How much central planning does transformation require – and who should be the planner?

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Agenda

1. Introduction
2. “Energiewende”: Some facts on the German situation
3. A simple model of co-ordination of grid and generation investment
4. Remarks on the impact of large price zones
5. Conclusion

“Central planning” is frequently called for – but is unclear what is actually meant by it.

Example Germany: Typical buzz worsd in the public debate

- “We need more co-ordination.”
- “We need a master plan.”
- “We need an energy ministry.”
- “We need a manager of the “Energiewende””

These quotes come from all over the place in the public debate

- Röttgen (Federal Minister of Environment, CDU)
- Trittin (Head of Green Party)
- Hundt (Confederation of German Employer Organizations)
- VKU (local utilities)

By “central planning” I refer to the co-ordination of network and generation investments.

What?

- Networks
  - horizontally: between TSOs, between countries
  - vertically: between TSOs and DSOs
- Generation
  - size, location, type of investment
- Generation & Network

Who?

- Market
- Regulators
- Ministries
  - Commission
  - Federal
  - „Länder“

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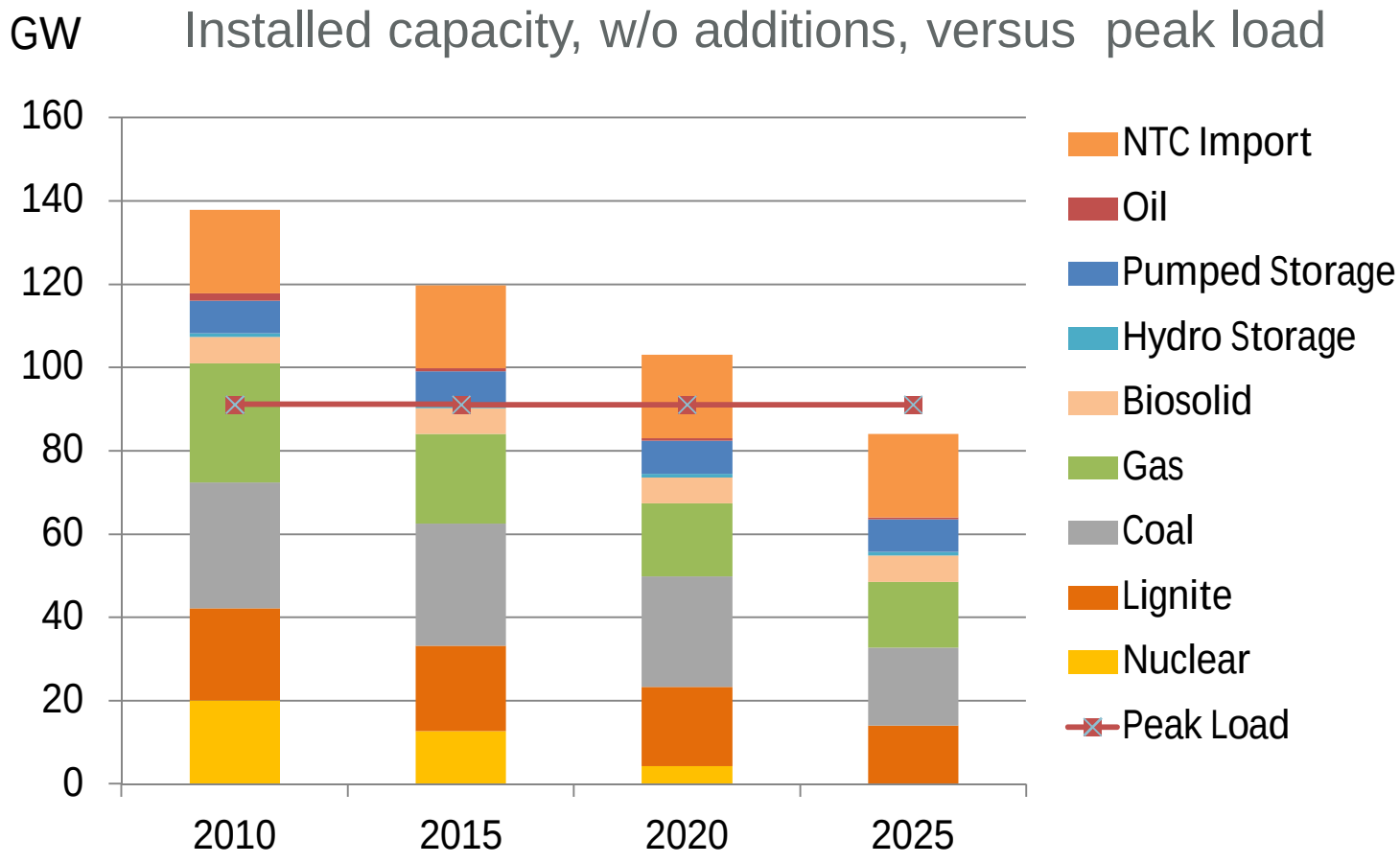
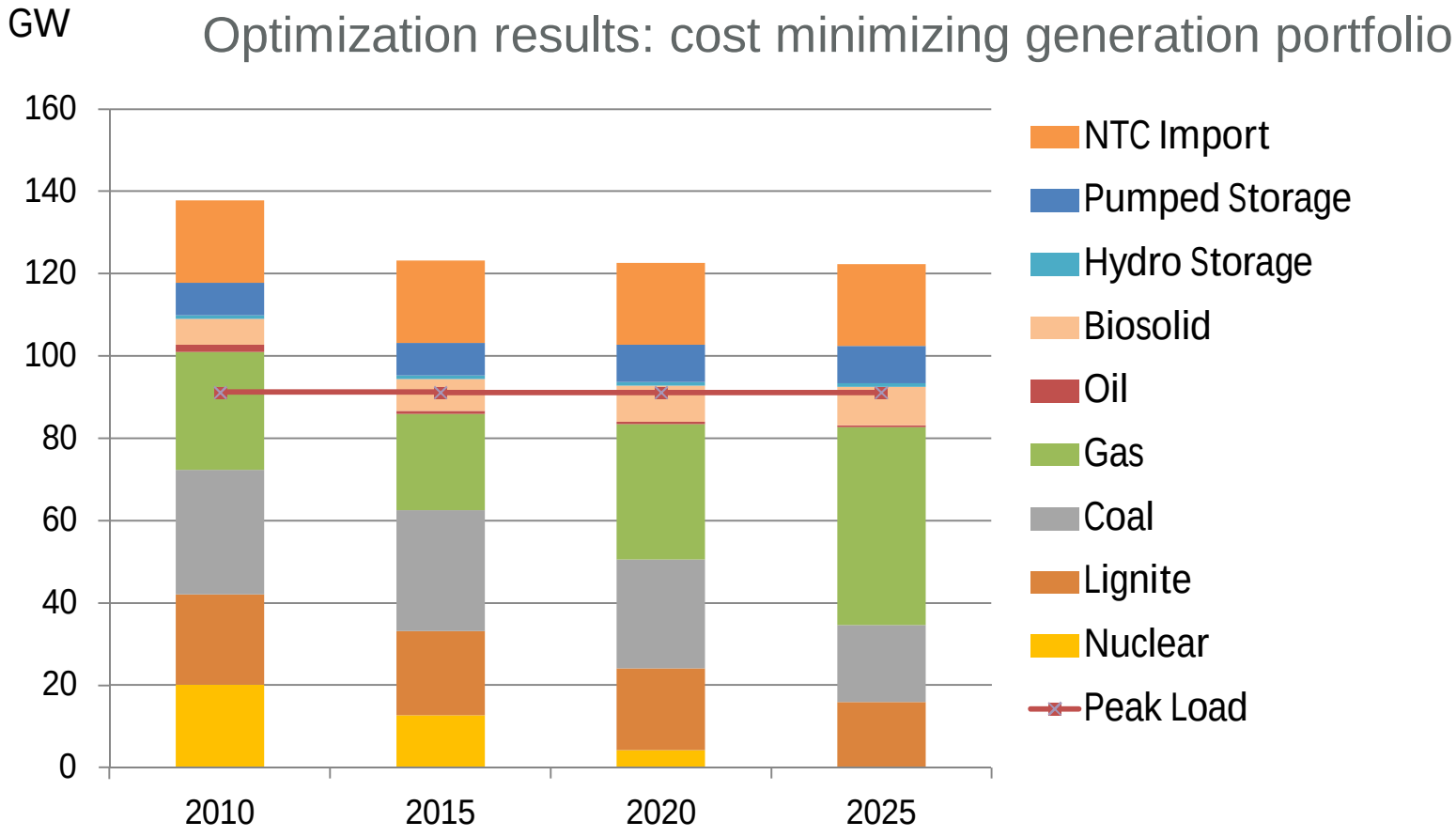
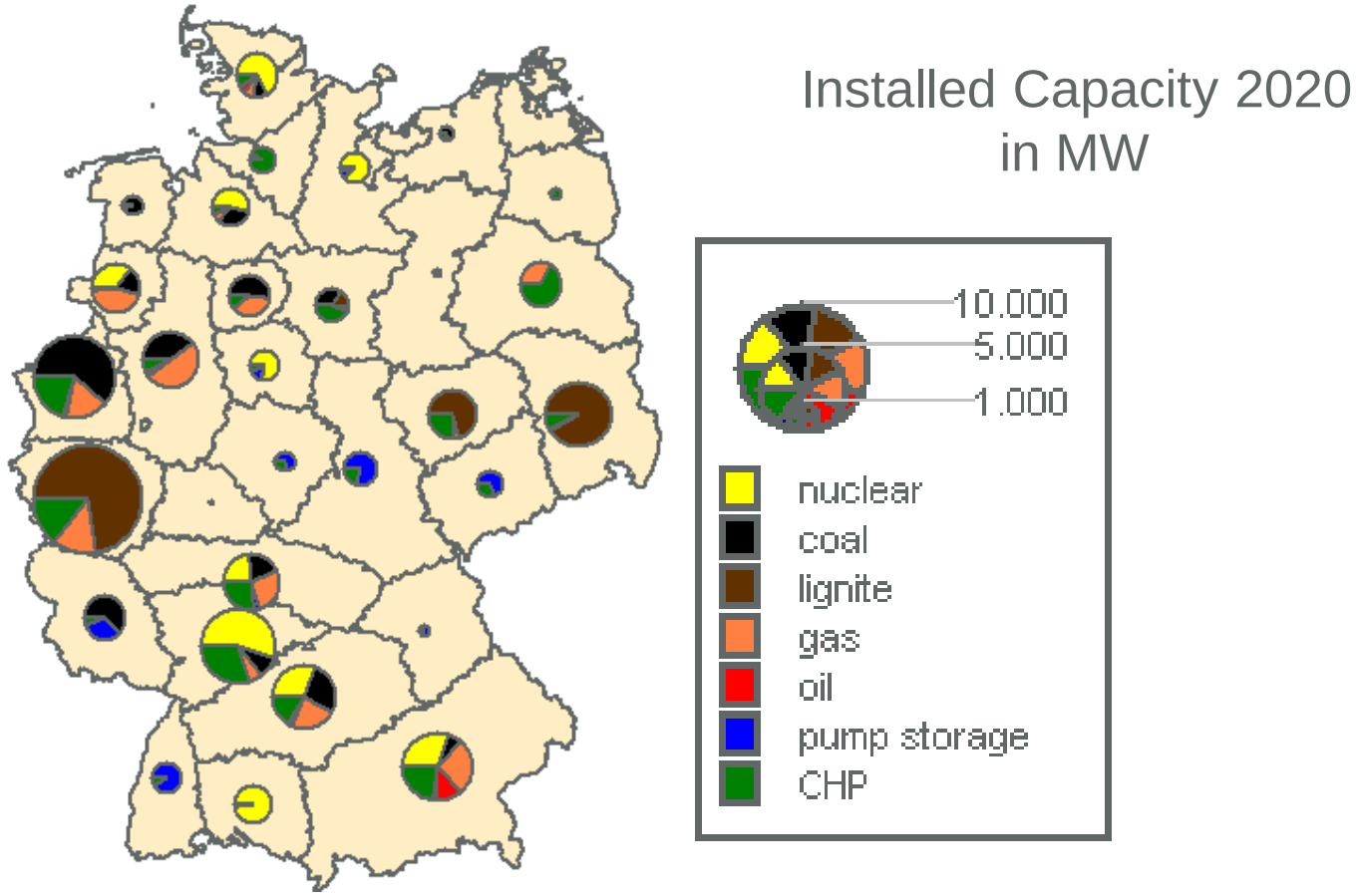
There is significant need for new capacity in Germany (only) after 2020.



The cost minimizing addition of capacity to ensure security of supply would mainly be gas turbines.

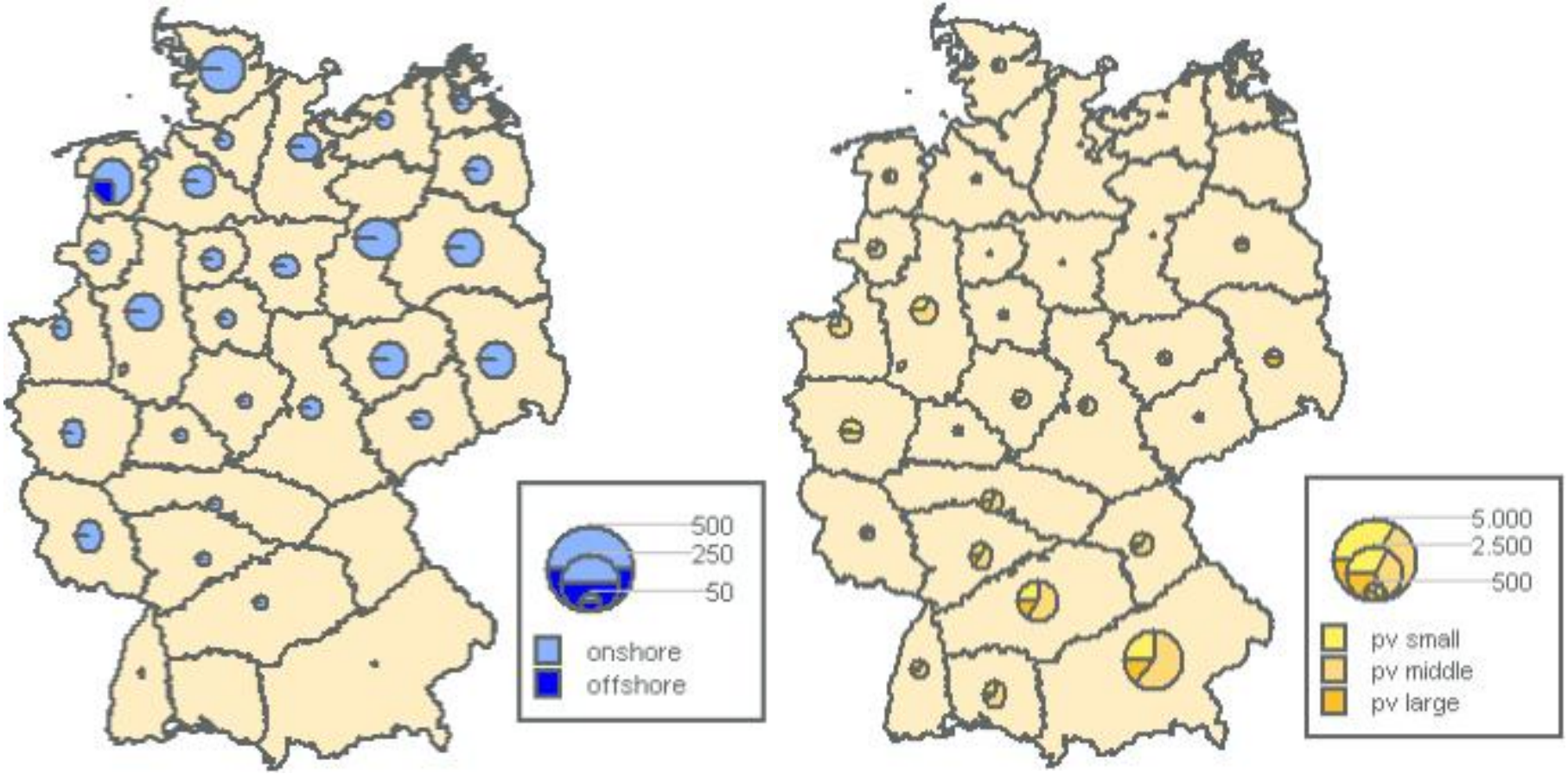


Installed non-RES capacities 2010 are close to load and nuclear is strong in the South.



Source: Nüßler (PhD Dissertation, Cologne, forthcoming).

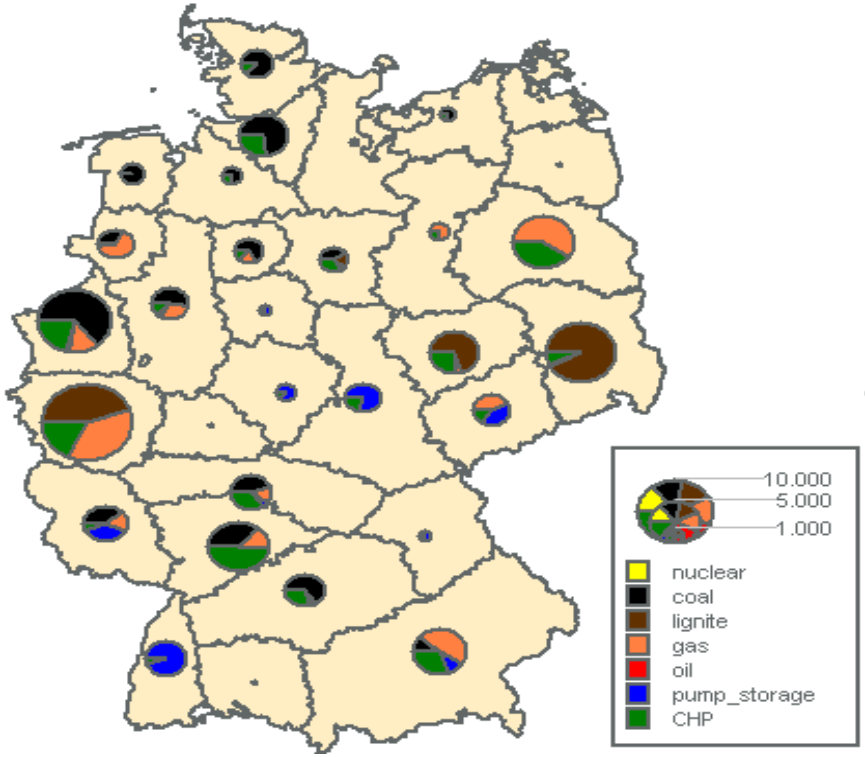
RES capacity in 2010 show a strong regional pattern: wind in the North, photovoltaic (pv) in the South.



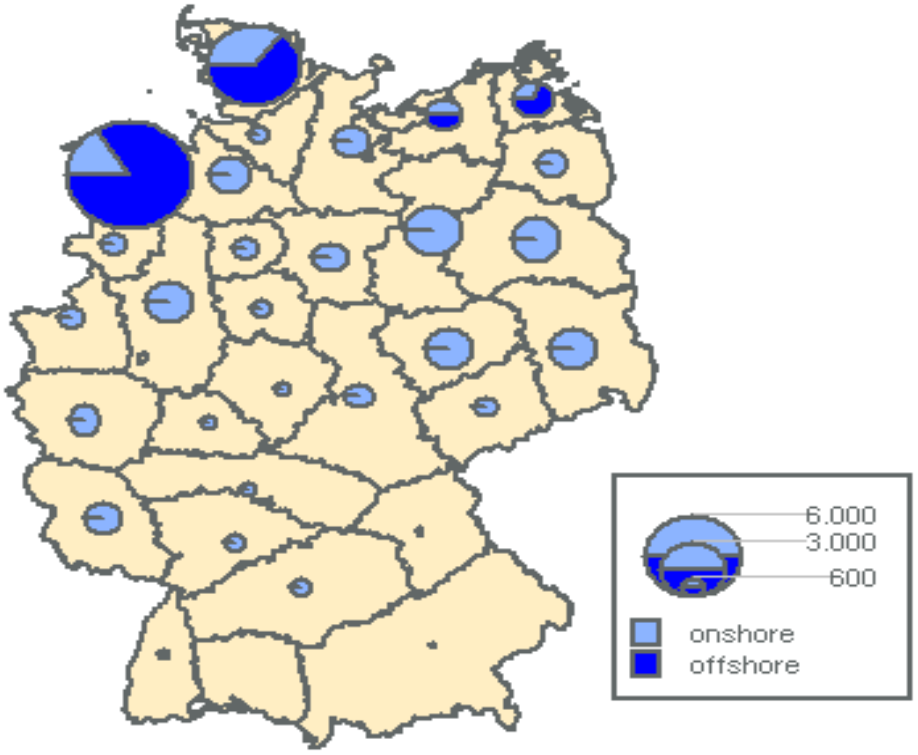
Source: Nüßler (forthcoming).

Planned increase in RES without a change in regional patterns for conventional leads to an imbalance.

Conventional Capacity
(legacy locations)



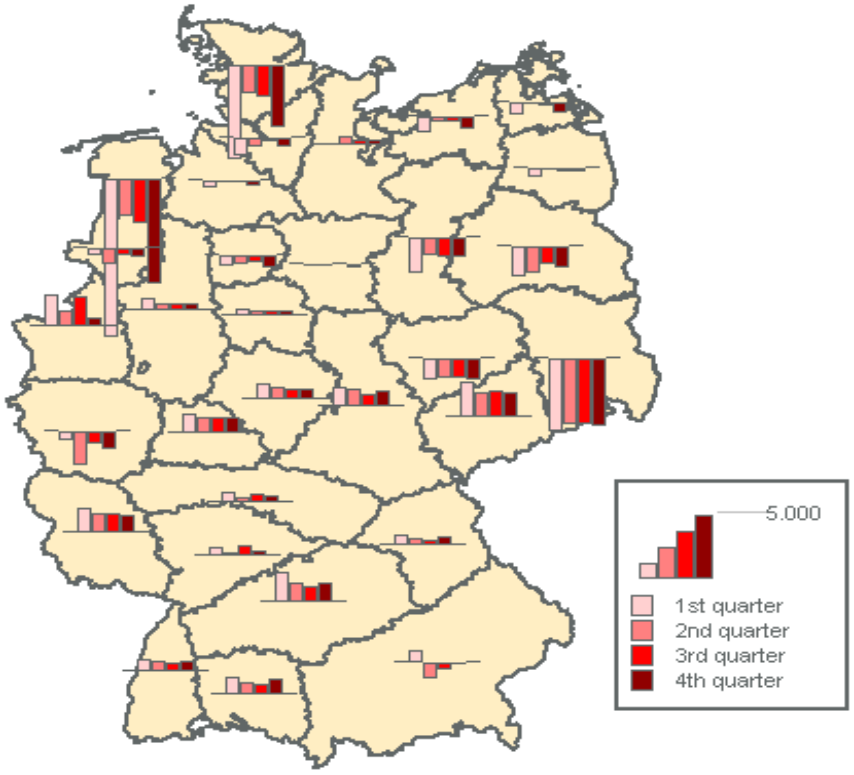
Wind
(optimal generation potential)



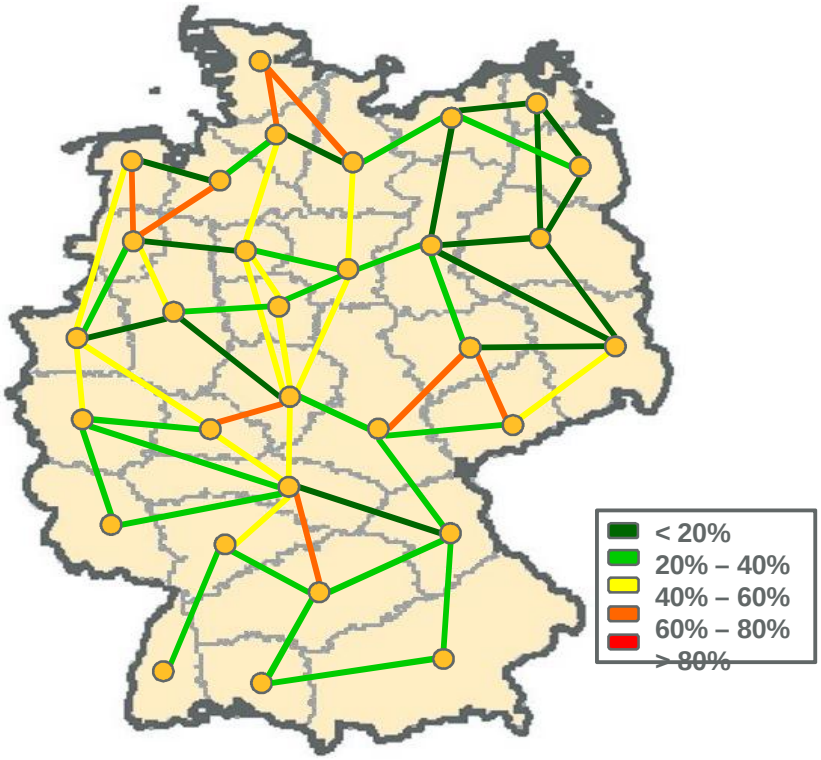
Source: Nüßler (forthcoming).

The regional imbalance in generation and load will put stress on the high voltage grid.

Regional Im/Exports
2025



Average Grid Utilization
2025



Regional aspects will become more important. This raises the question, how to co-ordinate this.

Importance of regional aspects due to the “Energiewende”

- Location of nuclear in the South close to load
- Best wind potential in the North
- Grid extensions and / or new conventional generation in the South required
- High share of renewables might increase the need for back-up capacities that are hard to finance on the electricity markets
- Any capacity mechanism (if needed) addressing this issue need to take care of the regional dimension

How to co-ordinate this in a world where

- grid investments are private, but heavily regulated
- generation investments are private, and not (yet) regulated

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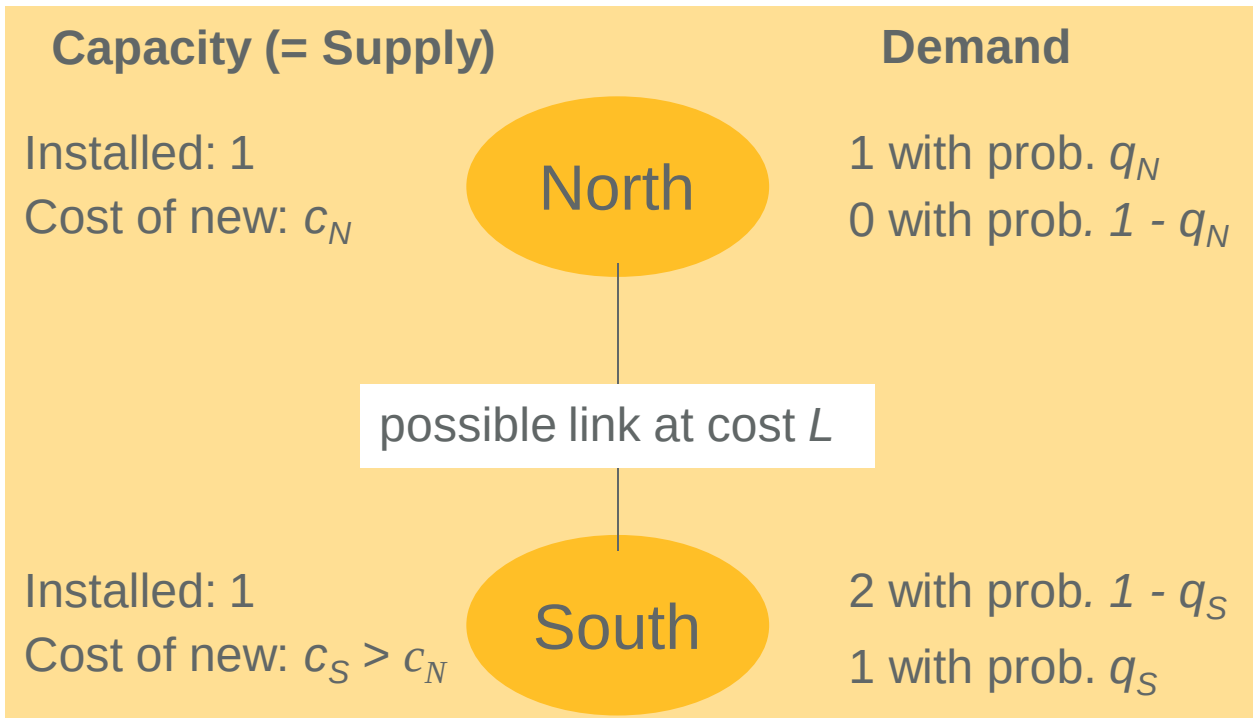
* based on joint work with Achim Wambach

We look at a simple two-node model where generation is cheaper in the North.



Prices

$D = S$ -> $price = m > 0$

$D < S$ -> $price = 0$

$D > S$ -> $price = M > m$

Social cost of blackout ($D > S$) equal $B > M$

One unit of capacity can be entered in the South and one in the North; any profitable capacity will be entered

The socially desirable outcome depends on the parameters – how to achieve it on the power of the regulator.

Outcomes

- S = generation build in the South
- NL = generation build in the North and link is build
- L = only the link is build

- S preferred to L iff $c_S < q_S q_N B + L$
- S preferred to NL iff $c_S < L + c_N$
- L preferred to NL iff $c_N > q_S q_N B$

Regulatory Power

- Regulator might
  - control the link
  - additionally influence the generation investment
- Regulator know the costs of the generation investment or not
- Regulator might be able to commit long-term with respect to the decision on the link, or not
  - formally: the regulator moves before or after private investors

Case I: Control of network only, no information and no commitment problems.

With full commitment and full information about cost of capacity, the only problem is the missing money problem: too little capacity is build, due to $m,M < B$

missing money if:

- first best is S, but $q_S m < c_S$ → S will not be realized by private investor since it is not profitable, thus (high) social blackout cost occur with prob. q_S
- first best is NL, but $q_S q_N m < c_N$ → N will not be realized by private investor since it is not profitable, thus (high) social blackout cost occur with prob. $q_S q_N$

Case II: Control of network only, no information problem but lack of commitment.

Due to a lack of commitment, even in the absence of a missing money problem, the first best can no longer be implemted.

Two inefficiencies:

- **Investment forcing**: private investor builds in the North, since he can rely on the fact that the regulator will always follow by building the link

  first best = S (i.e., $c_S - c_N < L$), but building the North is more profitable

  $$q_S m(1-q_N) < c_S - c_N < L$$

- **Investment preemption**: private investor builds in the South, since he can rely on the fact that the regulator will never follow by building the link

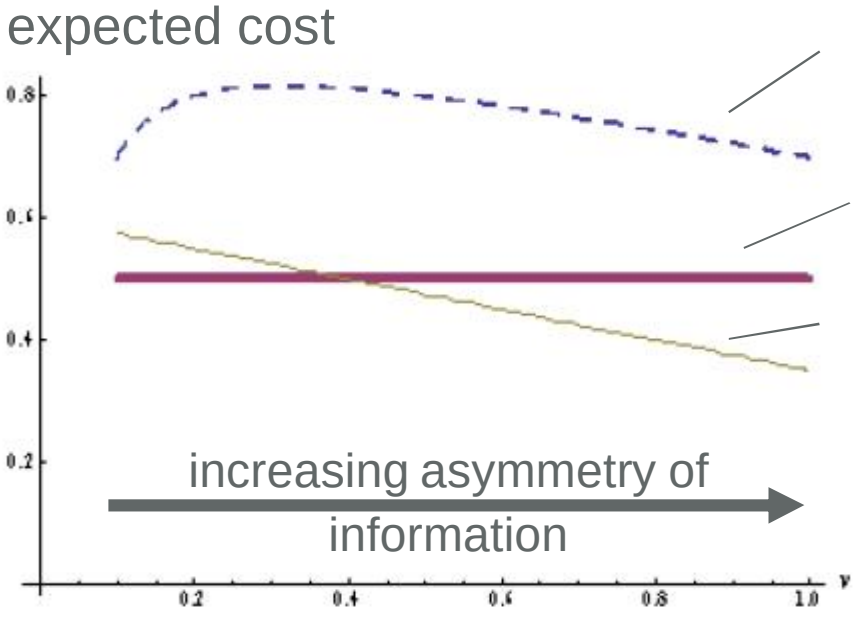
  first best = NL, but investing in the South is highly profitable

  $$q_S m - c_S > q_S q_{SN} m - c_N$$

Case III: Control of network only, information problem and the effect of commitment.

With high uncertainty about the cost, a lack of commitment, i.e. moving second, can become favorable for the regulator.

Example: Cost c_N drawn from a uniform distribuion with variance v



Parameters: high value of B and high value of L, on average, S preferred to NL.

Case IV: Regulator can also influence the private investment decision.

If there are no shadow costs of public funds, the regulator can implement the first best even under asymmetric information. He uses a simple procurement auction with a malus.

Procurement auction:

- Regulator buys capacity in an auction for each location
- Bidders in the locations receive a malus that reflects the network costs they impose on the regulator

Proposition 6 *The regulator can implement the efficient allocation by a second price reverse auction with the following properties: The reserve price is set by* $r = \min(L + q_S q_N B, q_S B)$. *The bidder in the north obtains a malus of* $G_N = L + q_S q_N m$. *The bidder in the south obtains a malus of* $G_S = q_S m$.

Even with locational pricing, the co-ordination of network and generation capacity is difficult.

Summary

- The ability of any „network regulator“ to co-ordinate is limited by problems of
  - lack of commitment
  - asymmetry of information
- There exists a general trade-off between these two limitations: asymmetry of information calls for the ability of the regulator to react to private investment decisions, since these reveal information; but regulatory flexibility (= lack of commitment) will be exploited by private investors.
- Co-ordination that includes also generation investments is possible – but then all investments are undertaken in a public procurement auction.

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Germany seems dedicated to keep a single price zone. Congestion then causes a need for redispatch.

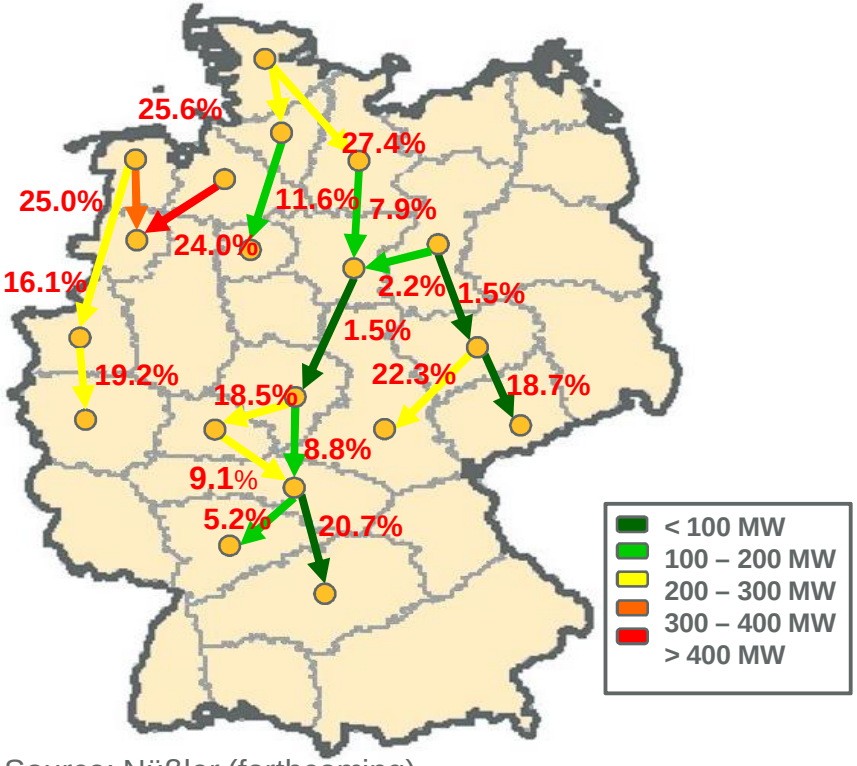
Situation in Germany

Wholesale market dispatch disregards internal network restrictions

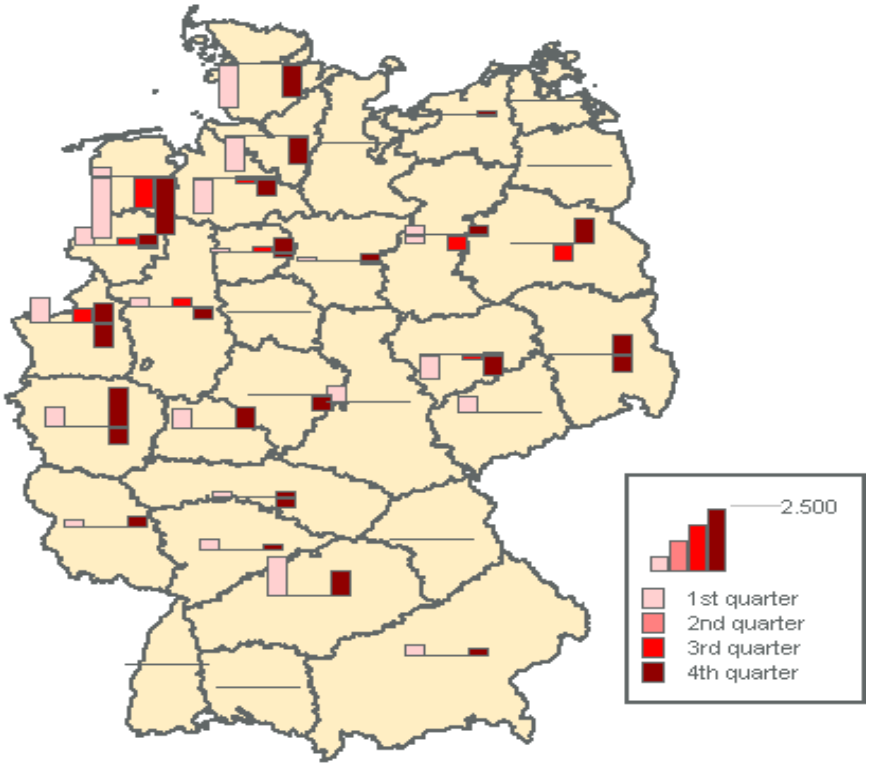
- Cost-based redispatch according to bilateral agreements TSO/utilities
  - Ramp-down of most expensive spinning units in energy surplus area
  - Ramp-up of least expensive non-spinning (or part-load) units in deficit area
- Total redispatch costs (BNetzA monitoring reports):
  2007: 30 Mio. €; 2008: 45 Mio. €; 2009: 25 Mio. €; 2010: 13 Mio. €
- Congestion taxing: redispatch costs socialized via grid usage fees

Simulations indicate a strong increase in the need of redispatch, with strong seasonality.

Congestion (in % of hours) in 2025



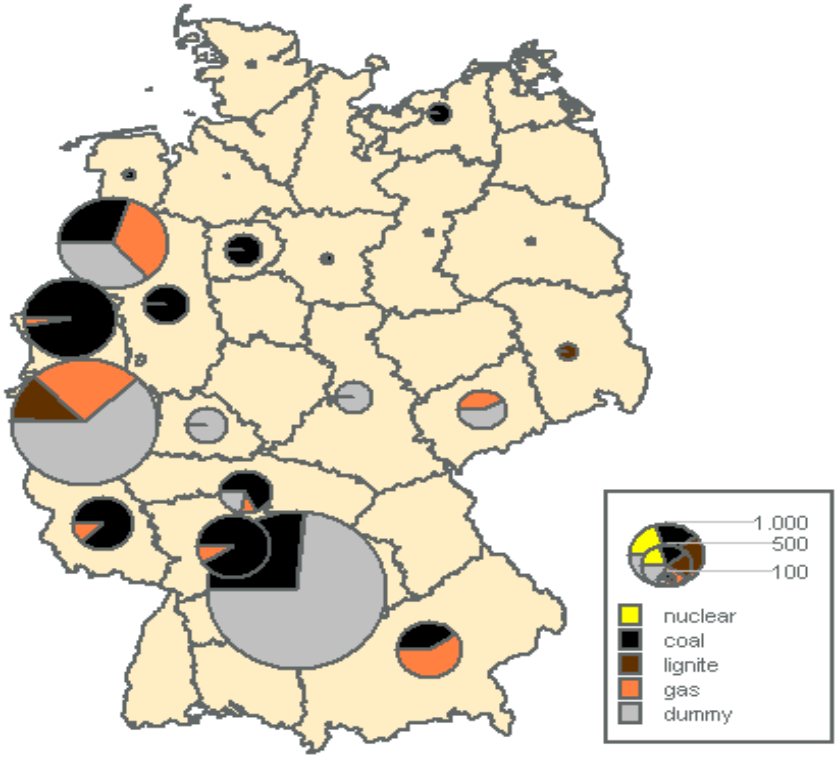
Redispatch in 2025



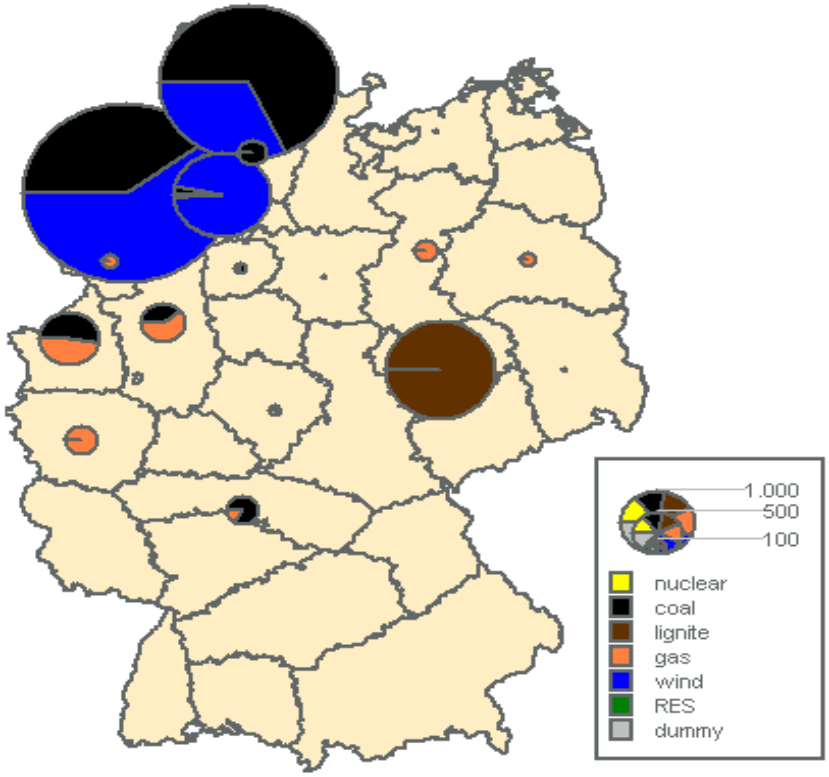
Source: Nüßler (forthcoming).

Without regional redistribution, Germany will lack capacities for generation-increasing redispatch

Redispatch – increasing regional generation, 2025



Redispatch reducing regional generation, 2025



Source: Nüßler (forthcoming).

Conclusion

- A co-ordination that accounts for regional aspects becomes increasingly important.
- Such a co-ordination is difficult, since any co-ordinator will face problems of asymmetry of information and lack of commitment, and the interaction of the two.
- Without zonal pricing, locational incentives for redispatch facilities become important.
- Co-ordination might not only take the form of regulation - maybe there is also potential for market based co-ordination, provided adequate incentives are given to e.g. network investors.

Thank you for your attention.

Do you have any questions or suggestions?

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