

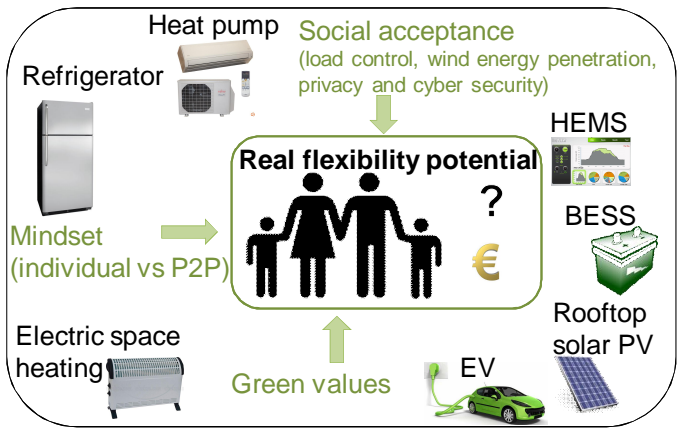


# Role of the end customer in a future flexible energy system

Nadezda Belonogova, Salla Annala,  
Samuli Honkapuro

Lappeenranta University of Technology

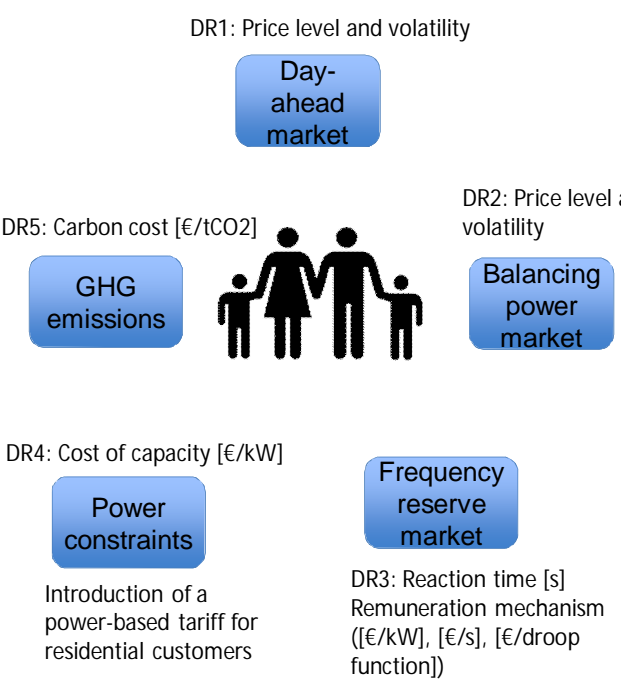
## Technical flexibility potential of a single residential customer



## Major challenges in the evolving operational environment

- Highly intermittent and distributed RES
  - Climate change leads to fossil fuel phase-out
- Need for:**
- Cost-effective and sustainable flexibility resources
  - Enhanced collaboration between TSO & DSO & retailer
  - A centralized data exchange platform (datahub)
  - Enabling of multiple demand response (DR) marketplaces for the end customer in order to harness the already available flexibility

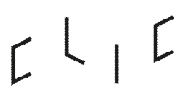
## Role of the end customer as a flexibility provider will be significant in the future flexible energy system



### Key highlights:

- Simulation of end customer's flexibility resources' use in multiple DR marketplaces reveals the most promising combinations of the DR marketplaces for various types of end customers.
- Operation of a flexibility resource in multiple DR marketplaces increases the socio-economic value for both individual customer and whole energy system.
- Optimal allocation of the end customer's flexibility resources to multiple DR marketplaces requires that the conflict of interests between involved stakeholders is resolved and their long-term goals are met.
- Sustainable end-customer behaviour maximizes the social welfare of the whole energy system by providing inexpensive flexible resources and reducing the need for new investments and operation of expensive flexibility options.
- Regulatory framework and electricity market design affect the DR marketplaces attributes (DR1,DR2,DR3,DR4,DR5) and thereby the customer participation rate.

RES renewable energy sources  
 EV electric vehicle  
 BESS battery energy storage system  
 HEMS home energy management system  
 P2P peer-to-peer  
 DSO distribution system operator  
 TSO transmission system operator



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