



Technische Hochschule
Ingolstadt

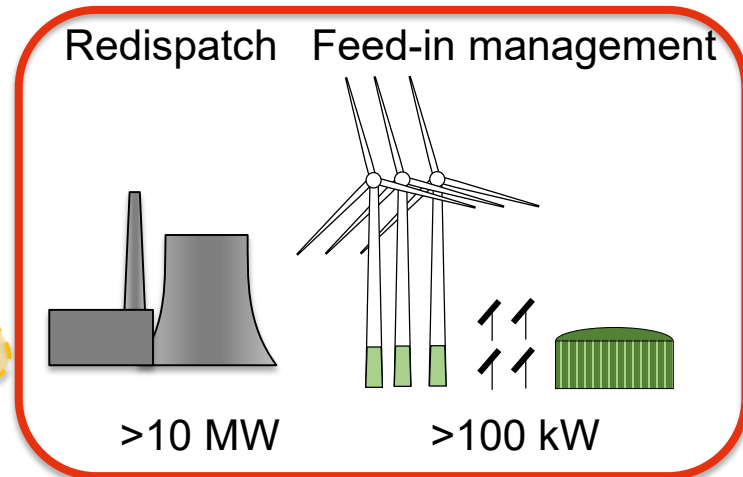
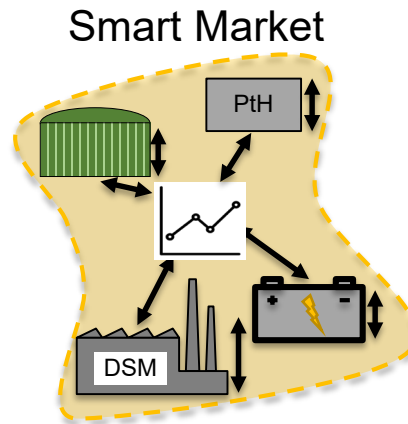
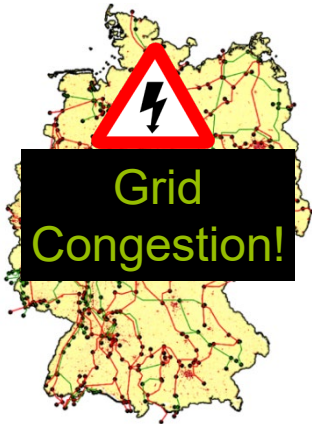
Institut für
neue Energie-Systeme



*Potential of Demand Side Management
and Biogas Plants in regional market-
based Congestion Management*

Tanja Mast 09.04.2021

Congestion Management



Merge to Redispatch 2.0 from
1.Oct. 2021

Voluntary participation and
market-based mechanism

Mandatory participation and
profit-neutral cost reimbursement

**Main Goal: Cost reduction
of congestion management**

Motivation

Definition of ‚Smart Market‘ approach

- Supplement to the current congestion management (RD 2.0 as fallback option)



- Properties:

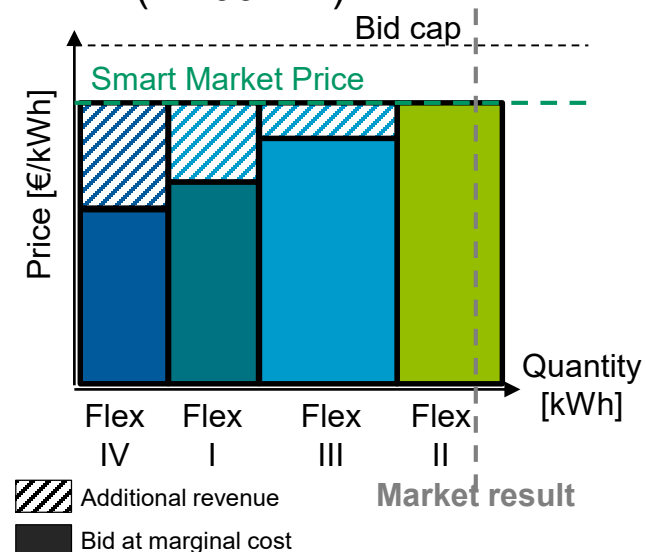
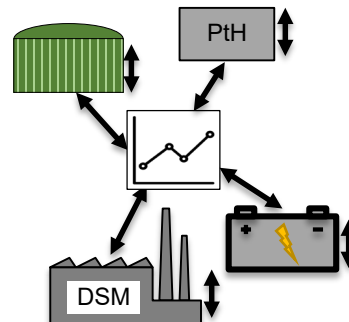
- temporary restriction → forecasted congestion situation
- local restriction → affected network area

- Market participants:

- Loads, flexible RE (e.g. biogas), storages, smaller capacities (< 100 kW)
- Competition among market participants

- Market design:

- pay-as-cleared
- Bids at marginal cost
- Bid cap



■ Investigation focus:

- potential of load shifting and flexible biogas plants to reduce congestion management at distribution grid level in Bavaria by participating in Smart Markets

Loads

Sector	Description
Residential	<ul style="list-style-type: none">• P2H (local + district heating)• Washing machine + dryer• Refrigerator + freezer
Industry	<ul style="list-style-type: none">• Cooling + Ventilation• Process heat• Energy-intensive processes
CTS	<ul style="list-style-type: none">• Power-to-Heat• Cooling + Ventilation
Transport	<ul style="list-style-type: none">• E-mobility

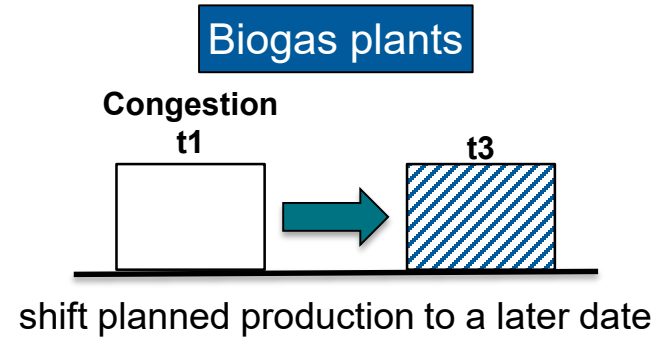
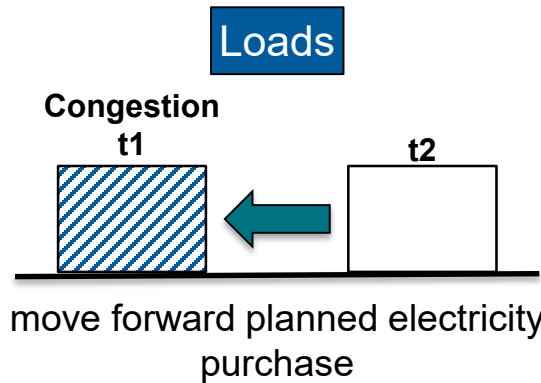
Biogas plants

Technology	Description
BGP	electricity price controlled BGP <ul style="list-style-type: none">• low flexibility• medium flexibility• high flexibility

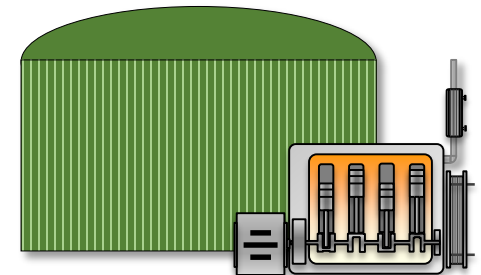
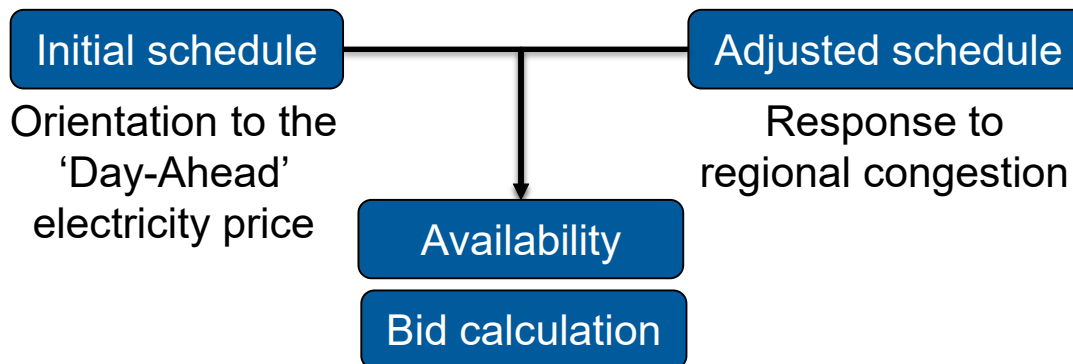
*Technologies and Regional Potential from Marktstammdatenregister and Branch experts
Initial schedule and Bid calculation by BGP optimization model
(consideration of technical restrictions)*

Technologies, Initial schedule, Regional Potential, Bids/Cost from Heitkötter et al. 2020

- Participation in Smart Market implies deviation from the initially planned schedule

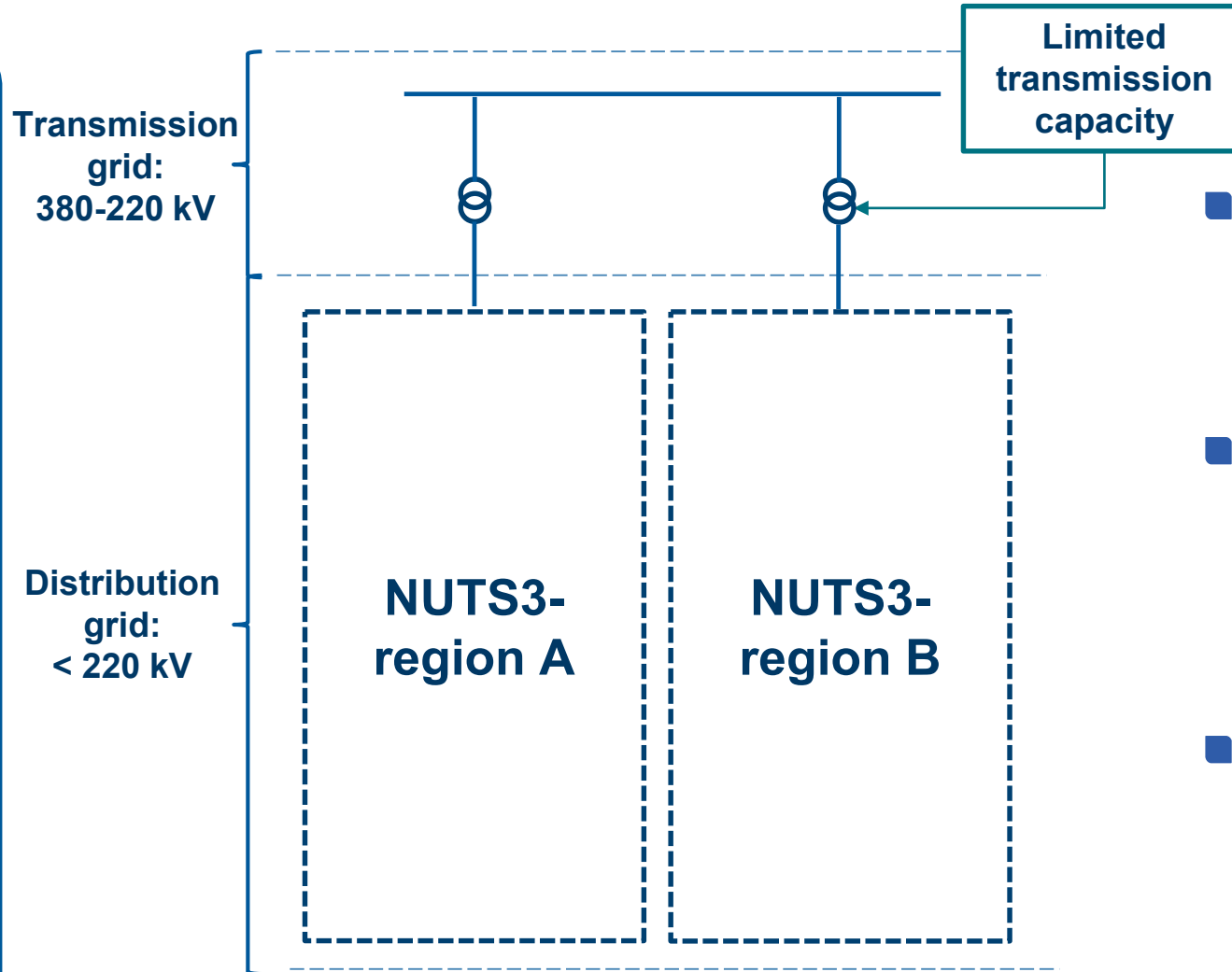


- Example electricity price controlled BGP:



Methods

Vertical grid congestions in Bavaria for Scenario 2025



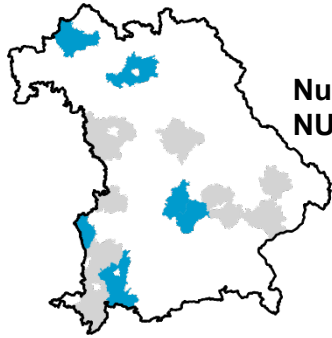
- RE expansion until 2025: Scenario B Grid Development Plan
- Difference between RE feed-in and load time series for weather year 2012 per NUTS3-region
- if difference > transmission capacity -> vertical grid congestions

Results

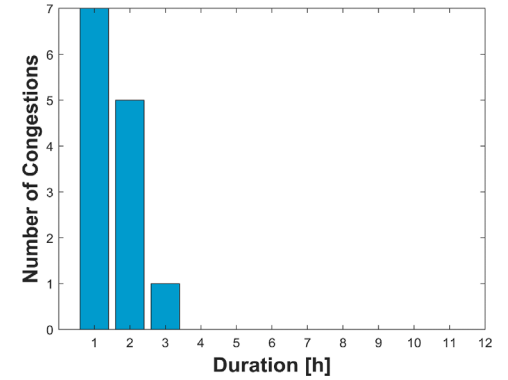
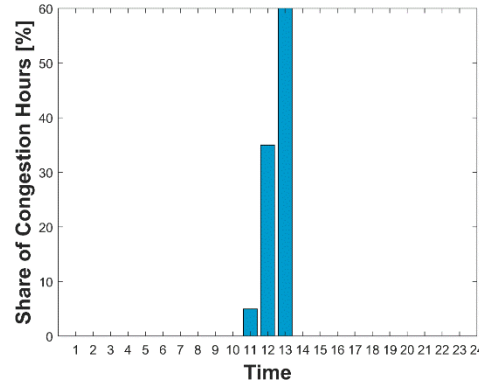
Congestion categories for Scenario Bavaria 2025

Characteristic of congestion categories

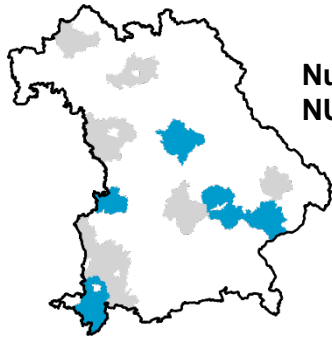
Category 1



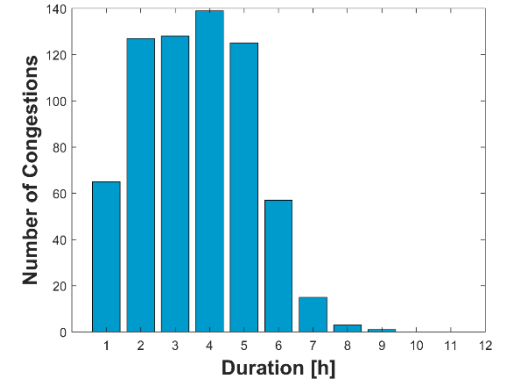
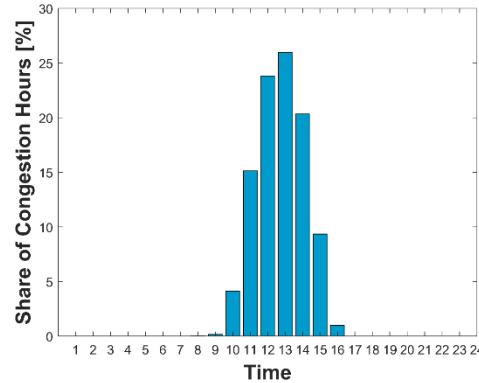
Number of
NUTS3-regions: 6



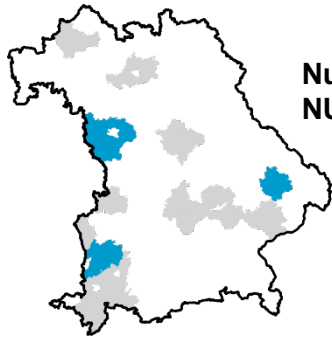
Category 2



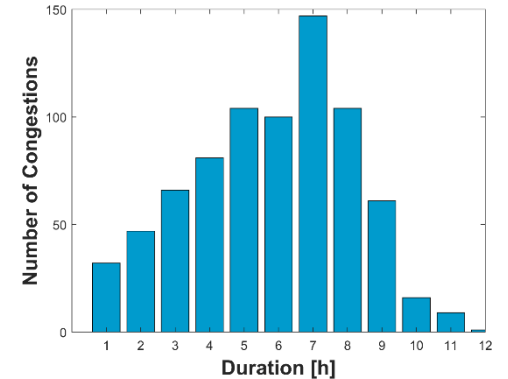
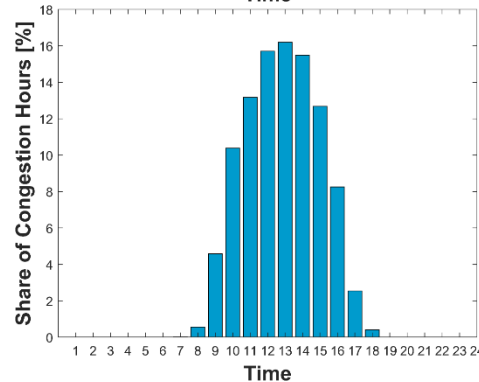
Number of
NUTS3-regions: 5



Category 3

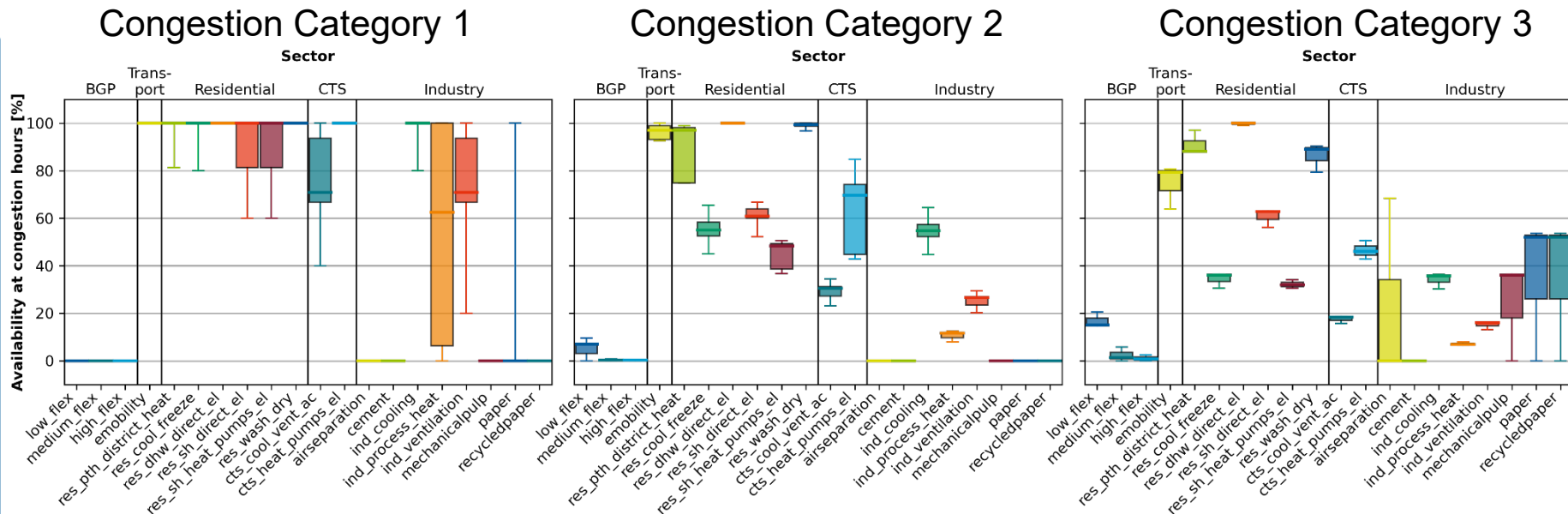


Number of
NUTS3-regions: 3



Results

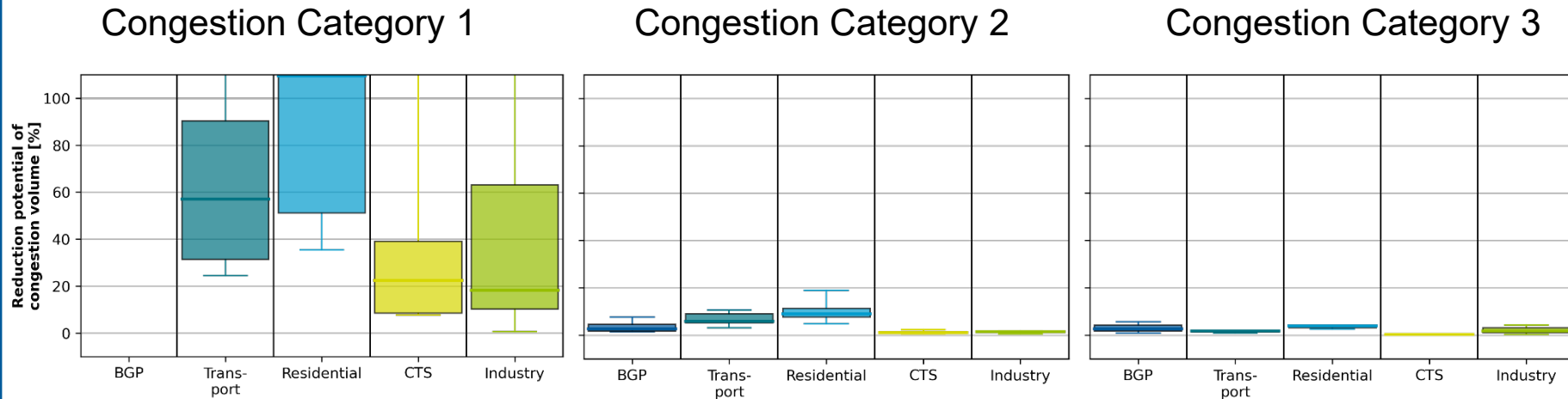
Availability at congestion hours



- Availability strongly technology and regionally dependent (some technologies not available in NUTS3 area or not available during congestion)
- The longer the congestions, the more the timeframe of load shifting (technical limited) gains in importance (especially cooling, heating, ventilation processes)

Results

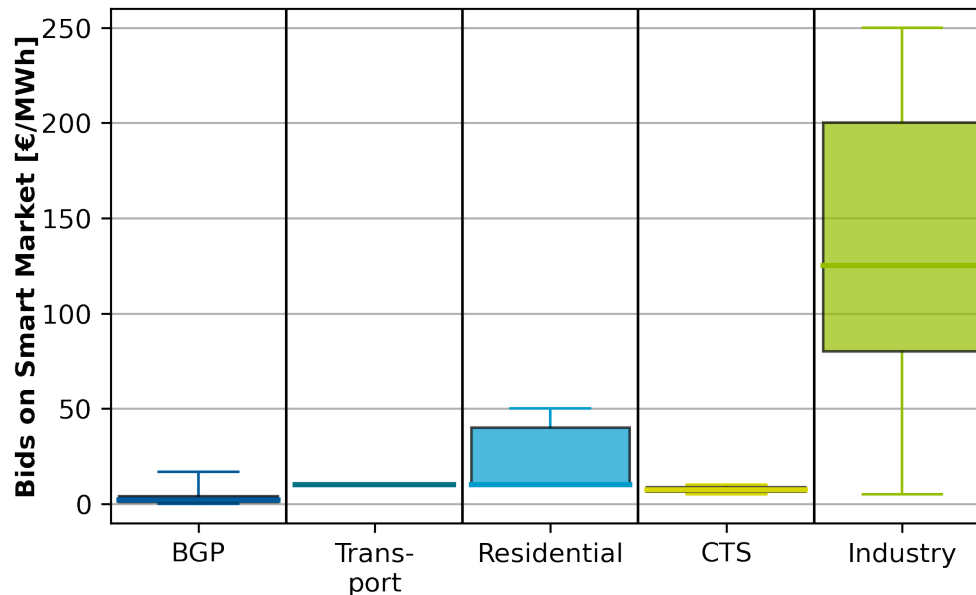
Reduction potential of congestion volume



- Available potential strongly technology and regionally dependent (some technologies not available in NUTS3 area or not available during congestion)
- The longer the congestion duration, the more the timeframe of load shifting (technical limited) gains in importance; typical shifting time for loads between 1 and 6 hours

Results

Bids on Smart Markets



- BGP bids reflect revenue losses at ‘Day-Ahead’ due to schedule adjustment
- Load bids reflect losses in production outputs and comfort (Heitkötter et al. 2020); cheapest technology Cooling and ventilation (5€/MWh)
- 84% of all BGP bids are below the lowest Load bid

- Potential of flexible loads and BGP in market-based congestion management strongly dependent on Technology, Regional potential and Congestion characteristic
- High availabilities and rapid growth of some flexible loads (E-mobility, P2H applications) lead to high potential of load shifting in market-based congestion management
- BGP have a low availability, but if available (especially in case of longer congestion periods) they have a good chance in the Merit Order of the market-based congestion management due to very low bids

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