



**Optimization of combined
heat and power plants**

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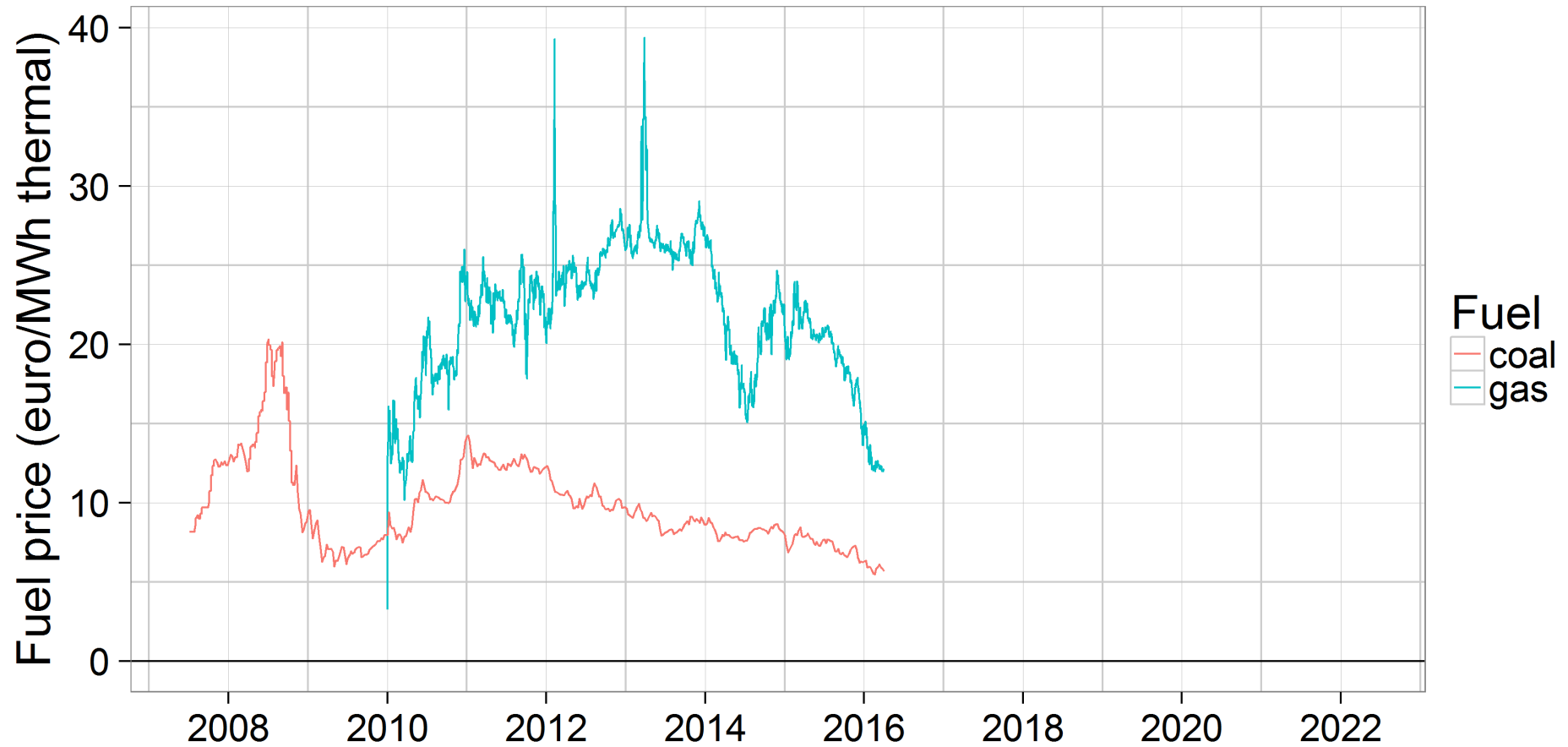
Overview activities Uniper in NL

- Power plants
 - Leiden: 83 MW CCGT
 - The Hague: 112 MW CCGT
 - Rotterdam: 210 MW CCGT, 50 MW GT
 - Maasvlakte: 2.120 MW coal, 70 MW GT
- Electricity sales (under E.ON name)
- Heat production in Leiden, The Hague and Rotterdam area
- Our role: management and operation of optimization models

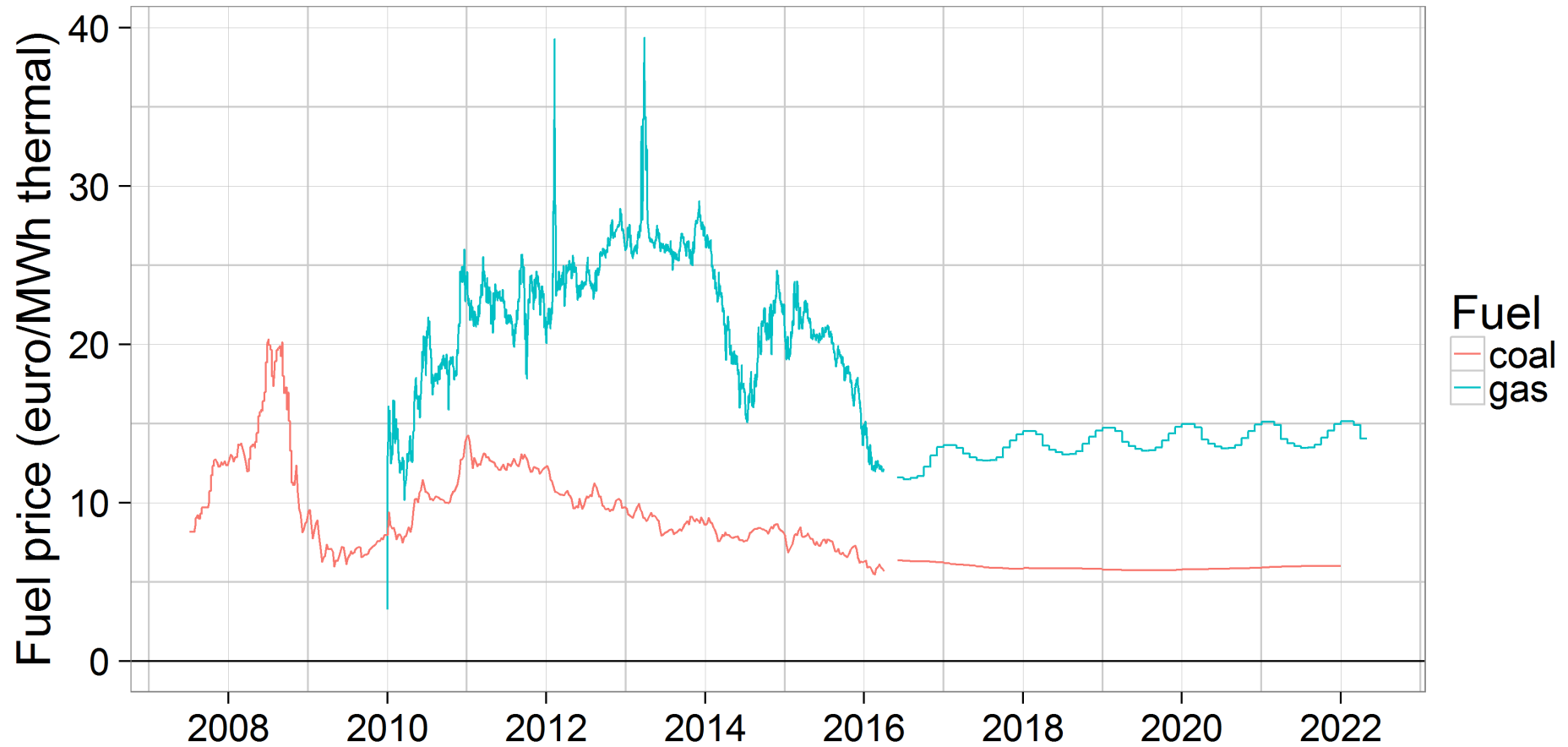


Market outlook

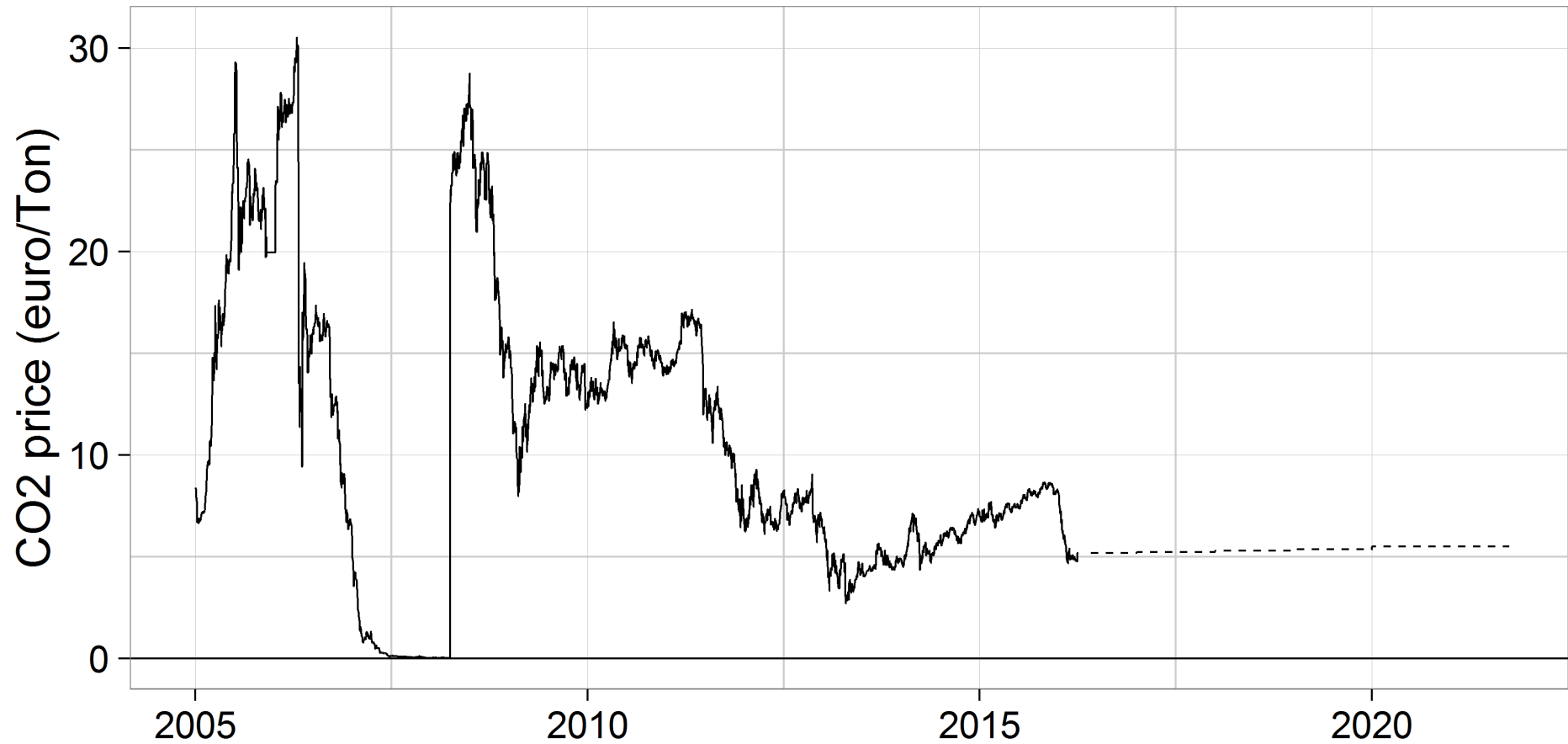
Commodity prices



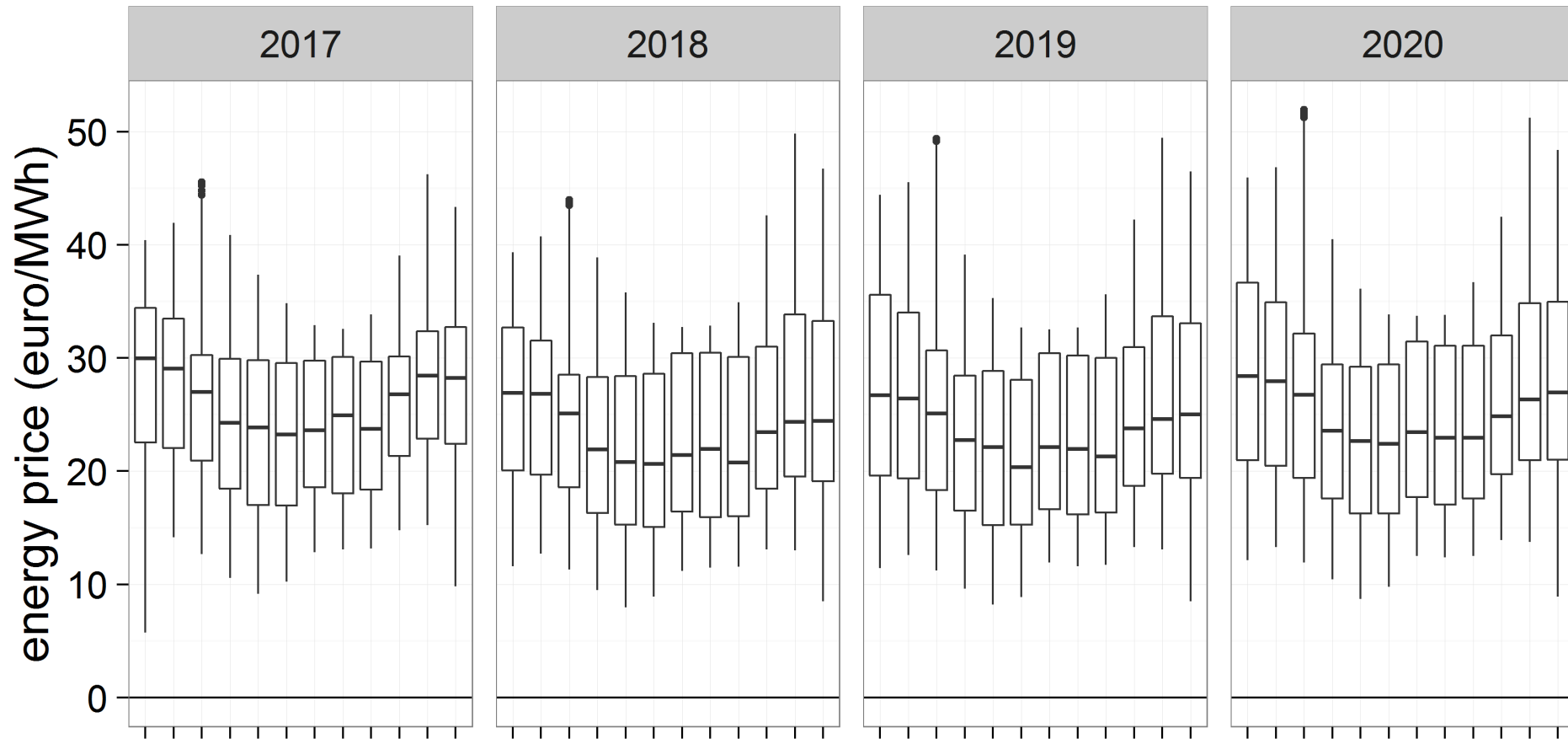
Commodity prices



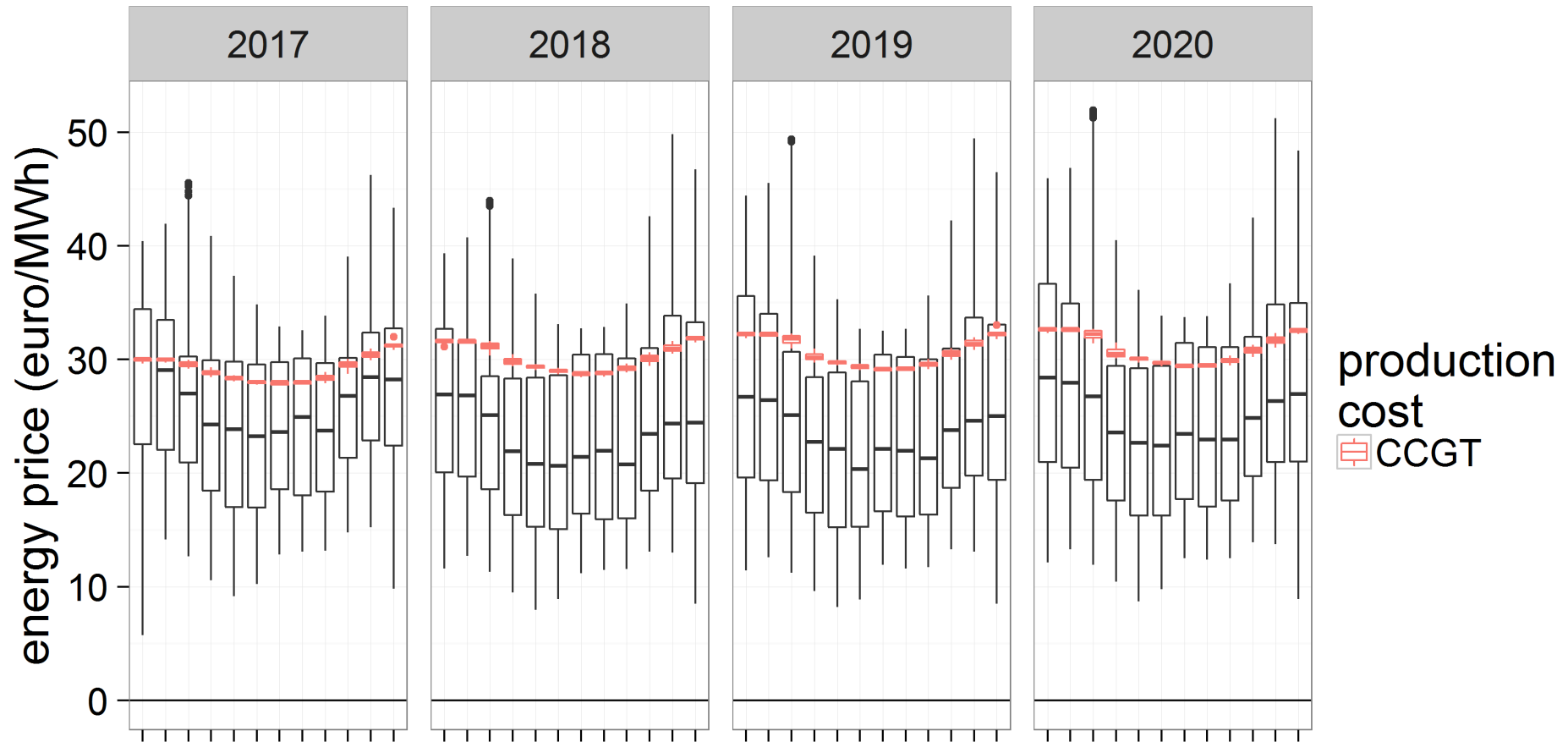
Commodity prices



Forward electricity prices



Gas production under pressure



Dutch merit order

Dutch Merit Order and Residual Load Distribution

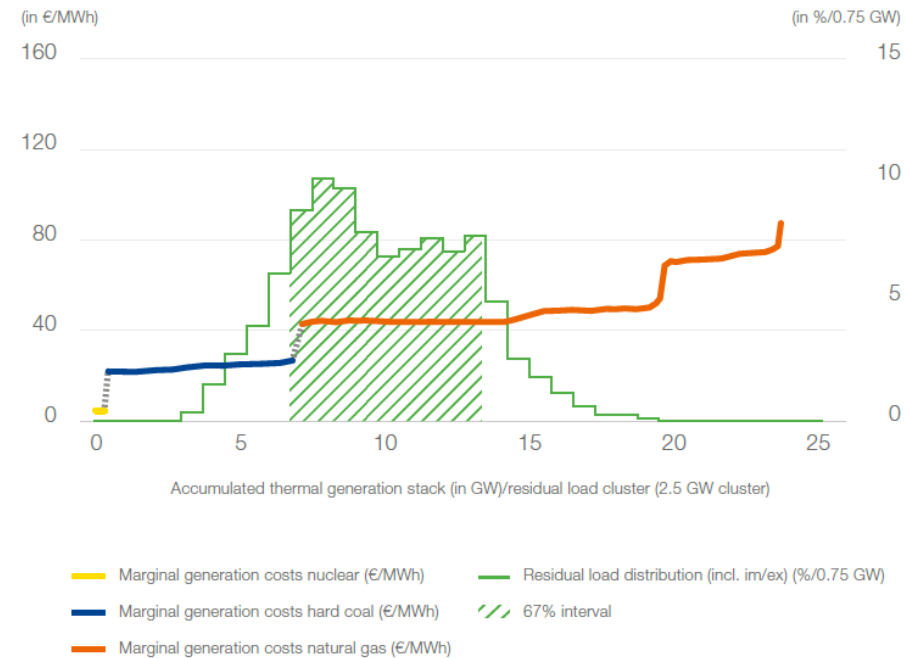


Figure 10: Dutch merit order and residual load distribution in 2014.
Source: TenneT, ENTSO-E, EEX, IAEW

German merit order

German Merit Order and Residual Load Distribution

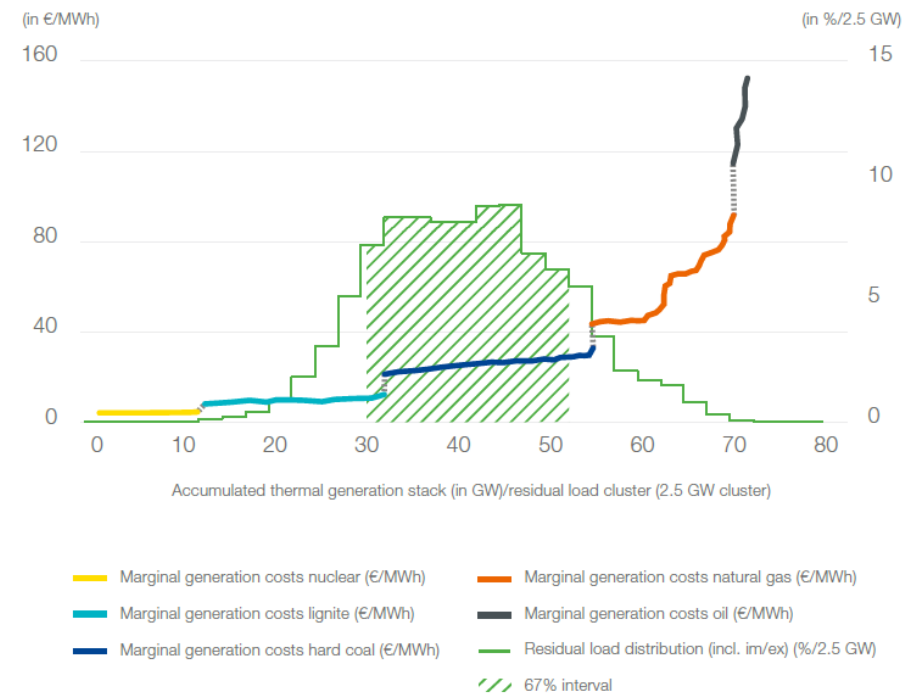


Figure 9: German merit order and residual load distribution in 2014.
Source: ENTSO-E, EEX, Bundesnetzagentur, IAEW

Dutch Merit Order and Residual Load Distribution

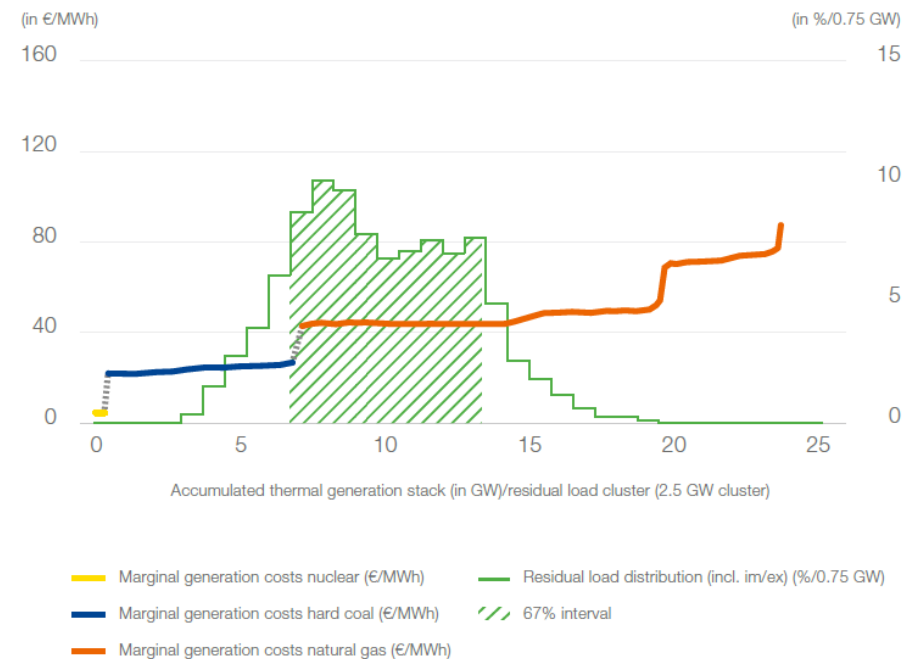
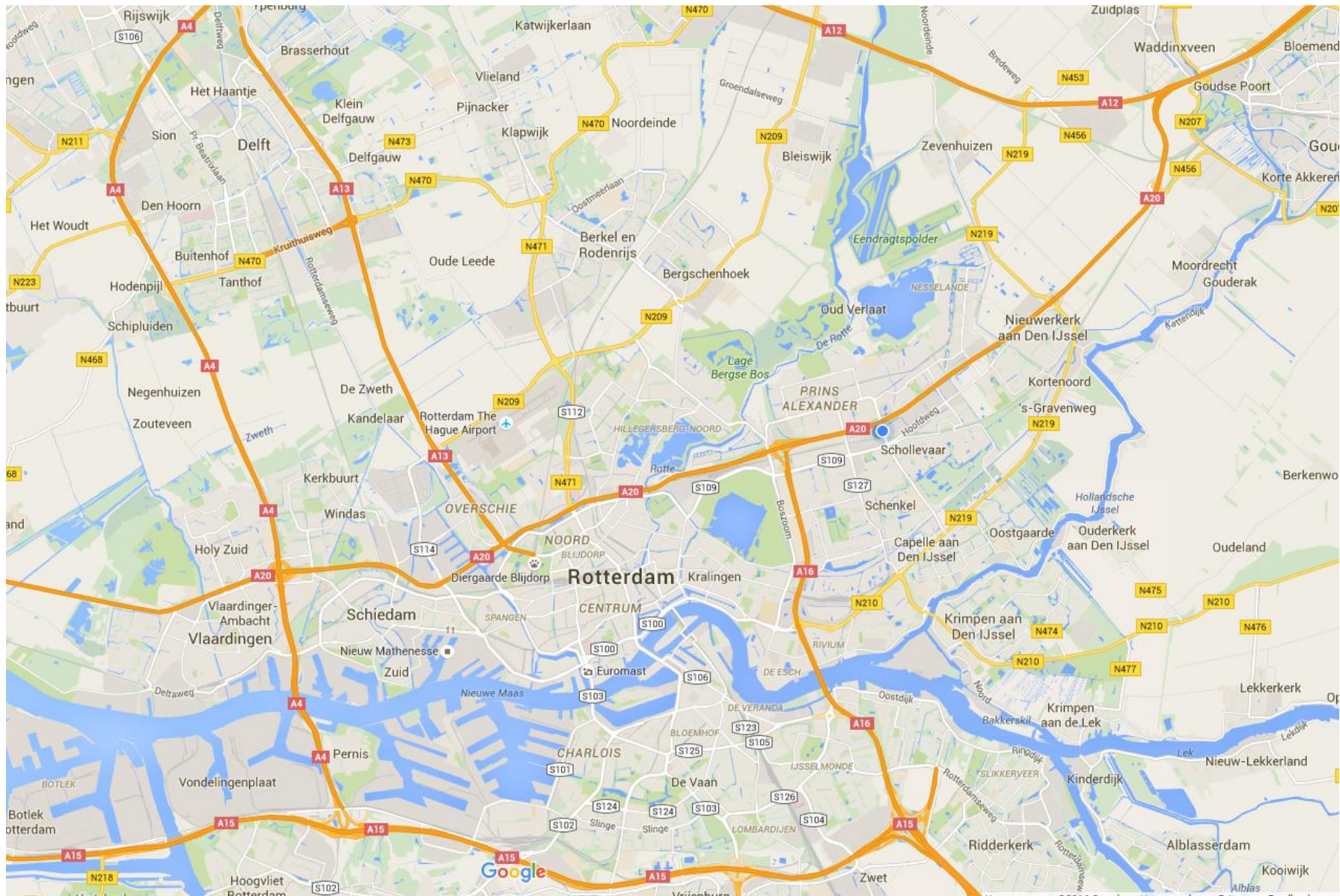


Figure 10: Dutch merit order and residual load distribution in 2014.
Source: TenneT, ENTSO-E, EEX, IAEW



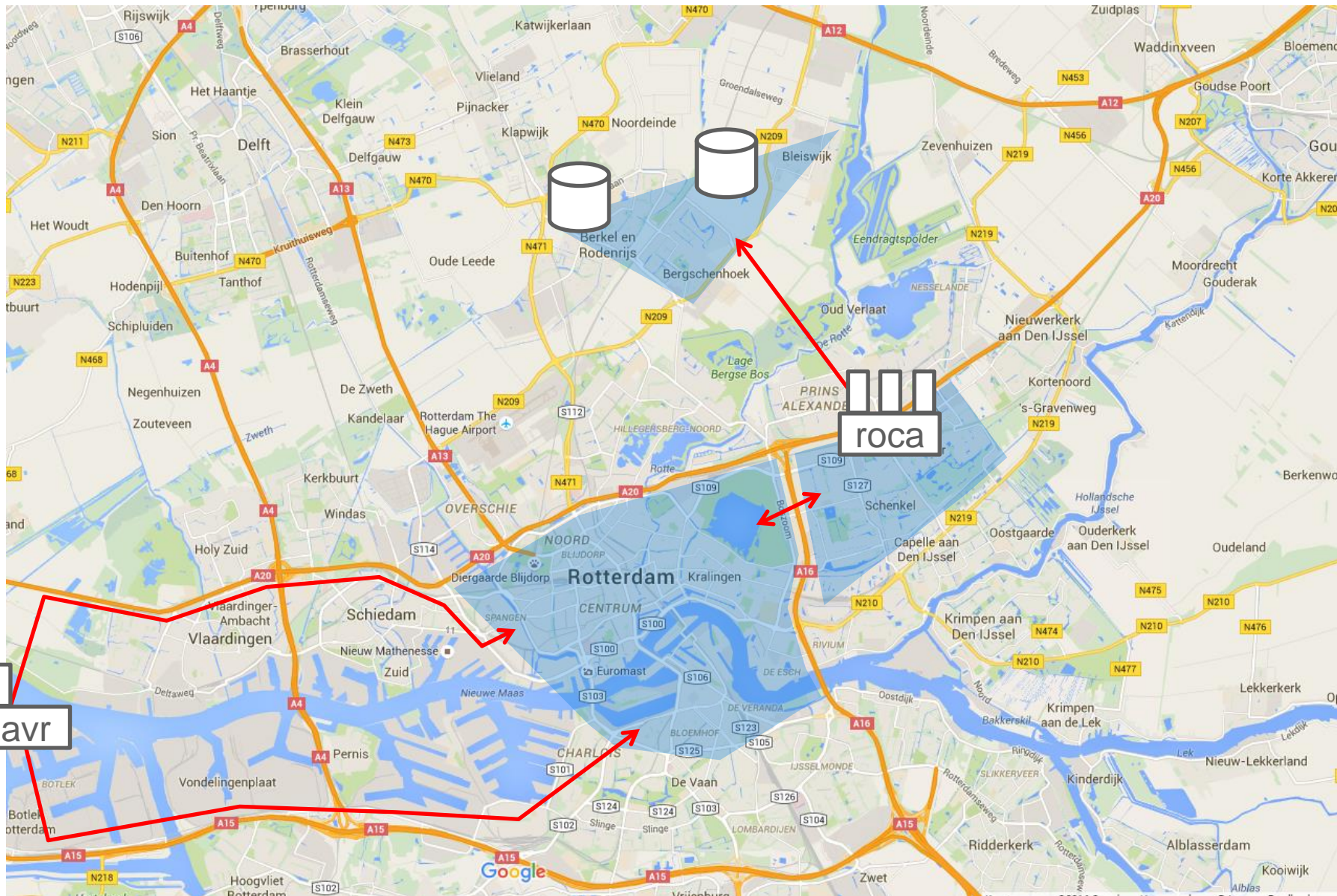
**Optimization of heat delivery to
greenhouses in 'B3Hoek'**

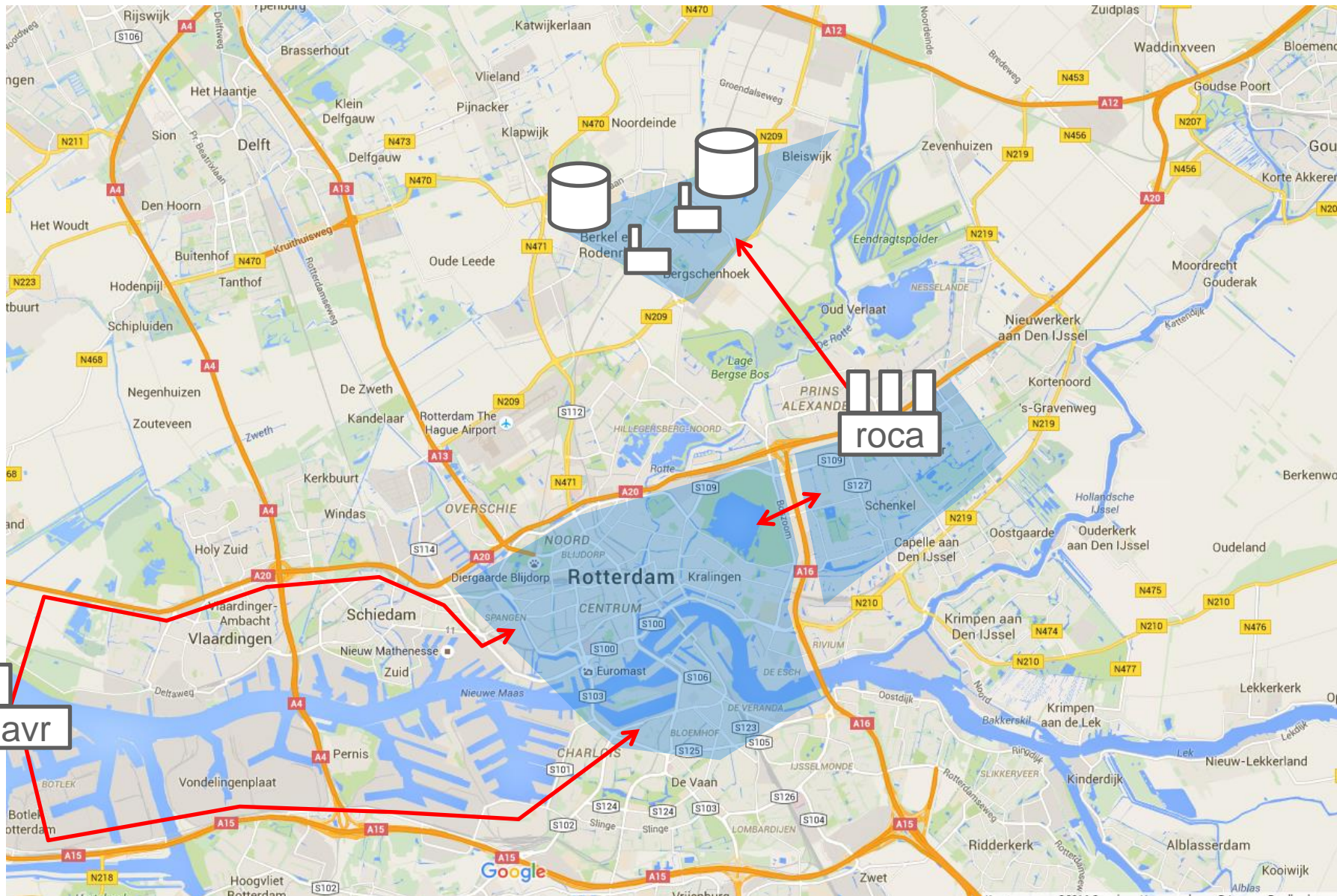




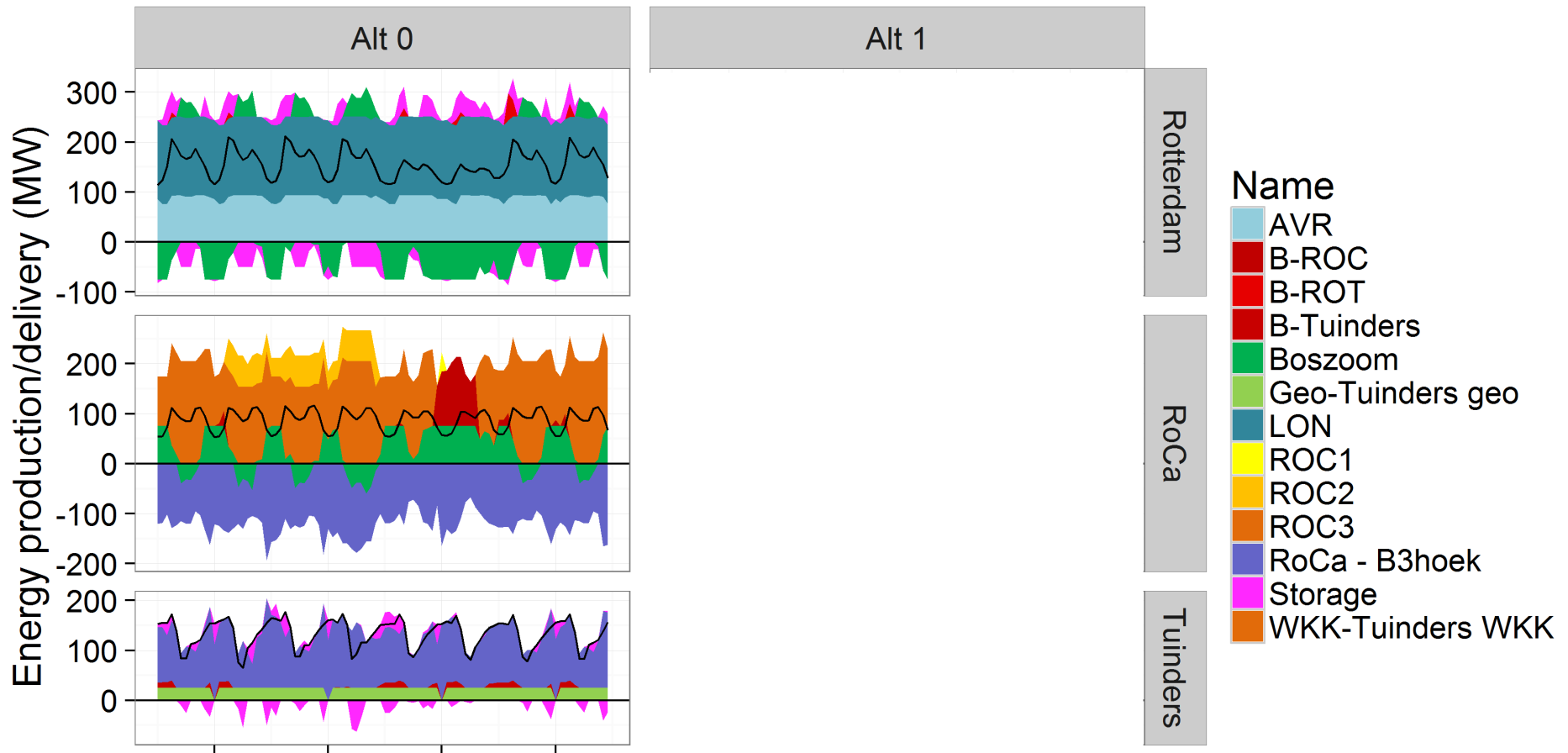




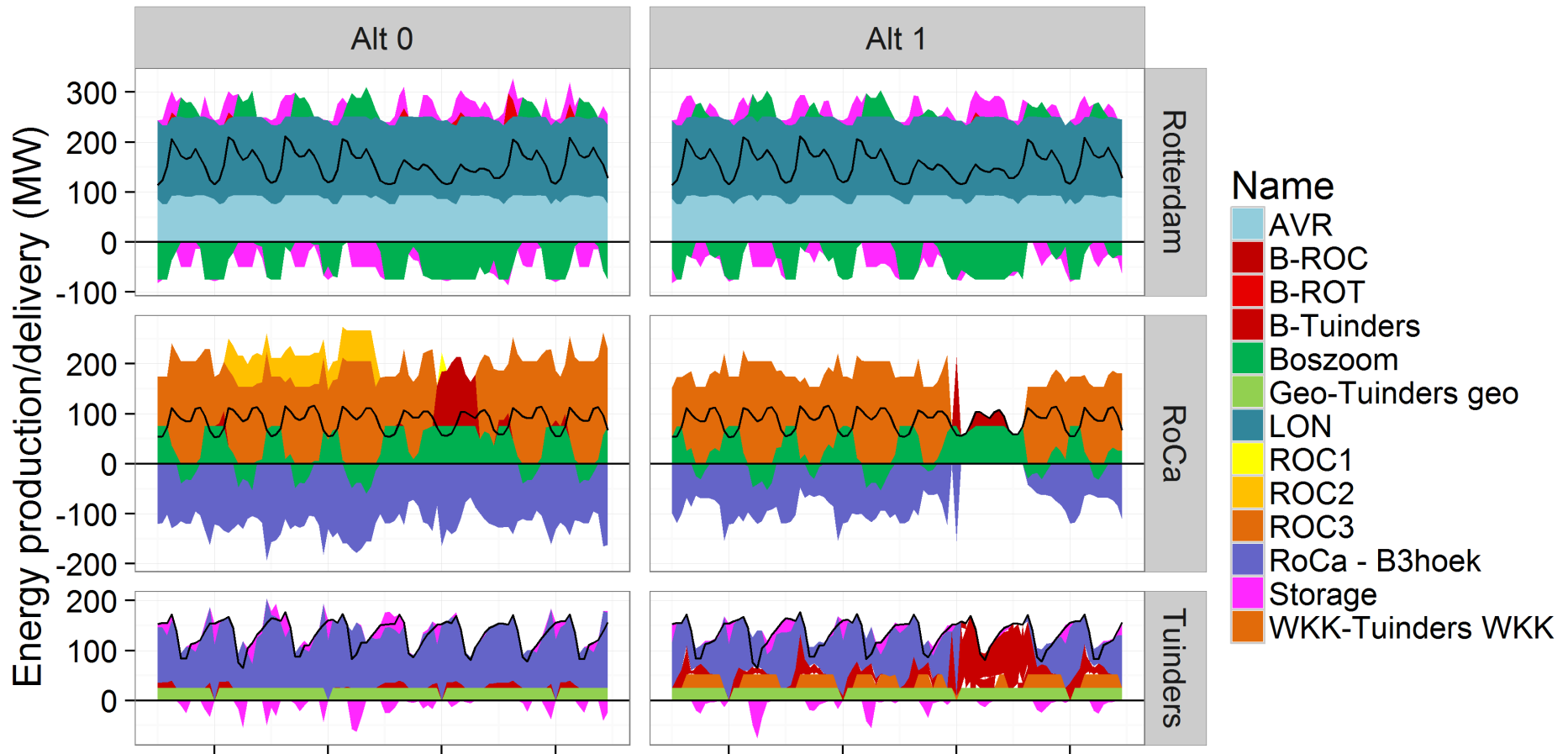




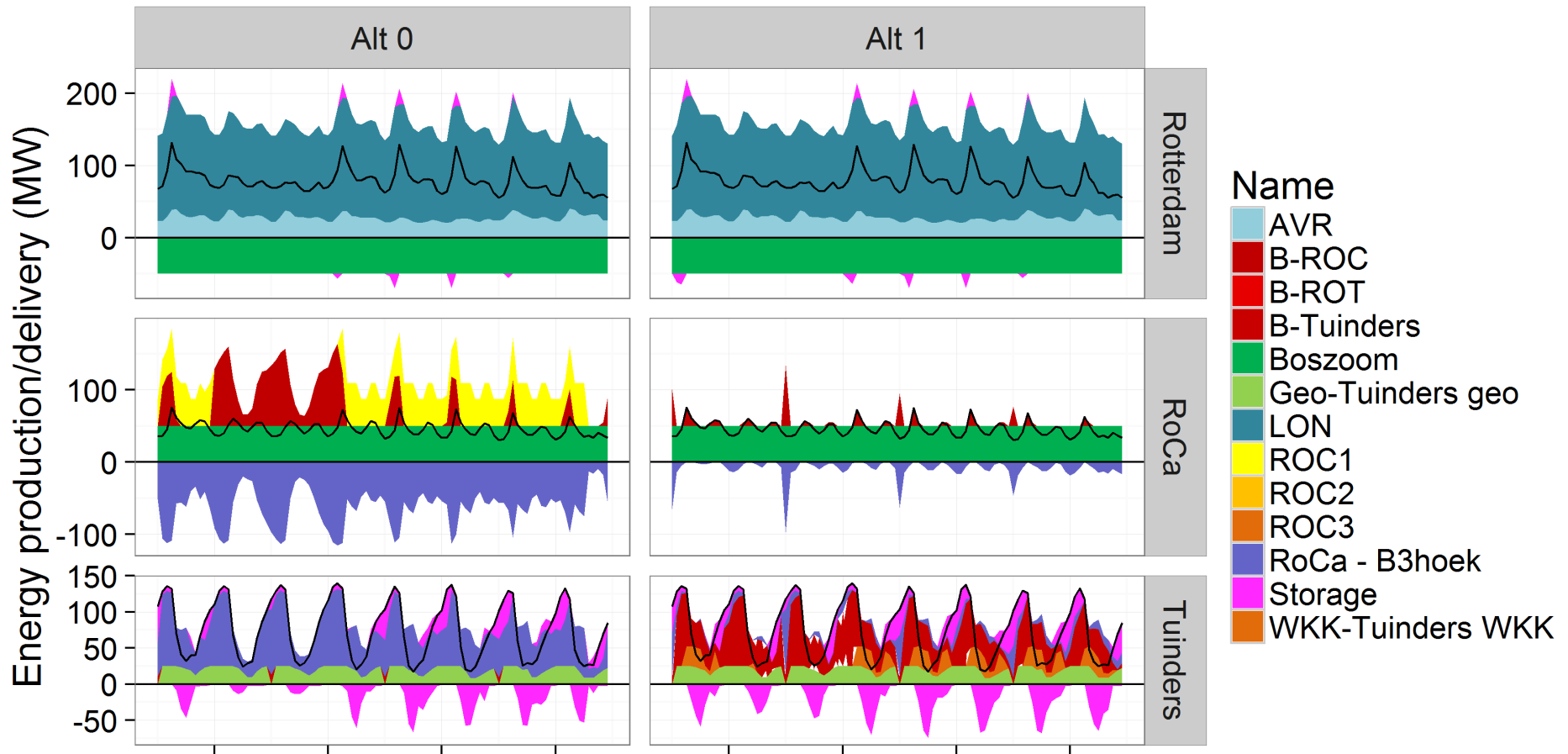
Production – week in February



Production – week in February



Production – week in April



Future steps

- Create price communication platform
- Test price responsiveness greenhouses on small group



Heat roundabout 'Zuid-Holland'



Warmtekrachtcentrale stadsverwarming - bestaand

Restwarmtebron



Bestaand / in aanleg



Potentieel



Biomassa

(Aard)warmteproject



Gerealiseerd



Lokaal in voorbereiding



Eventueel ultradiep



Eventuele energieopslag

Warmtetransportleiding



Bestaand



Gerealiseerd 2013/2014



In studie



Mogelijk toekomstig



Gebied waar bedrijven
warmte uitwisselen



Vergunning voor opsporing
of winning van aardwarmte
aangevraagd (2012)



Bebouwd gebied



Bedrijventerrein



Glastuinbouw



0

5

10 km

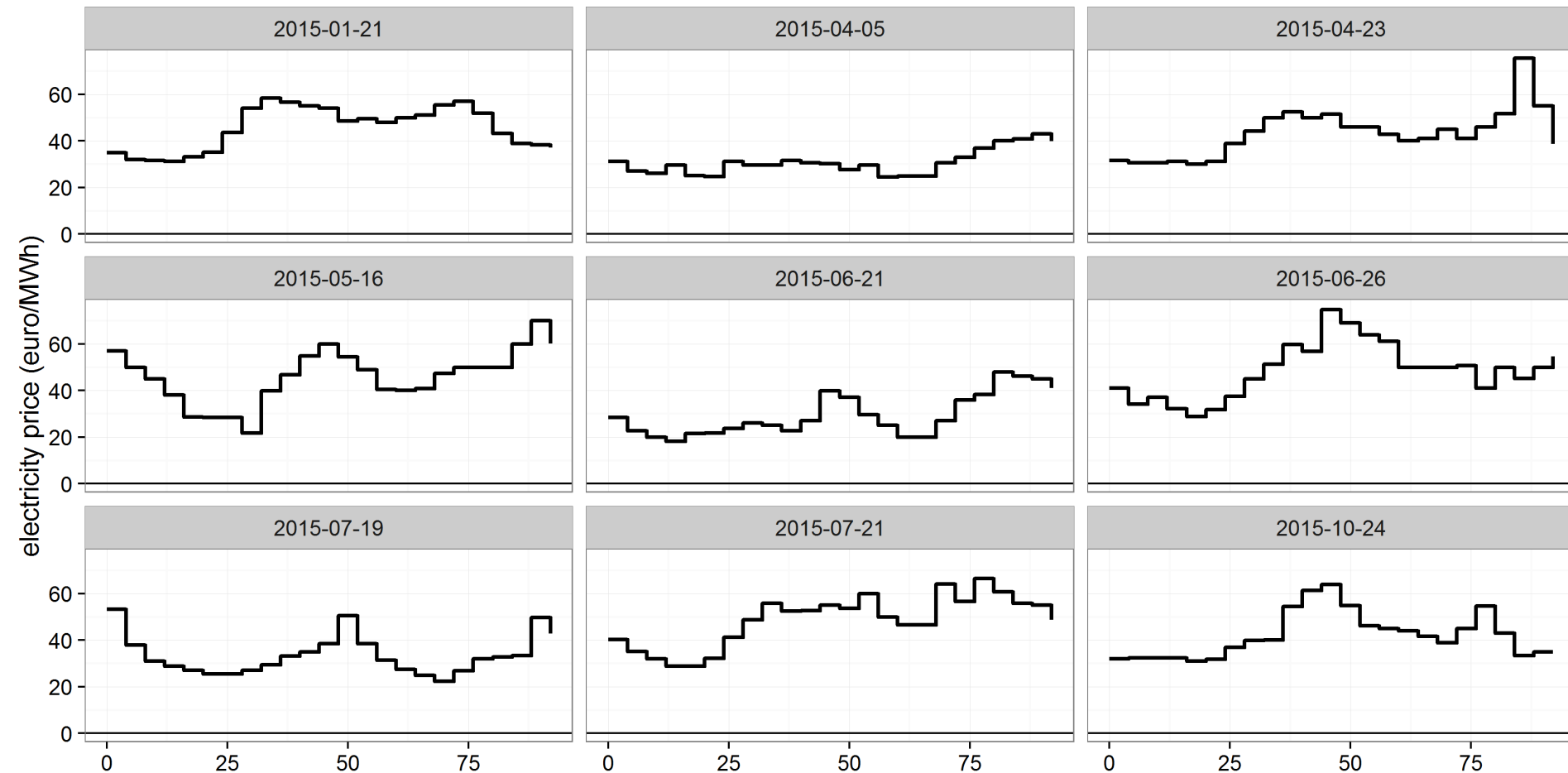
Market operation

- Goal: first open access district heating network
- Requires:
 - Grid operator
 - Market operator
 - Rules and regulations
- Challenge: How to bid in connected electricity-heat market?

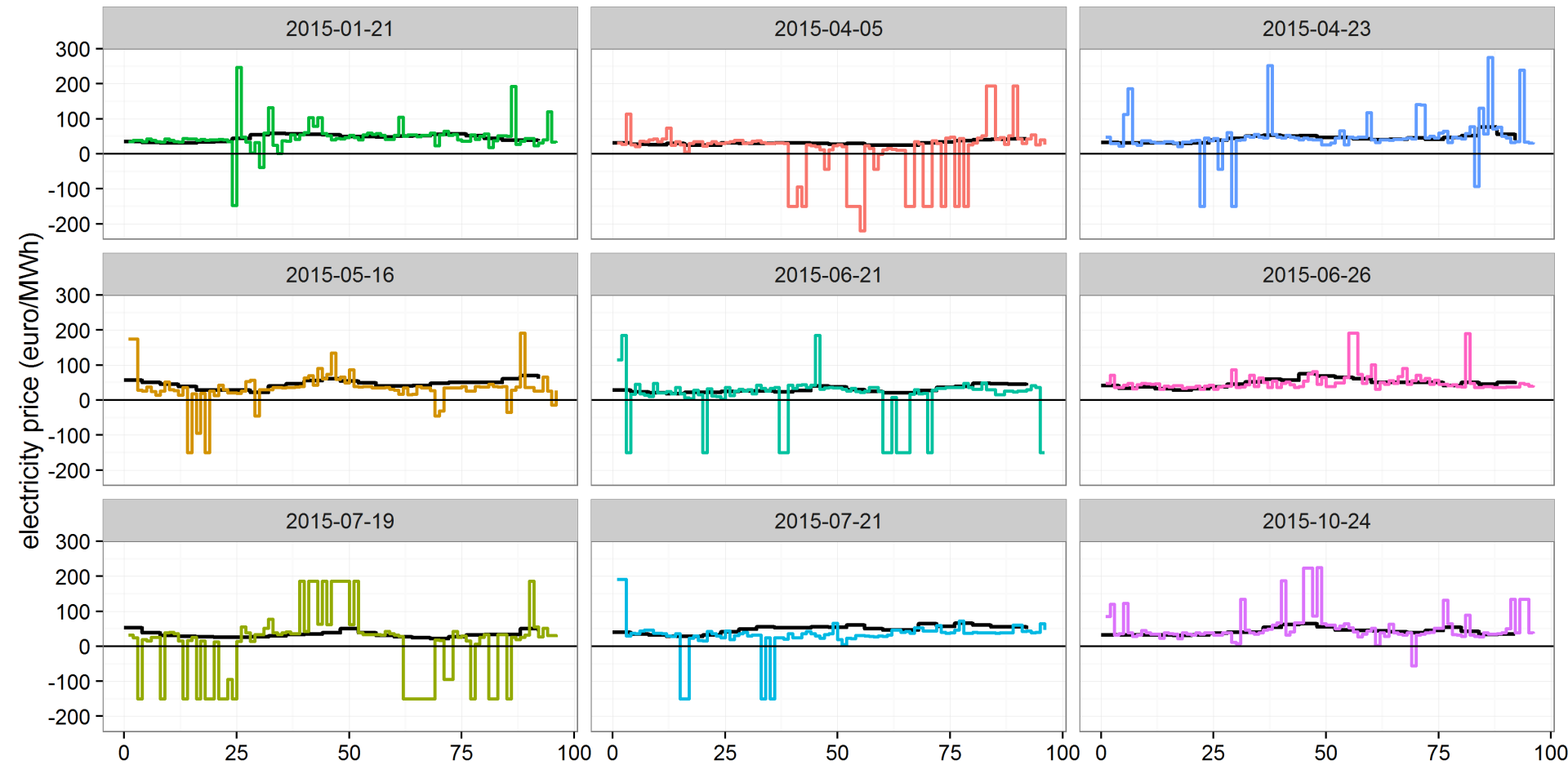


Power to heat - Electric boiler

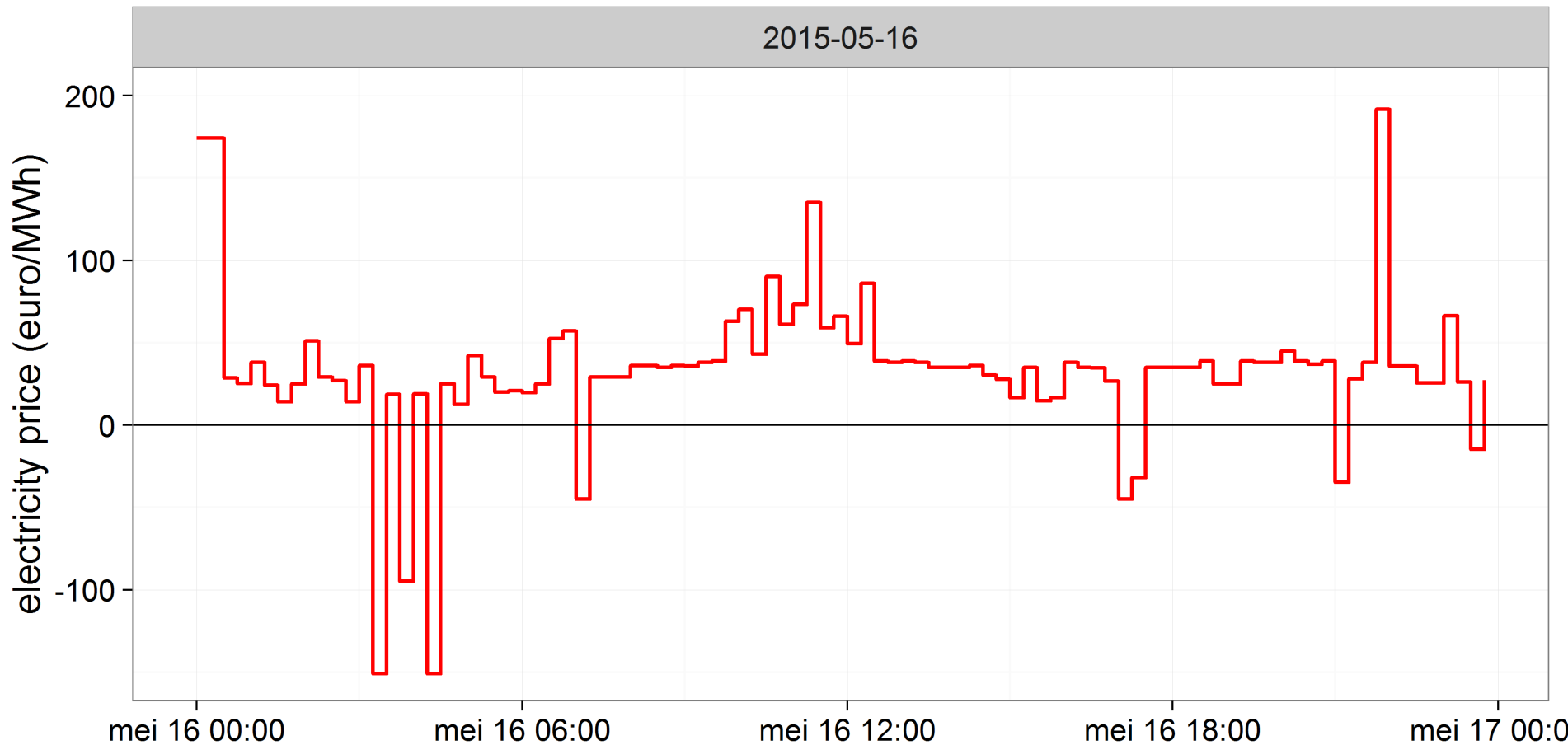
Electricity prices 2015



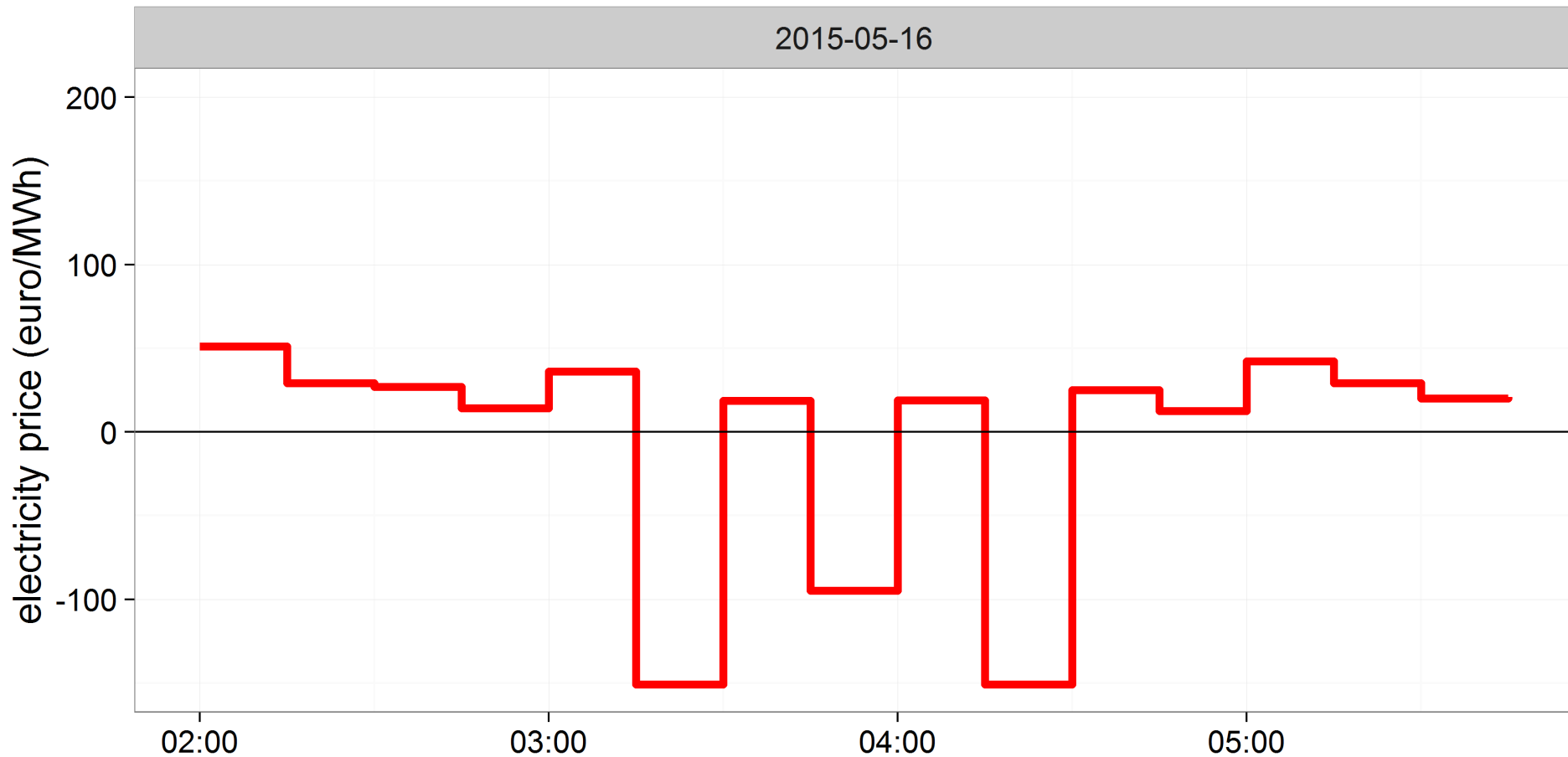
Imbalance prices 2015



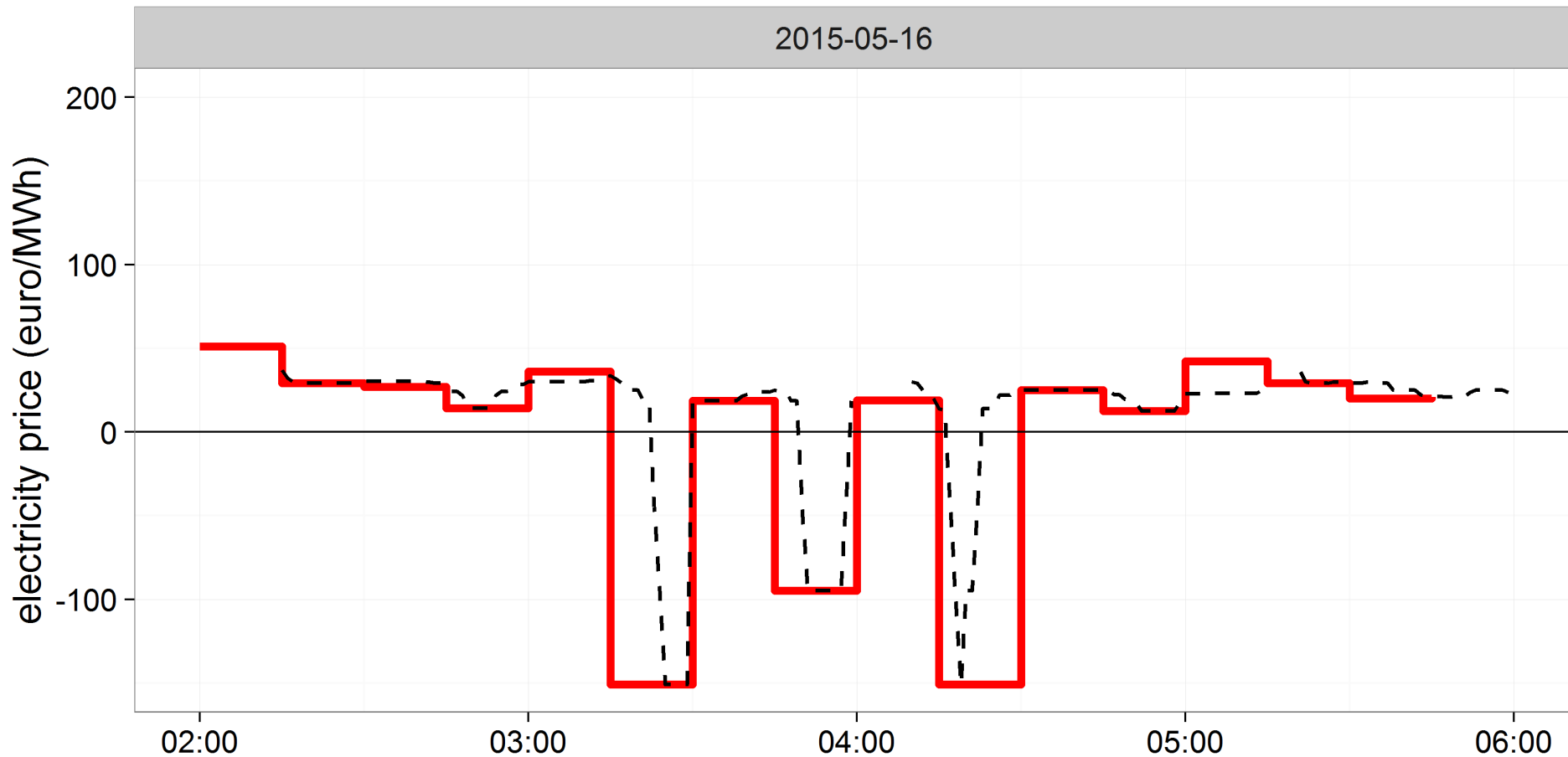
Imbalance price detail



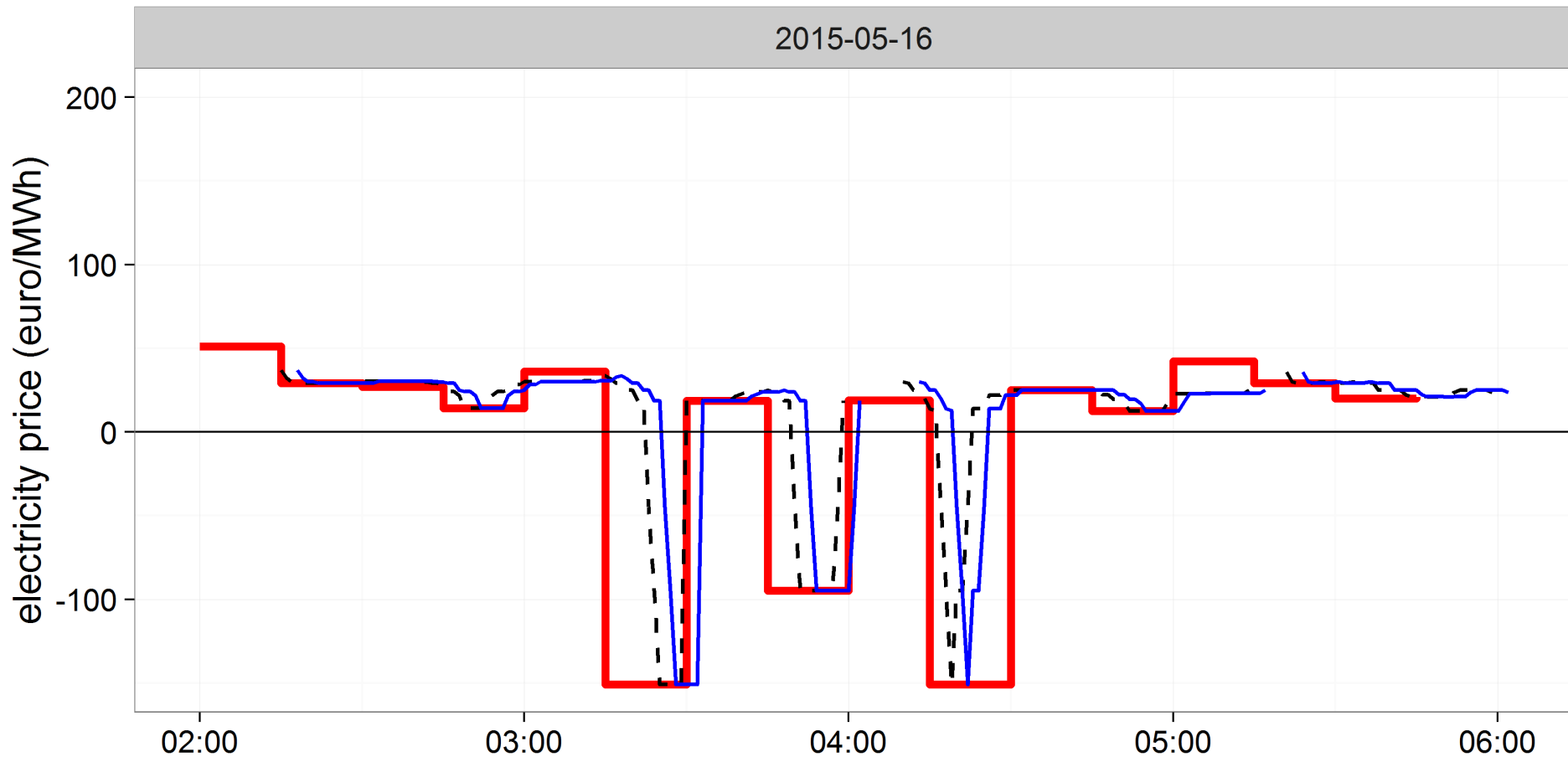
Imbalance price detail



Imbalance price detail



Imbalance price detail



Conclusion & Discussion

- Large CO₂ reduction potential in district heat
- Current market conditions not easy
- Many interesting optimization challenges!