



## Nordic solutions for unlocking a decarbonised, sustainable energy future

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Nordic solutions for  
unlocking a decarbonised,  
sustainable energy future



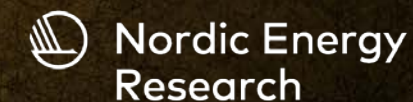
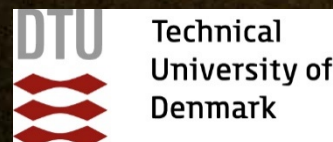
**Flex4RES**

Flexible Nordic Energy Systems

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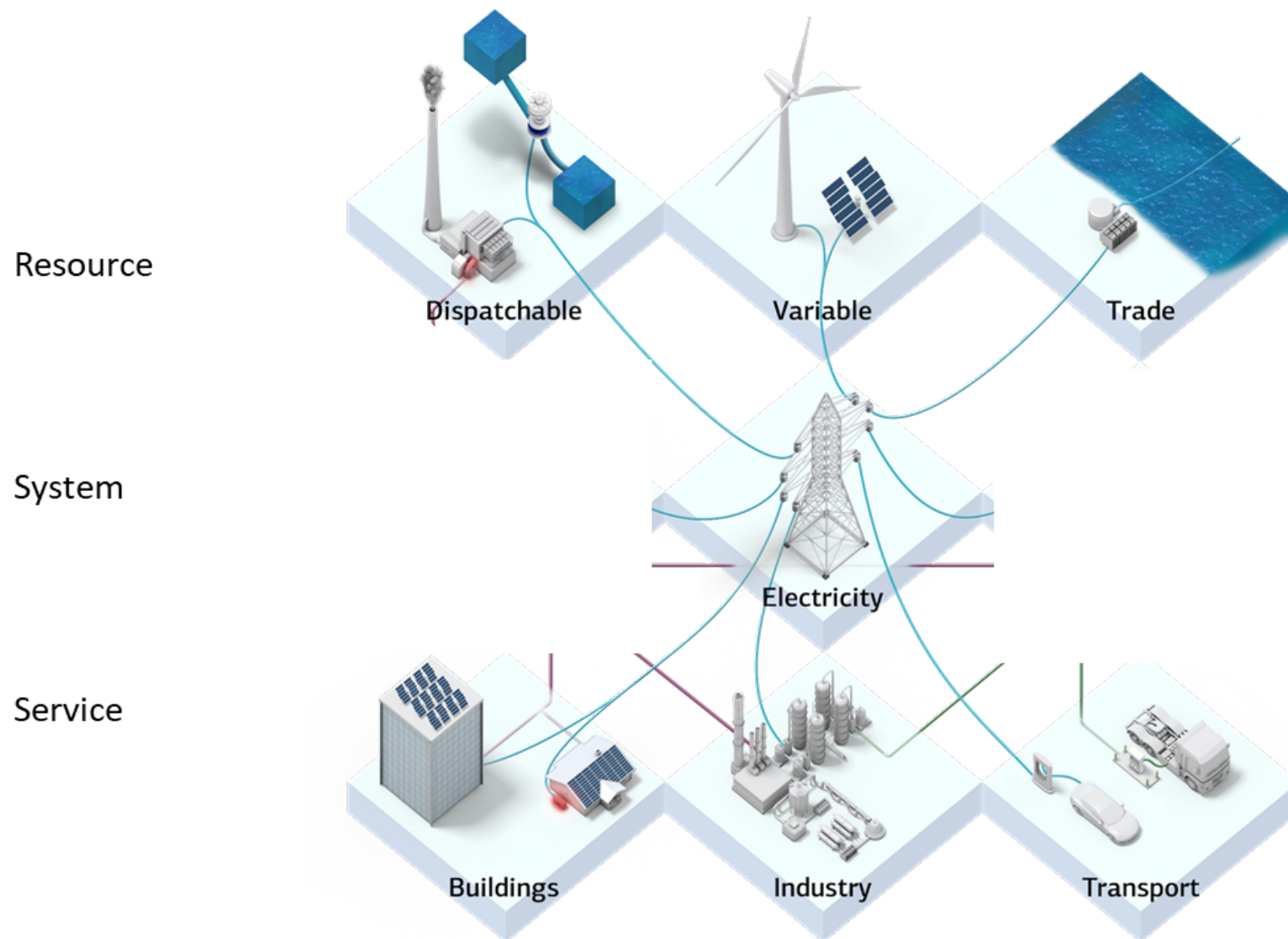


# Flexibility Resources

Finding ramping capabilities



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Supply flexibility

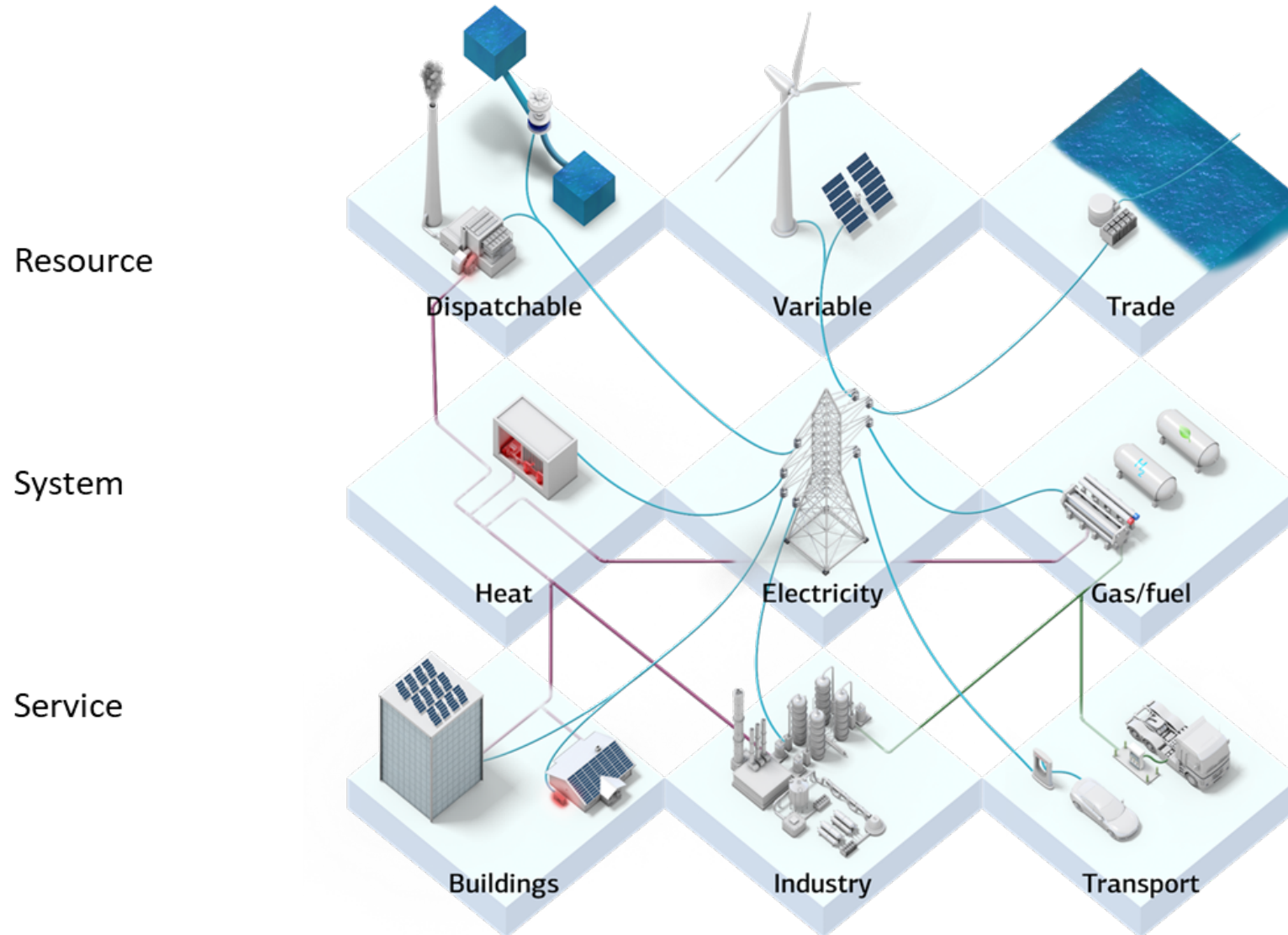
Demand responds

# Flexibility Resources

Finding ramping capabilities



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Supply flexibility

Sector coupling/  
Electrification

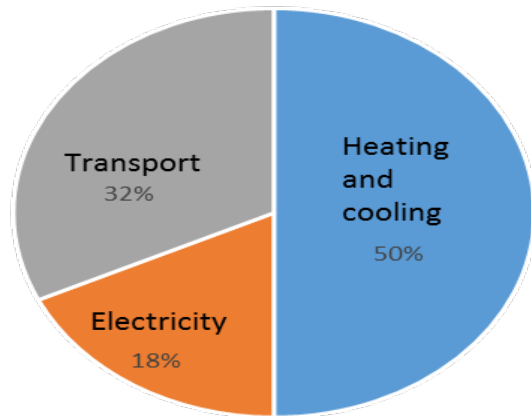
Demand responds

# Sector coupling

## Electrification as source of flexibility

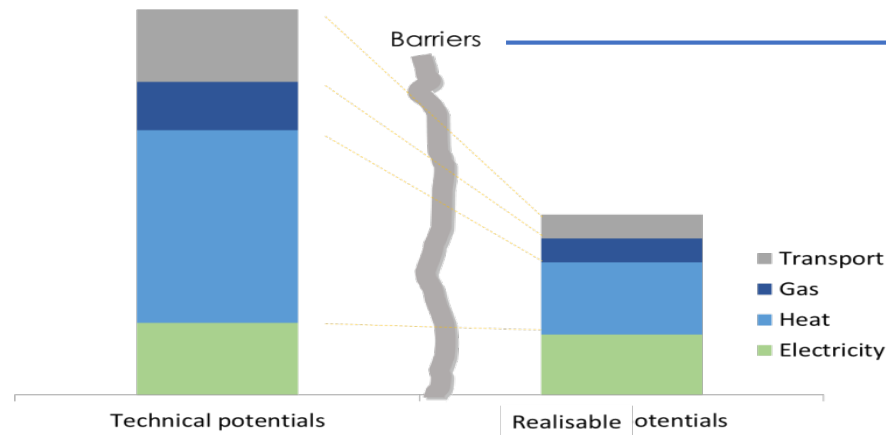


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Distribution of EU energy consumption  
(Source: EU Heating and Cooling strategy)

### 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

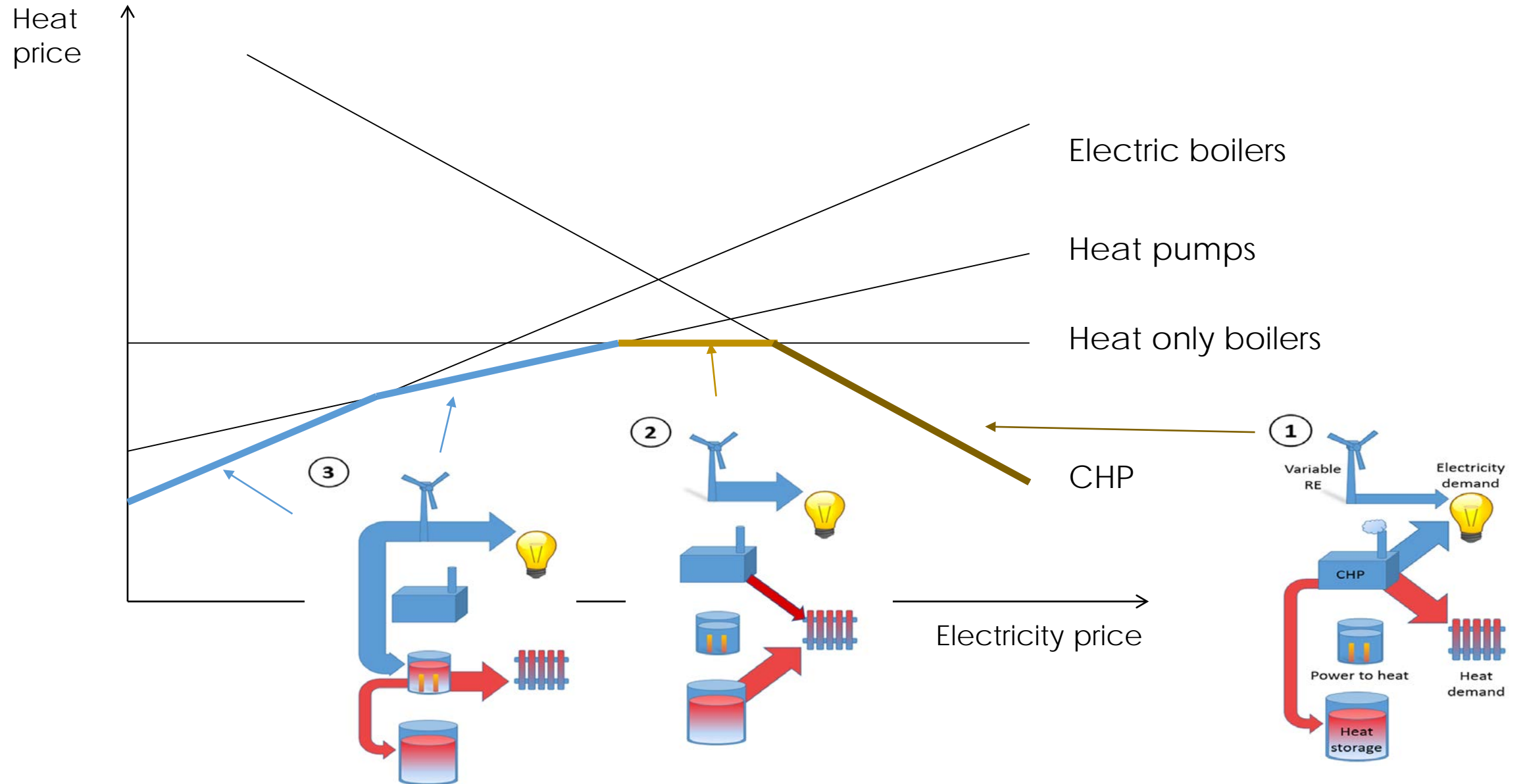
Remove barriers

# District heating-electricity interface

Electrification as source of flexibility



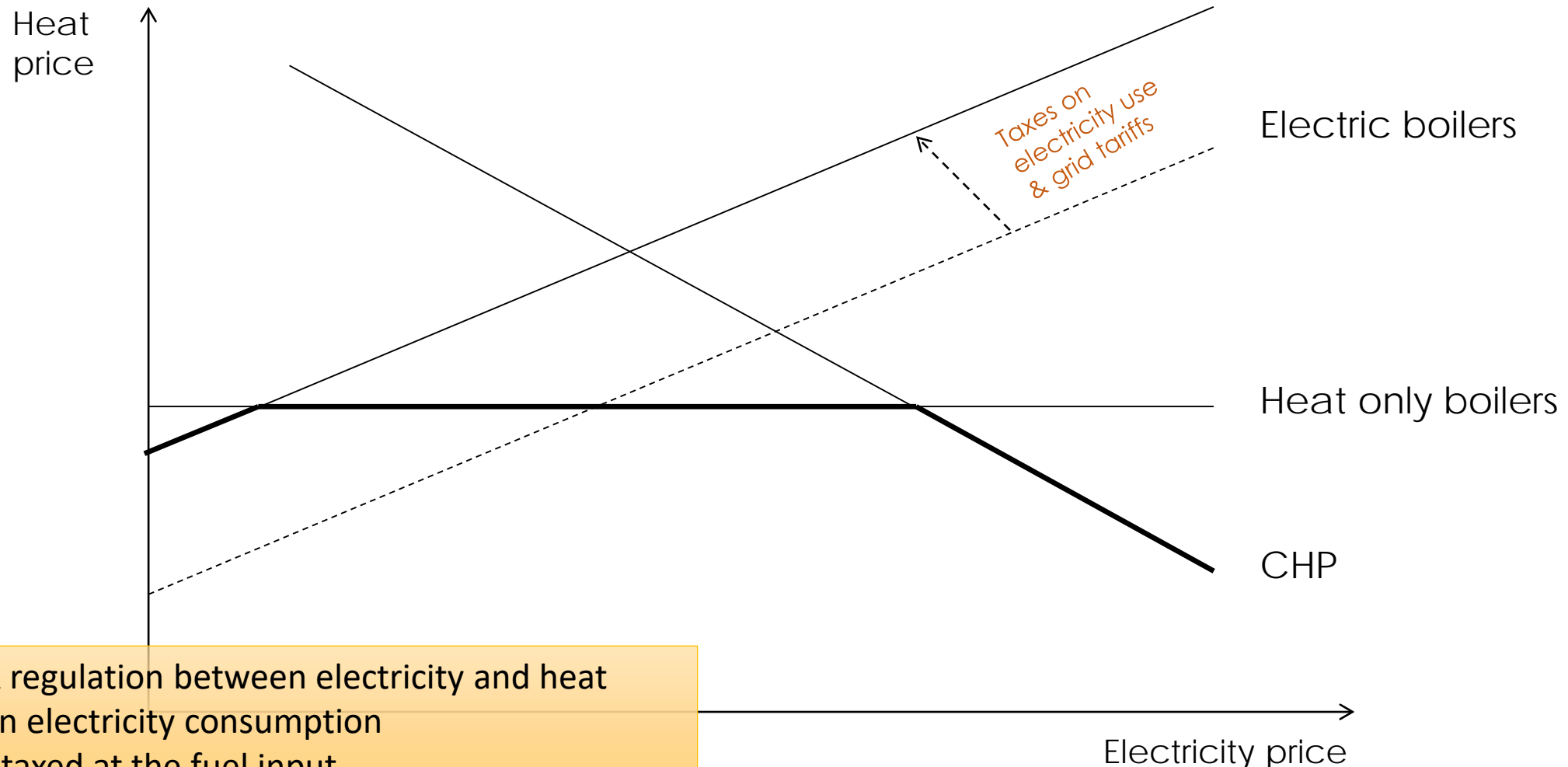
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# Choice of heat supply - at different electricity prices



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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



## Unlocking a decarbonised, sustainable energy future

Make the sector coupling/electrification  
as flexible as possible

- Remove barriers
- Improve the business case for flexible power-to-heat/gas technologies
- Increase market integration and the value of VRE

Coherent changes in market designs,  
regulatory framework condition, and  
coupling of markets

Strong today - Stronger tomorrow



**Flex4RES**

Flexible Nordic Energy Systems

[www.Flex4RES.org](http://www.Flex4RES.org)

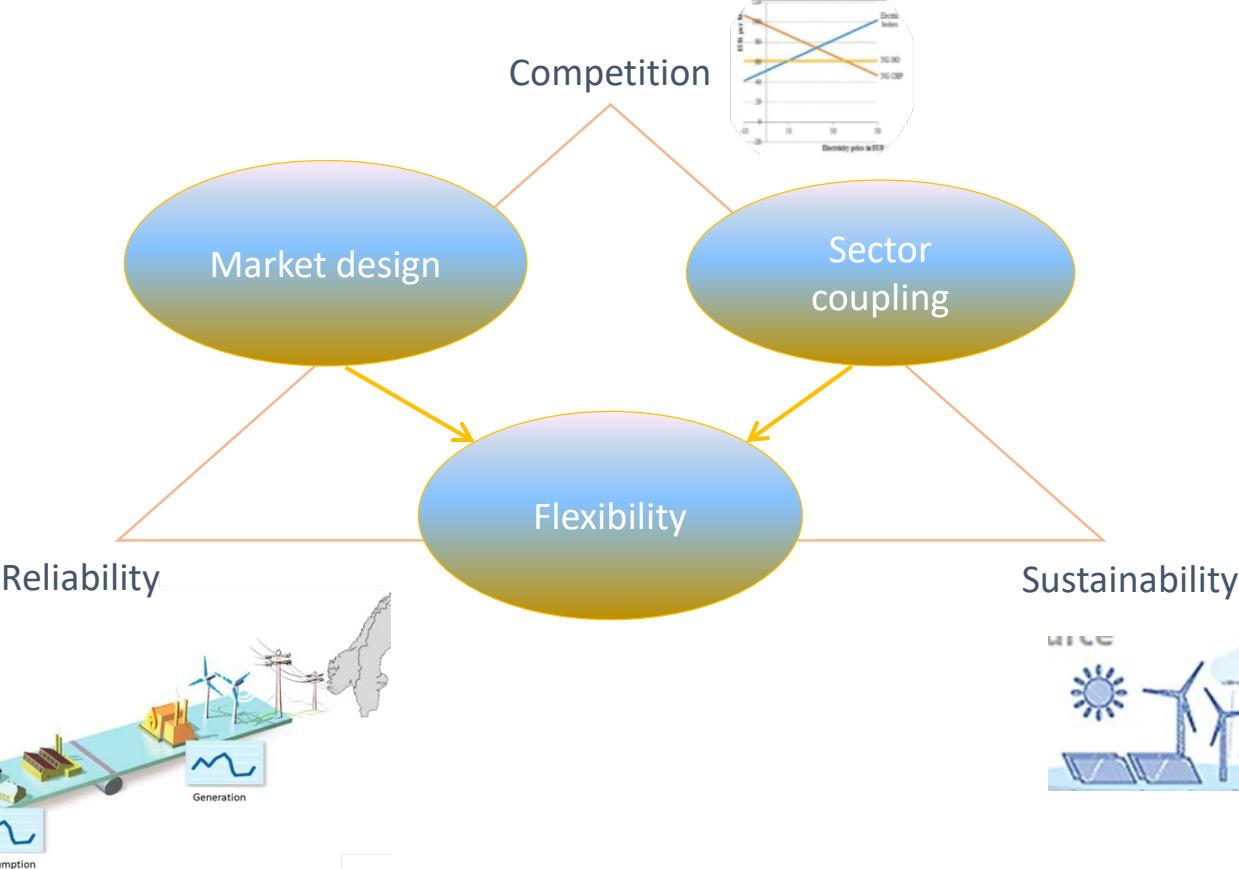
#Flex4RES



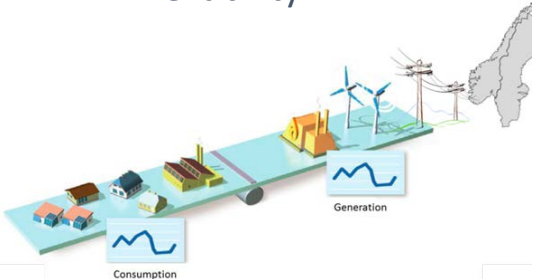
# Goals and RE-thinking of the Energy System



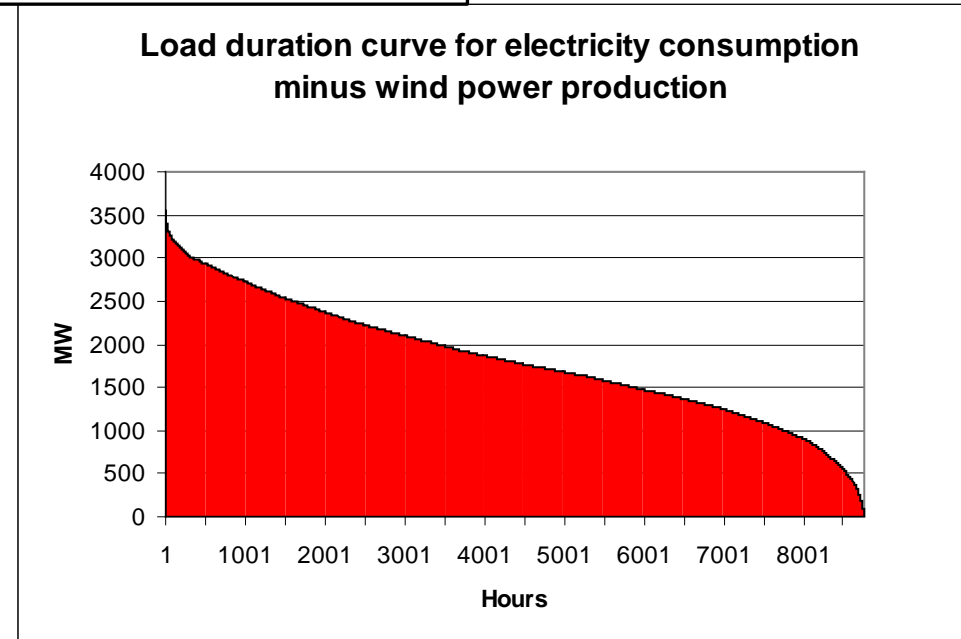
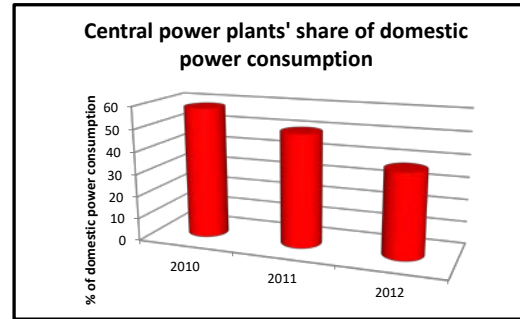
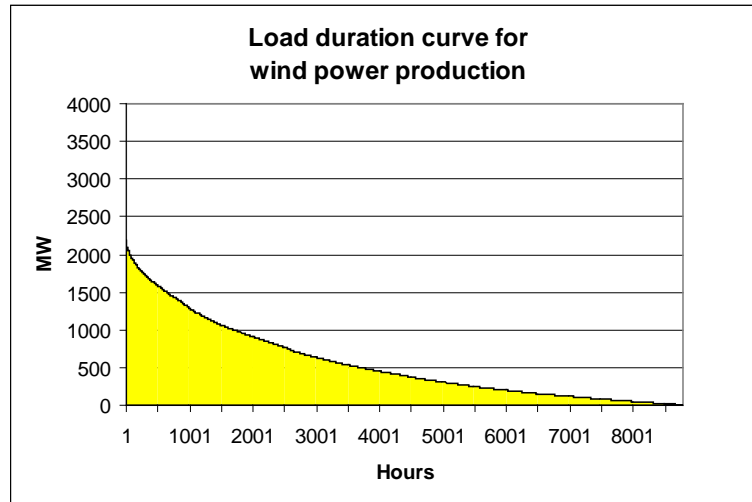
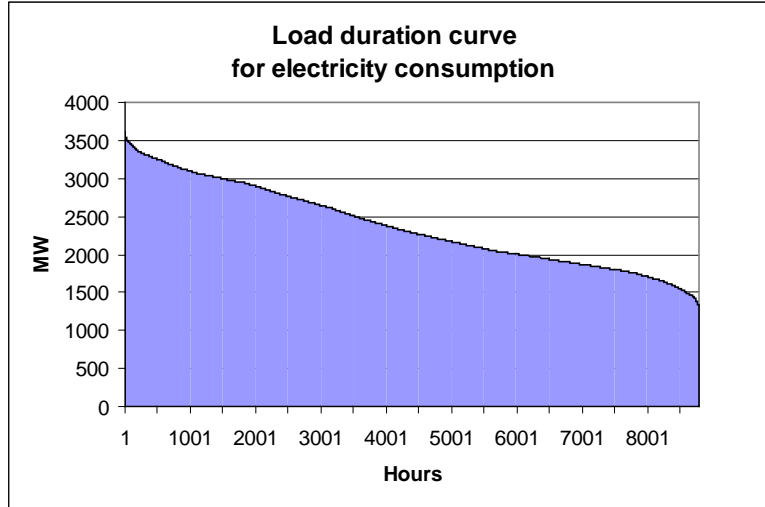
Centralised fossil-intensive supply  
Electricity market only



Decentralised  
+ Variable renewable energy  
+ Phase-out of fossil peakers  
System integration



# Wind Power has consequences for the energy system!



## Steeper residual load duration curve

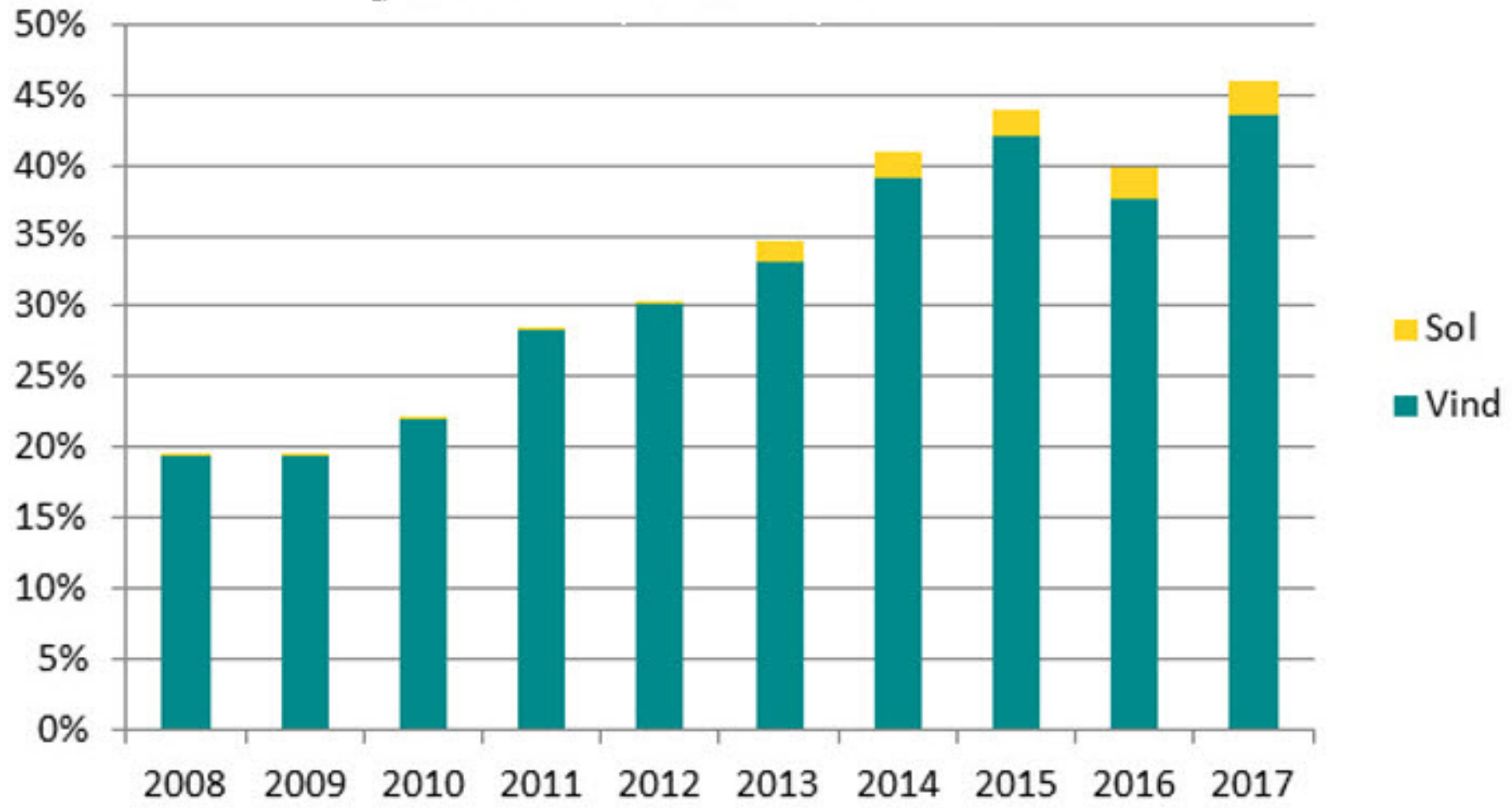
- Less base load hours
- Lower price levels

Market design:

Capacity mechanism or  
Scarcity pricing



# Wind share in Danish annual electricity consumption



Sol- og vindenergiens andel i elsystemet er vokset år efter år. 2017 sætter ny rekord med en vind- og solandel på **45,8 procent**. Nedgangen i 2016 skyldes primært, at året var meget vindfattigt.