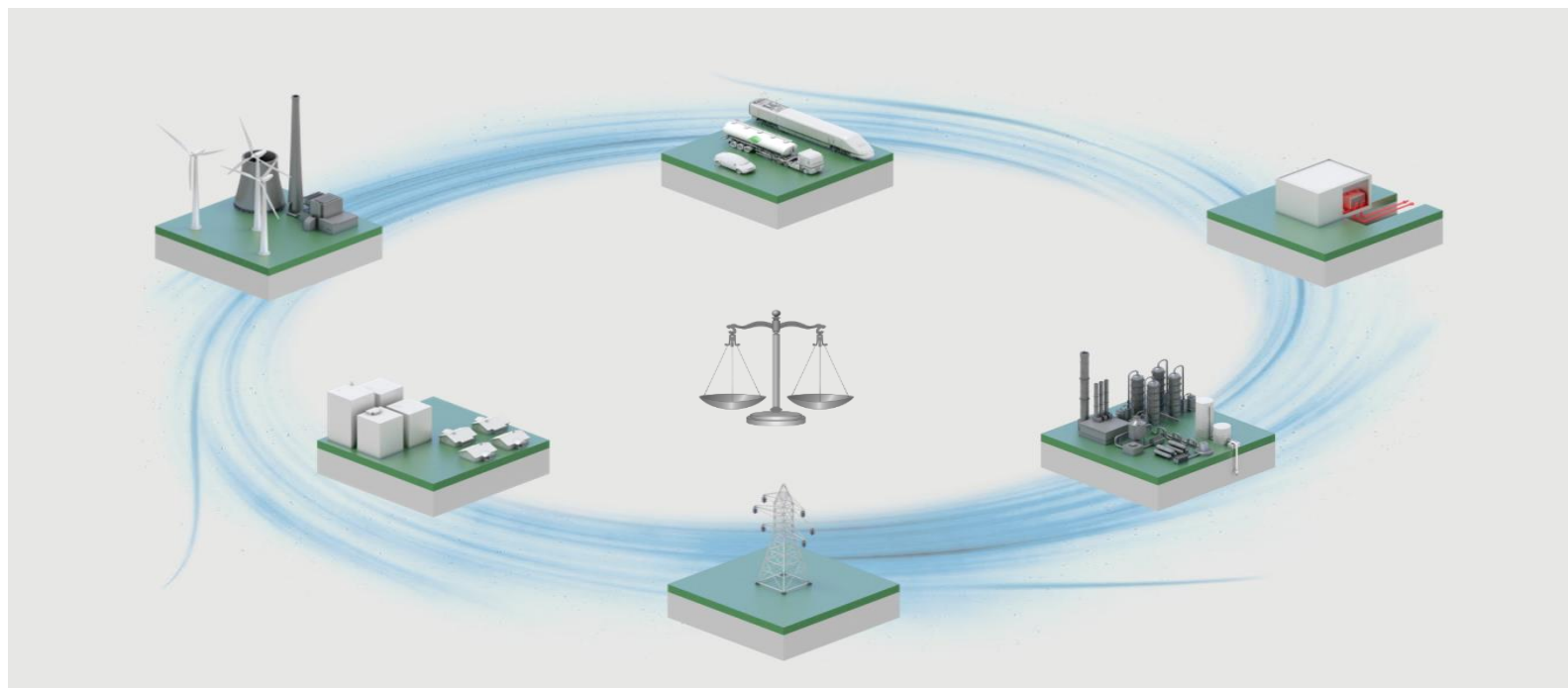
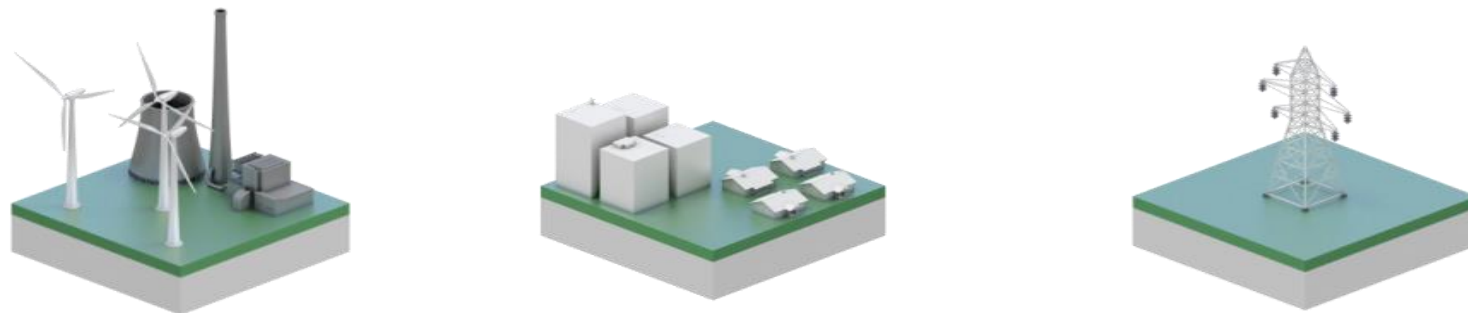


Flexibility Resources/Market Actors

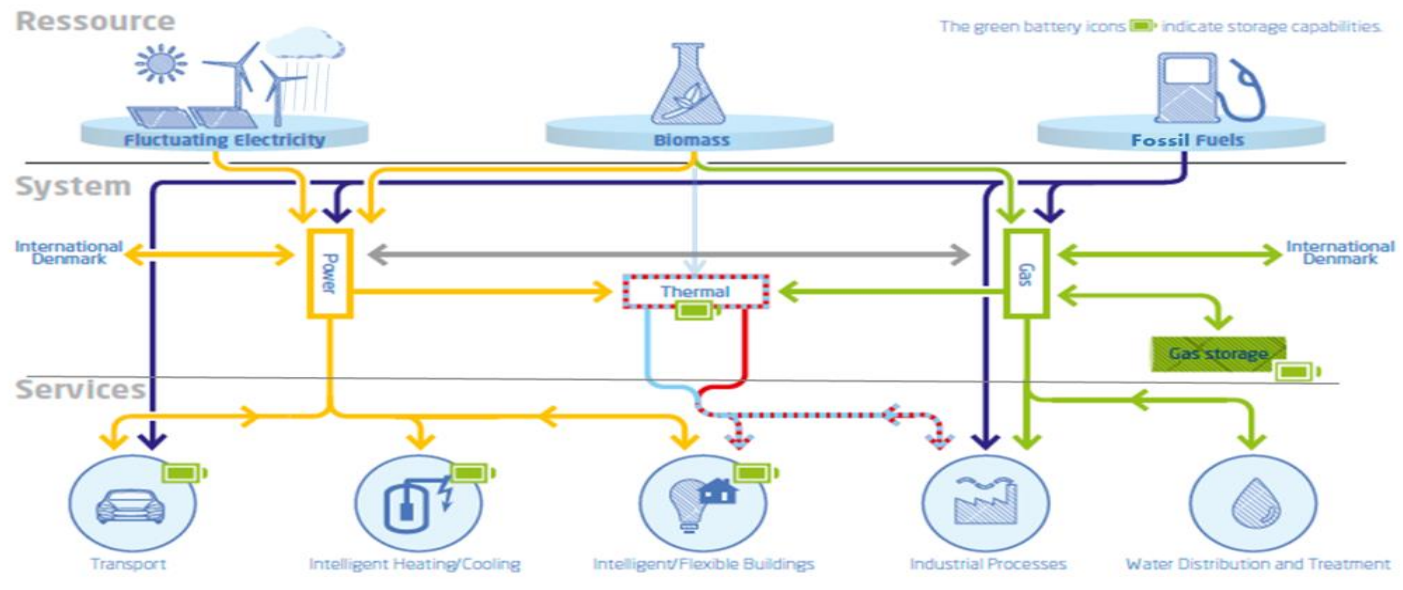
Electrification/sector coupling - Finding ramping capabilities



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Challenges in a larger perspective



Energy system integration



Energy Efficiency



CCS



Regulation & market design

Infrastructure

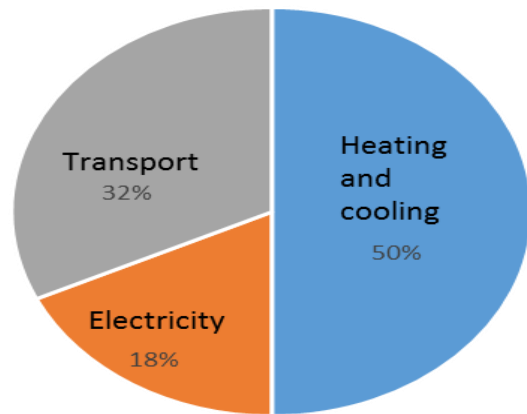
Biomass Supply

Sector coupling

Electrification as source of flexibility

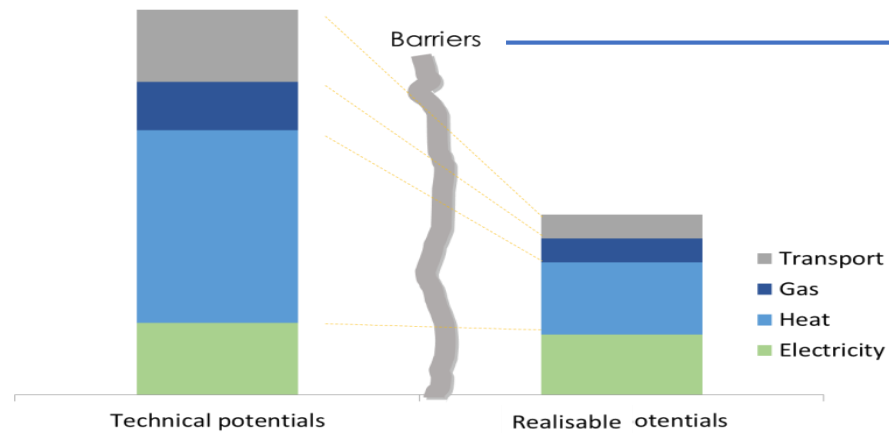


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Distribution of EU energy consumption
(Source: EU Heating and Cooling strategy)

From technical to realisable potentials



Framework conditions

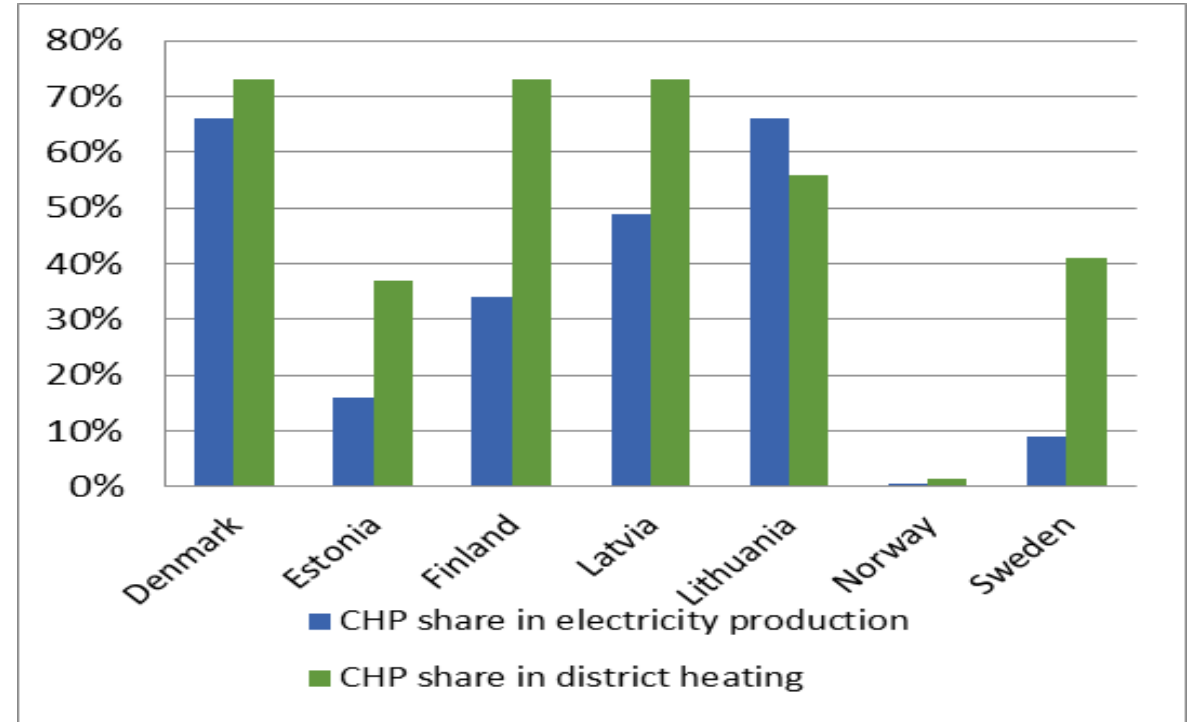
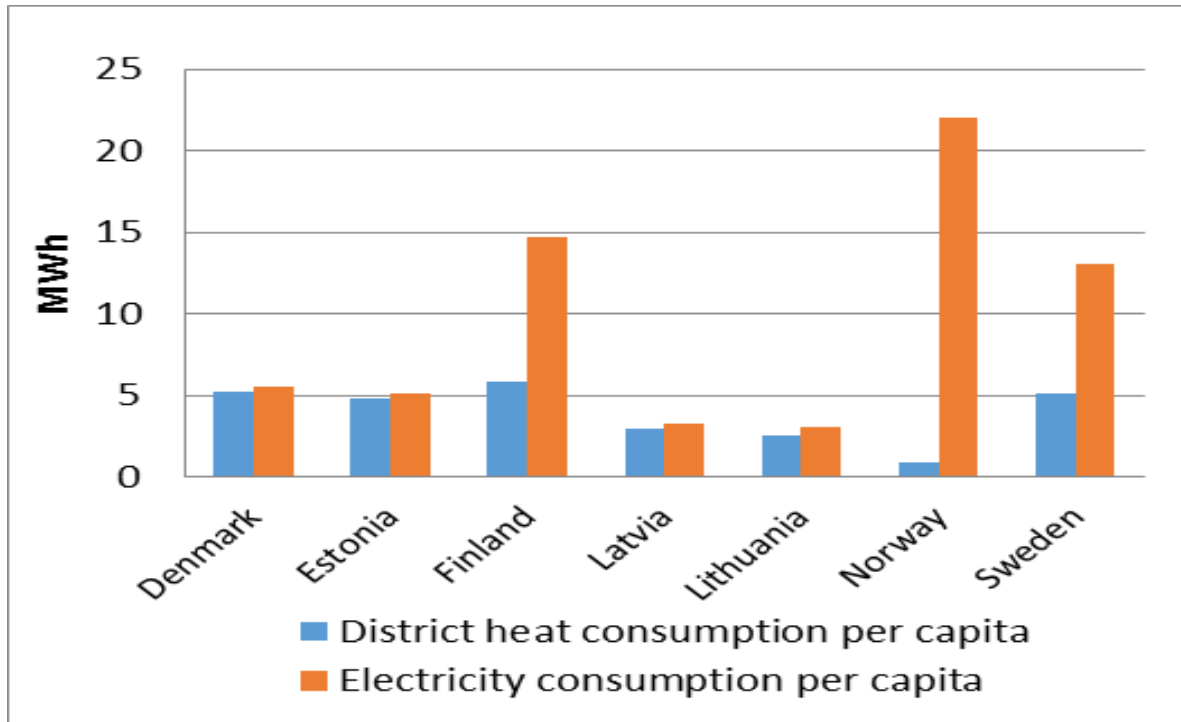
- Market design
- Direct regulation
- Fiscal policies
- Support schemes
- Grid regulation

Large flexibility potentials in electrification of the energy sectors

Hindered by regulatory barriers

Remove barriers

District Heating in the Baltics/Nordics



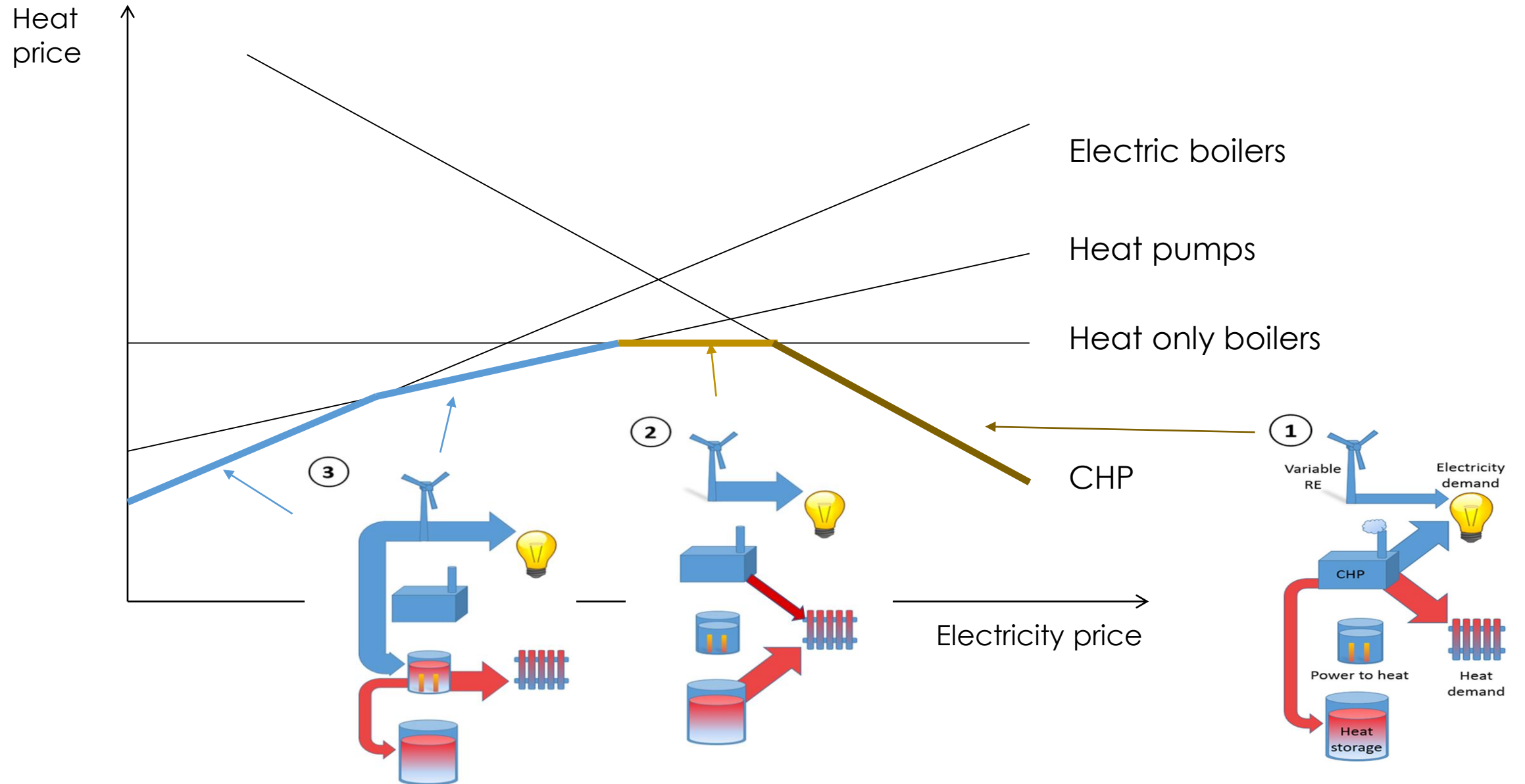
Source: Euroheat, 2015

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

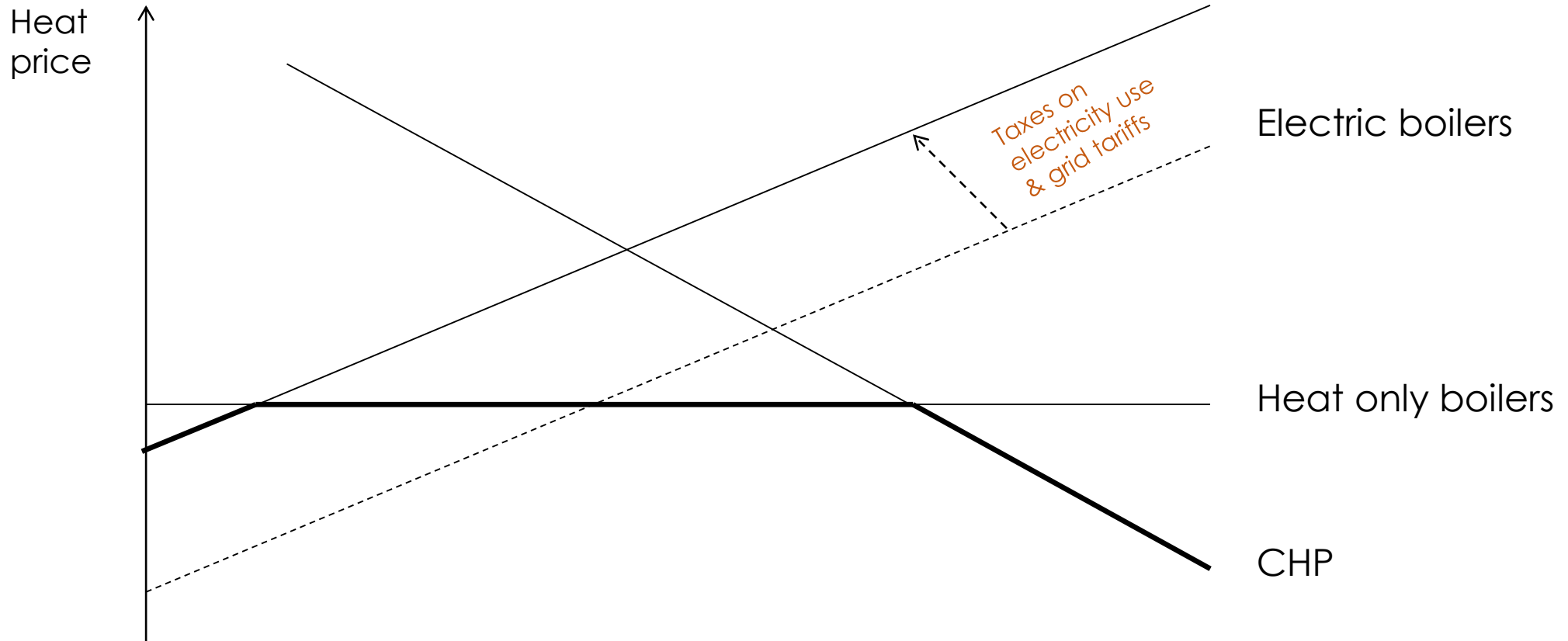
District heating-electricity interface



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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



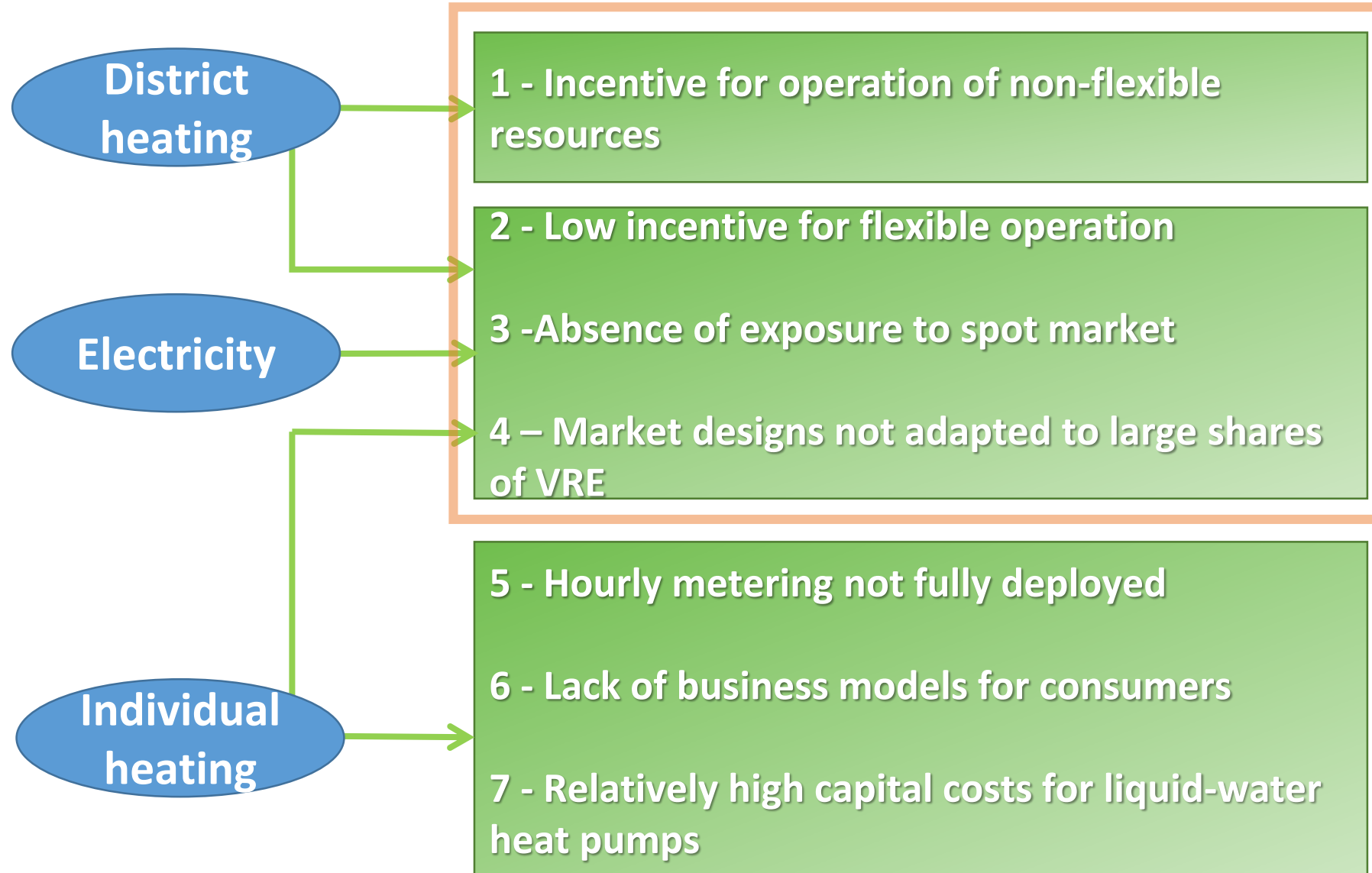
More heat only boilers.
Decoupling of electricity and heat markets

Common and sector-specific barriers

- examples



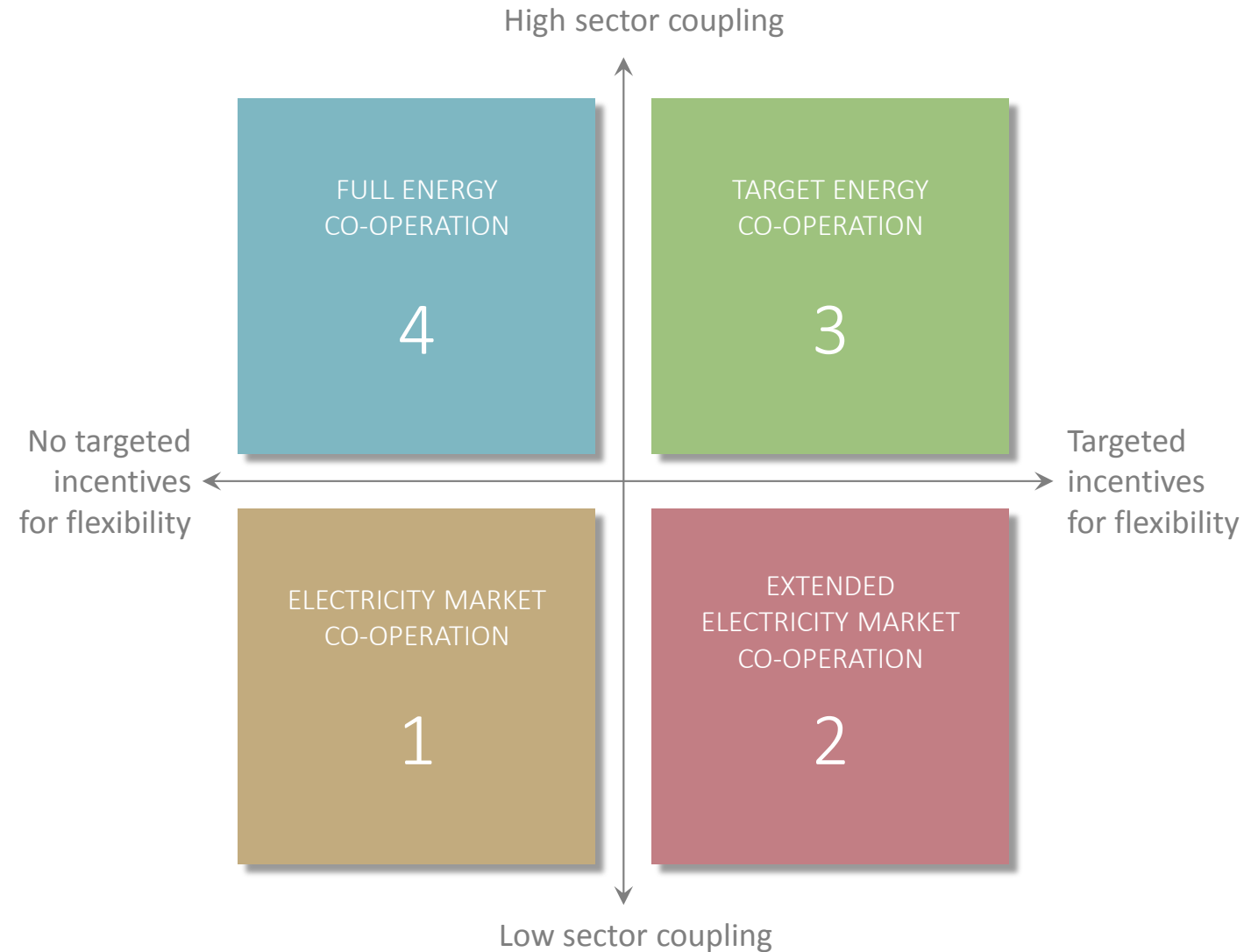
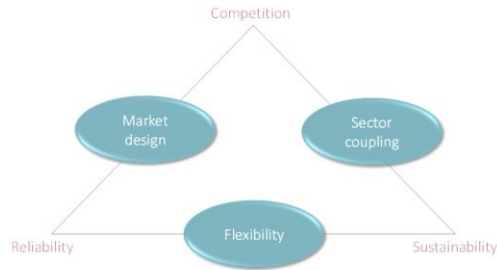
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Nordic Energy Co-Operation Policy Scenarios towards 2050



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Work Packages

WP1: Flexibility need and potentials

Task 1.1 Review and Method development

Task 1.2 Flexibility potential cost curves, Technology catalogue

Task 1.3 Flexibility need, uncertainty and impact on reserve need

WP2: Framework conditions

Task 2.1 Review of existing framework conditions

Task 2.2 The Nordic energy system designs

Task 2.3 Market integration, frameworks, and market designs

Task 2.4 Coherent market scenario set-ups

Task 2.5 Pathways to a flexible Nordic energy system

WP3: Energy system analysis of integrating energy systems

Task 3.1 Model update / adaption

Task 3.2 Market coupling analyses

Task 3.3 Analytical results: comparison and interpretation

WP 4: Policy recommendations

Task 4.1 Economic impact of VRE and flexibility

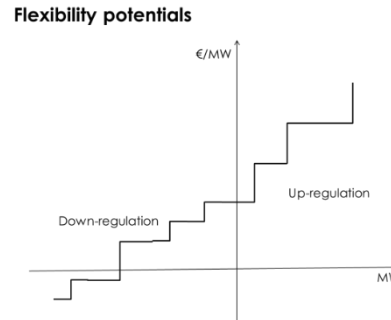
Task 4.2 Creating a sustainable and stable Nordic energy System

WP 5: Dissemination and capacity building

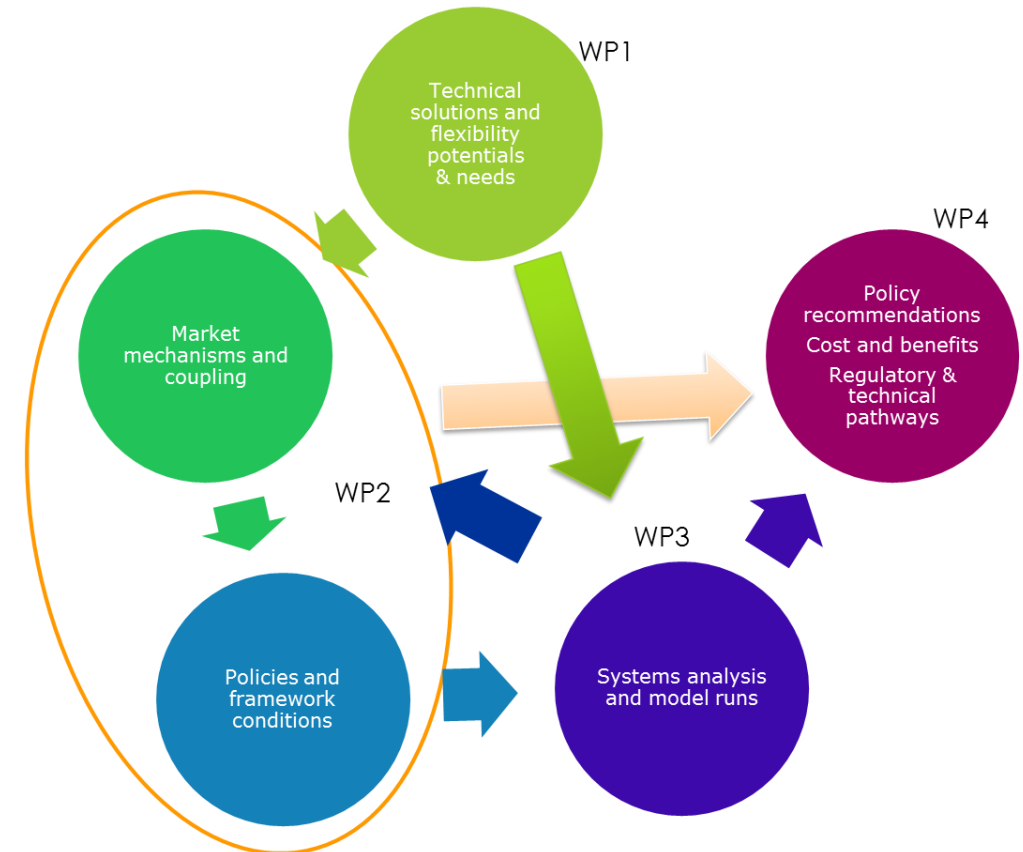
Task 5.1 Website, LinkedIn, and Newsletter

Task 5.2 Advisory board meetings

Task 5.3 Workshops/Seminars



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Project meeting 13-14 March



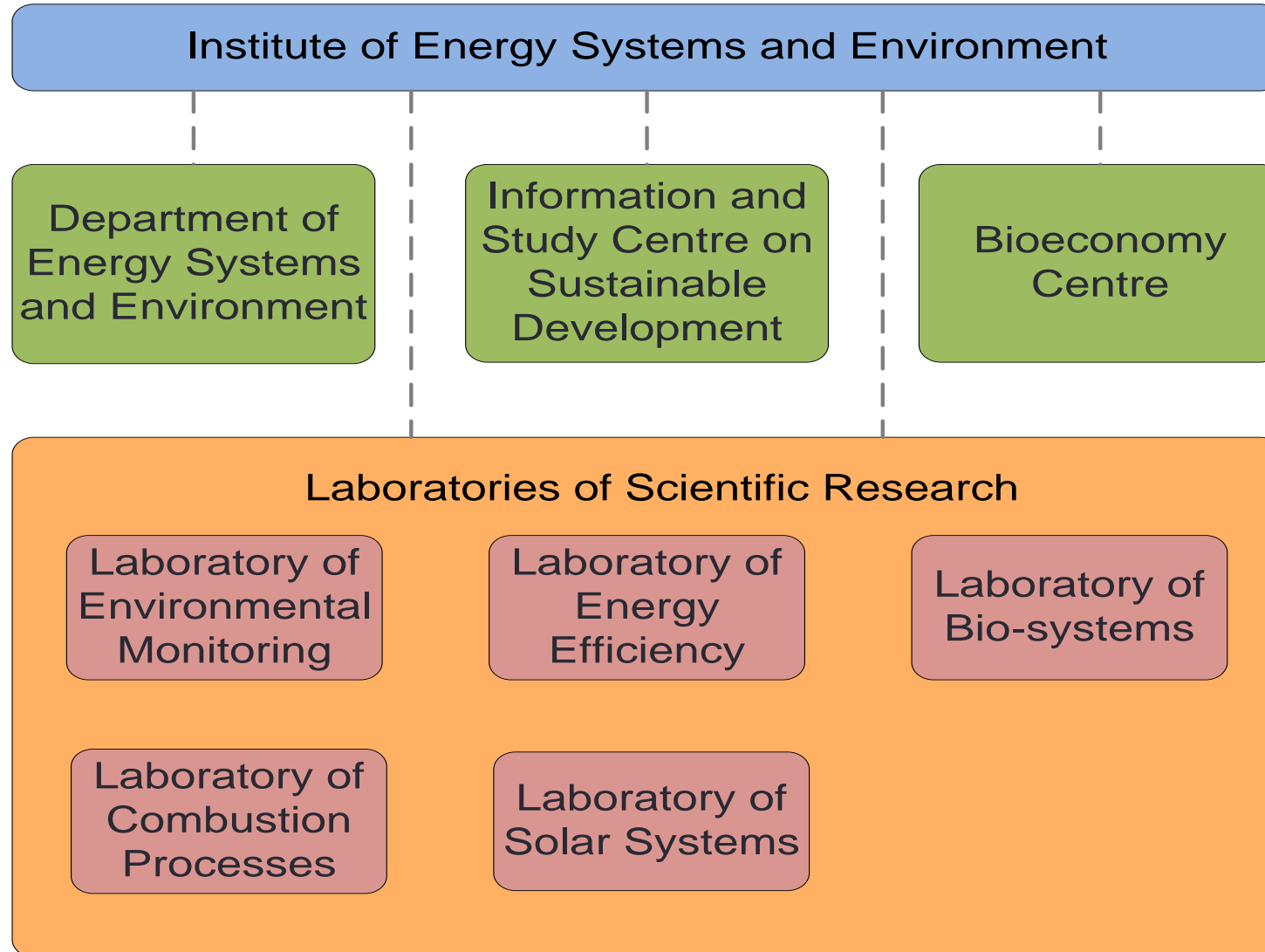
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www.Flex4RES.org

Structure of the Institute of Energy Systems and Environment in RTU



Scientific and academic personnel



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- 6 professors
- 4 associate professors
- 11 assistant professors
- 9 lectors
- Research personal - 45



The average age – 36

In total: 55 persons

2 – habilitated doctors, **27** – doctors (incl. **22** – young scientists),

26 – Experts of the Latvian Academy of Science,

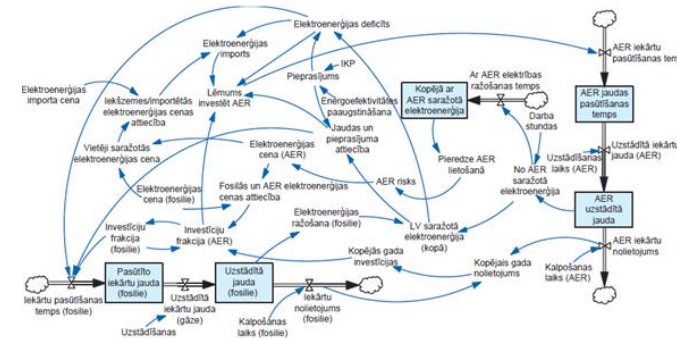
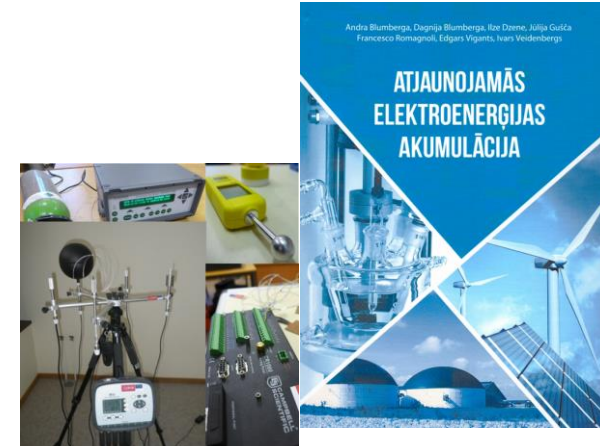
15 – EU experts

Research topics



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- Zero emission technologies
- Demand side management, consumers/prosumers
- Smart energy management
- Combustion technologies
- Environmental and energy management
- Renewable energy
- Bioeconomy
- Sustainable development
- Environmental monitoring
- Cleaner production
- Ecodesign
- Energy efficiency in buildings
- Bioresources
- Environmental modelling: system dynamics and LCA



Scientific cooperation (ongoing)



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- **H2020 project:**
 - Leadership: 2 projects
 - Partnership: 2 projects
- **Interreg programme:**
 - Partnership: 3 projects
- **Nordic Energy Research programme:**
 - Partnership: 8 projects
- **ERA-NET programme:**
 - Partnership: 1 project
- **Erasmus and Erasmus+:**
 - Partnership: 1 project
- **Norwegian Grants:**
 - Partnership: 2 projects
 - Leadership: 5 projects



Erasmus+



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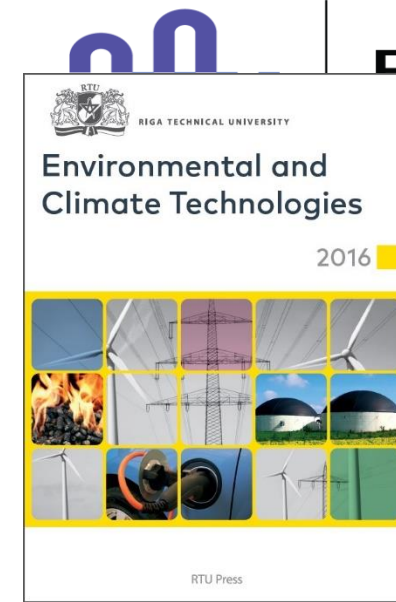
European Union
European Structural
and Investment Funds

International project
portfolio since 2004:
57 projects

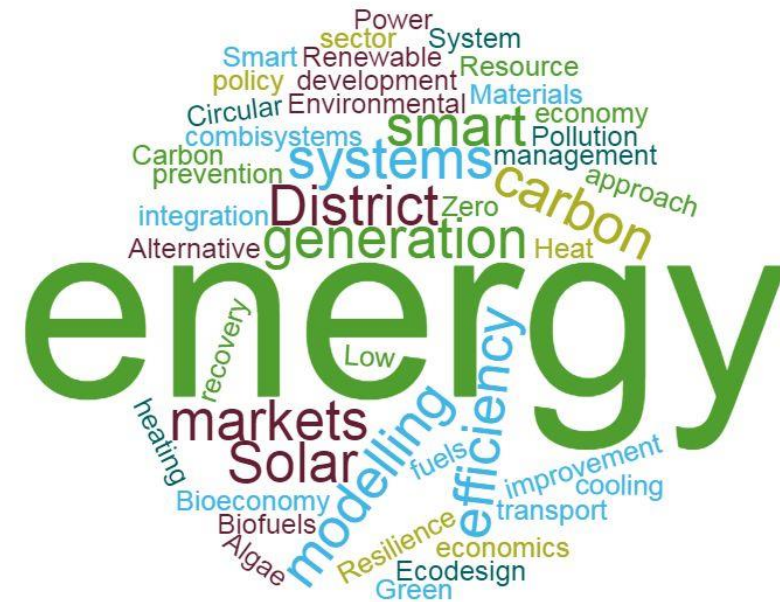
International journal *Environmental and Climate Technologies*

- Open access Journal
- Indexed in SCOPUS (**SNIP 1.316**) and **Web of Science**
- **2 issues per year**
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- Bioeconomy and low carbon development
 - Biofuels and alternative fuels
 - Energy and carbon markets
 - Energy and environmental modelling
 - Energy efficiency improvement
 - Energy management, policy and economics
 - Green transport systems
 - Heat and power generation, incl. district heating and/or cooling
 - Pollution prevention
 - Renewable energy
 - Resilience
 - Resource efficiency, circular economy and ecodesign
 - Smart energy and zero carbon technologies
 - System approach integration in energy sector
-
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