Decentralization, Regionalization and Power Grids

Meta-Study about assumptions, findings and narratives

Dr. Eva Schmid, Germanwatch e.V.

RGI Scenario Workshop

Berlin, 24.10.2018

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What is the motivation?

- How much electricity do we need to transport within Germany in the next years and decades?
- Which factors have the largest impact on this transport requirements?
- Can we not save ourselves from a lot of transmission grids, if we locate generation closer to demand centers?

Basic Info Meta-Study

- Commissioned by:
  Renewables Grid Initiative

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Dezentralität, Regionalisierung und Stromnetze

Meta-Studie
über Annahmen, Erkenntnisse und Narrative

Berlin, 11.03.2018

für die
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- Study and further Material online (currently in German):
  https://renewables-grid.eu/Metastudie/

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Lead questions Meta-Study

1. What is the definition of the terms "decentralization", "cellular approach", or "regionalization"?

2. Which findings do we really have on the need for expanding the transmission grid in the studies?

3. By means of which assumptions do the different study generate which findings?

4. And what is missing to render the current discussion more fact-based?

Which studies were included?

- Studies that were included in the meta-study, including customized data (28 scenarios)
  - **Öko-Institut/Prognos:** Stromsystem 2035+ (WWF), 2018
  - **Öko-Institut:** Transparenz Stromnetze (BMBF), 2018
  - **FAU:** Regionalkomponenten bei der EE-Vergütung (MonK), 2017
  - **Fraunhofer ISI/Consentec:** Langfristszenarien (BMWi), 2017
  - **E-Bridge/Prognos et al.:** Energiewende Outlook 2035 (50Hertz), 2016
  - **Consentec:** Netzstresstest (TenneT), 2016
  - **Prognos/FAU:** Dezentralität & zelluläre Optimierung (N-ERGIE), 2016
  - **VDE:** Der zellulare Ansatz, 2015
  - **Reiner Lemoine Institut**: Vergleich und Optimierung von zentral und dezentral optimierten Ausbaupfaden […], 2013
- Studies that did not contain sufficient data for inclusion, and for which the authors could not/ did not want to deliver data individually to the authors on request
  - **FAU:** Regionale Preiskomponenten im Strommarkt, 2015

Method Meta-Study

1. Qualitative analysis: Specification and conceptional classification of decentralization and cellular approaches

2. Quantitative analysis: Pre-analysis of spatial demand and supply patterns for solar and wind energy

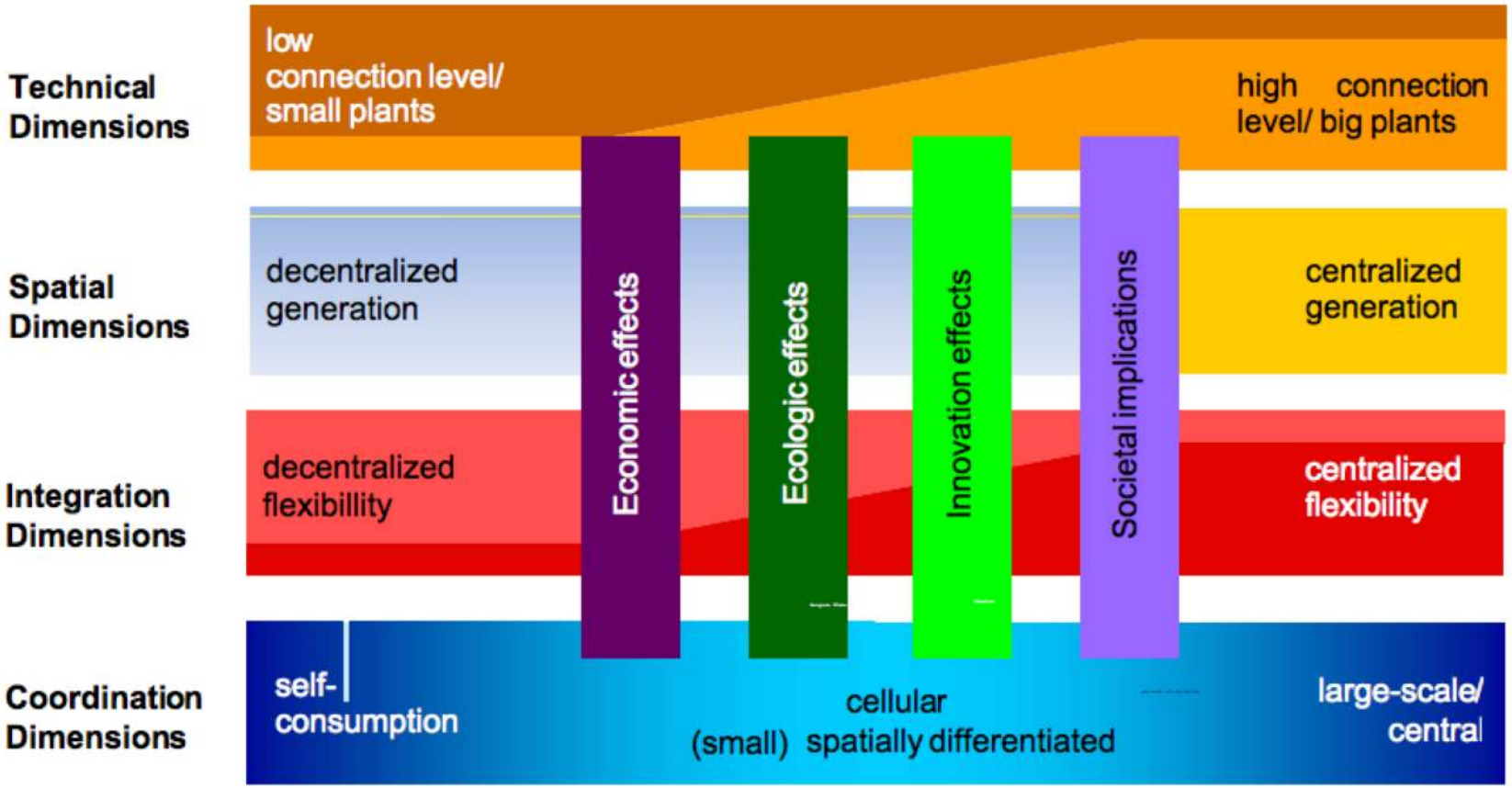
3. Qualitative & quantitative meta-analysis:
   - Short description of studies and scenarios
   - sourcing of comparable data
   - systematic data comparison

4. Conclusions

Findings lead question 1:

What is the definition of the terms "decentralization", "cellular approach", or "regionalization"?

→by means of dimensions / perspectives / aspects

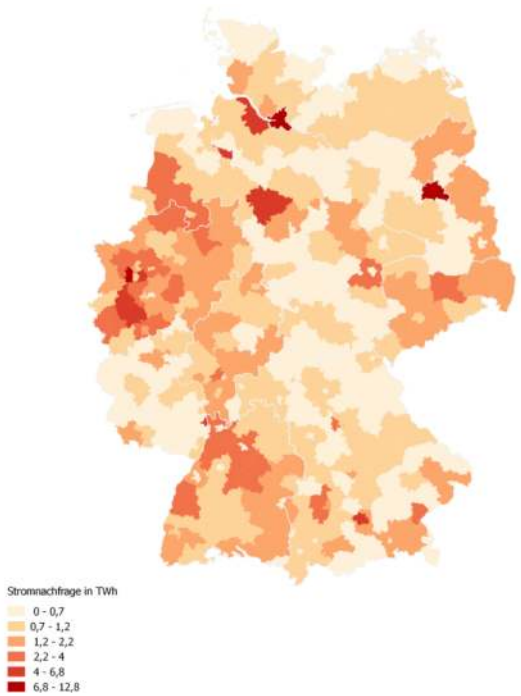


Findings lead question 2:
Which findings do we really have on the need for expanding the transmission grid in the studies?

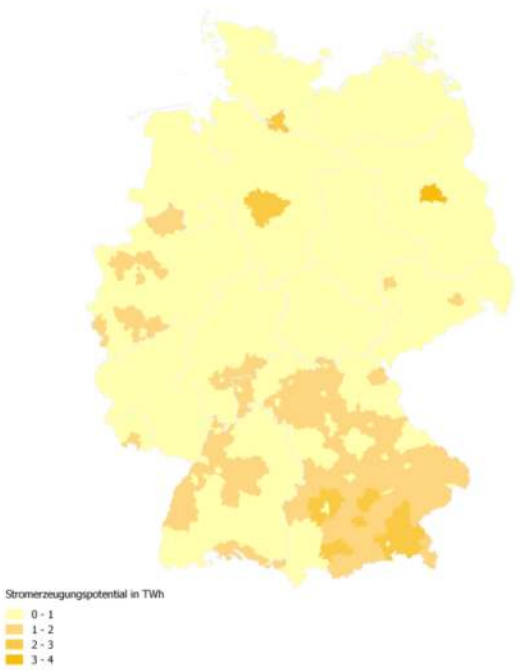
- Current studies do not allow for a systematic cost-benefit analysis
  → Weighting of interests in a political process
- Predominantly ignored in the studies:
  Fit of development of coordination mechanisms ↔ regulation in Germany and Europe
  → Need for further research!
- Expansion of the transmission grid takes place in all scenarios
- Regional distribution of renewables generation is the factor with the most explanatory power for grid expansion need

Potentail boundaries for solar and wind generation - boundaries for decentral optimization (1)

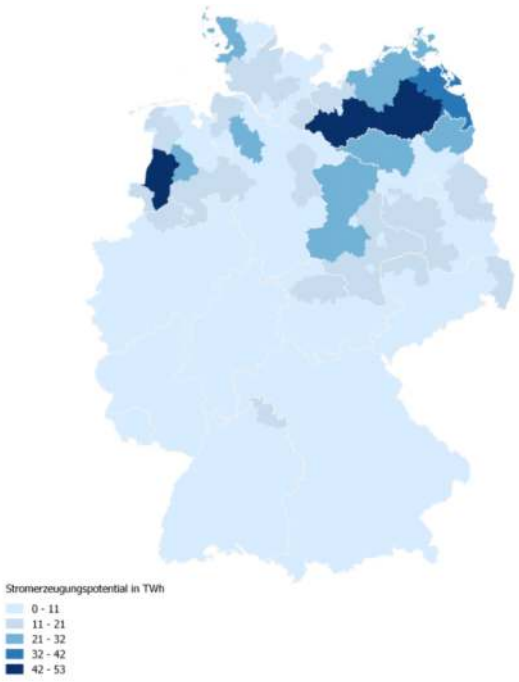
Demand (2030)



Solar



Wind



- Spatial patterns show strong clusters and little coincidence
- Potential for generation is theoretically and spatially restricted

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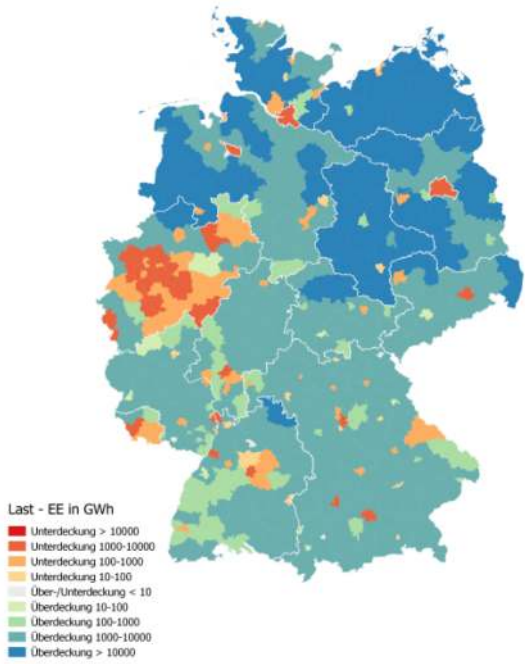
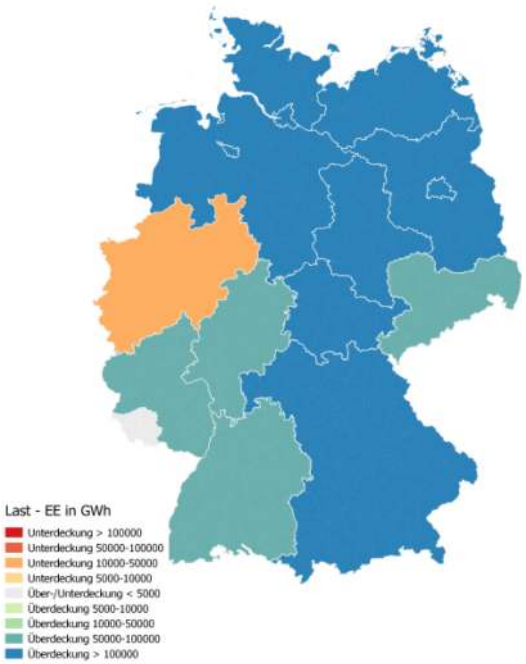
Potentail boundaries for solar and wind generation - boundaries for decentral optimization (2)

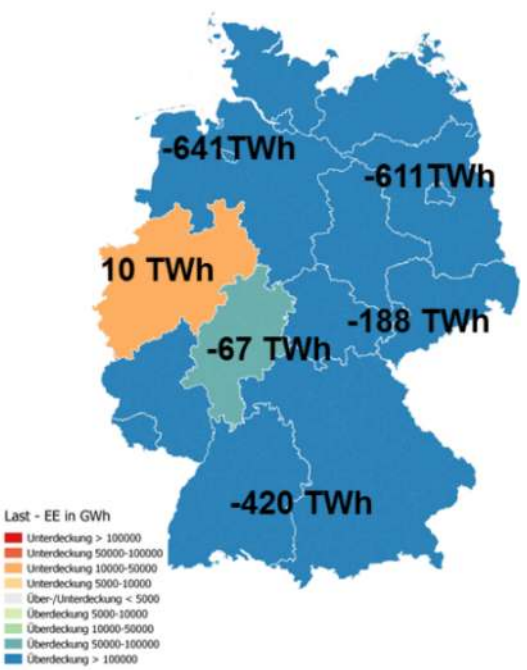
County



Federal States



Zones

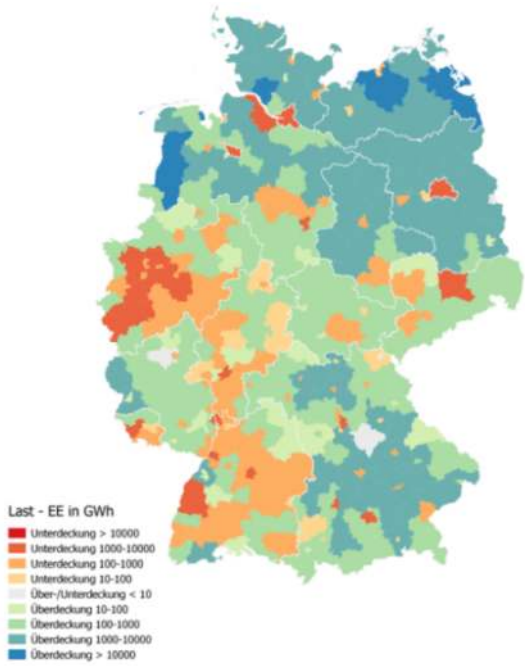


Theoretical cellular fulfillment of demand in the year 2030

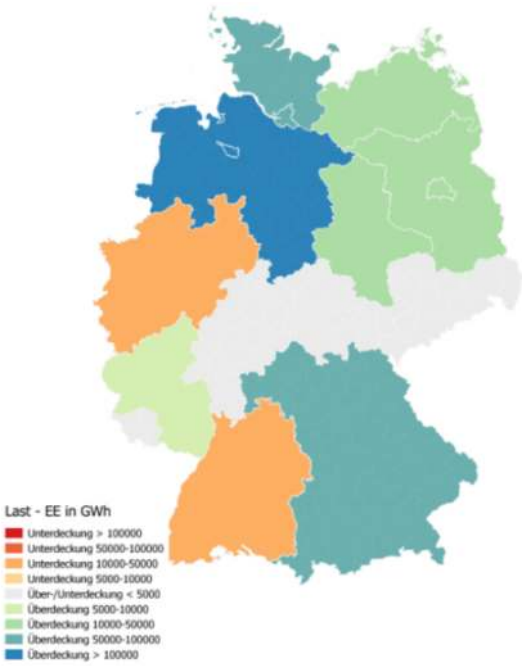
without consideration of costs or flexibility options

Potentail boundaries for solar and wind generation - boundaries for decentral optimization (3)

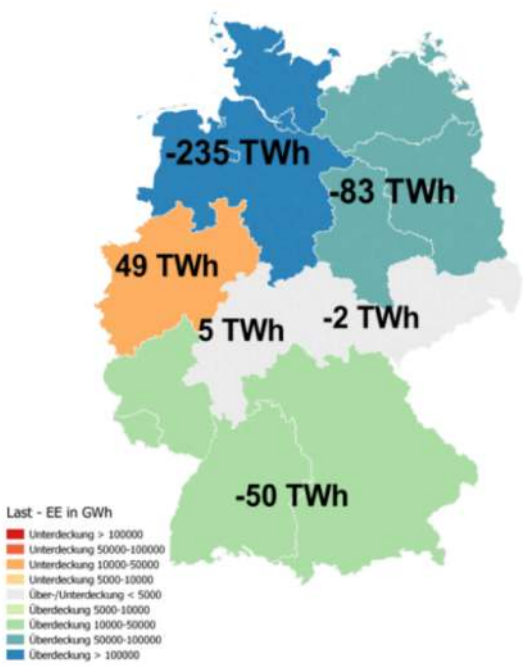
County



Federal States



Zones



"Realistic" cellular fulfillment of demand in the year 2030

without consideration of costs or flexibility options

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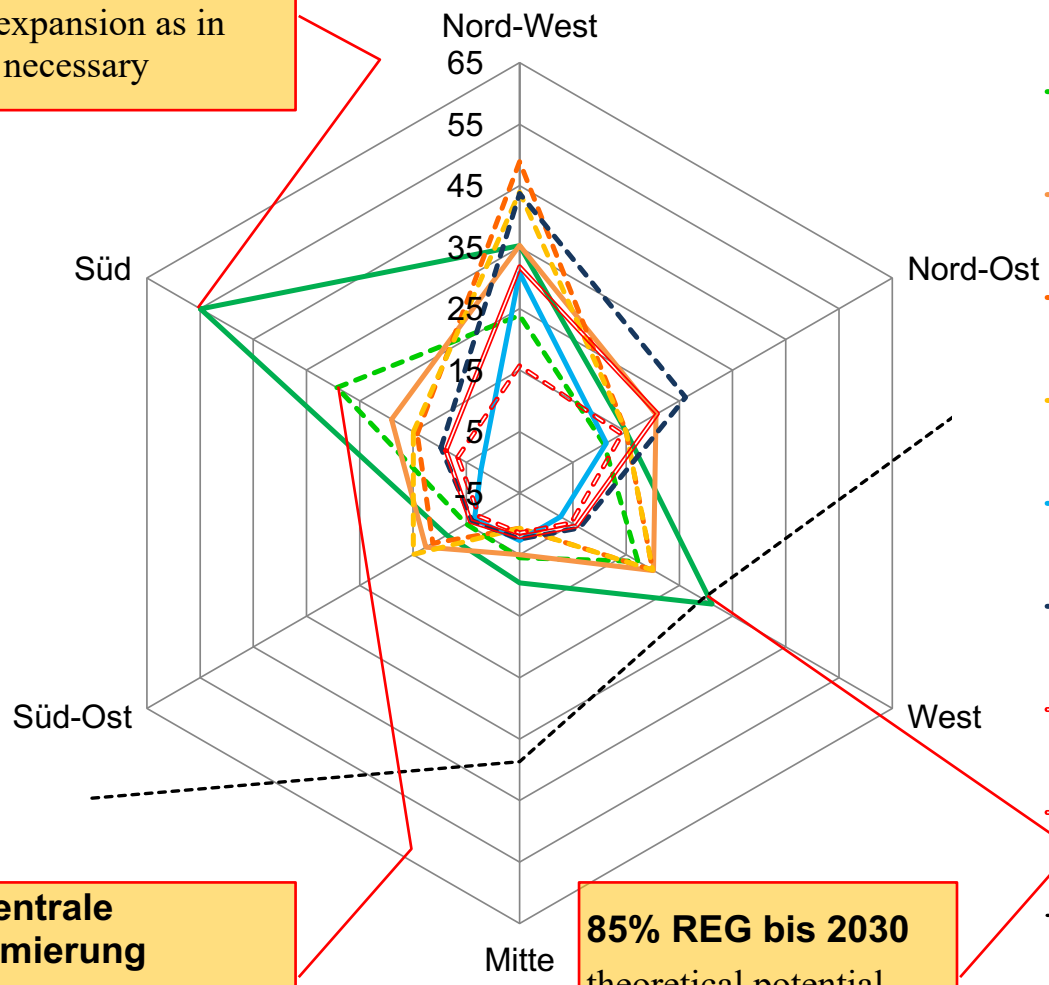
Findings lead question 3:
By means of which assumptions do the different study generate which findings?

- **Decentrally optimizing coordination mechanisms** (cellular concepts, regional markets) **have a small impact on reducing the need for grid expansion; dominating is the regionalization pattern of wind generation capacities**
- Studies, which have reduced need for grid expansion in the order of magnitude 20-50% assume:
  - High expansion of wind energy in the south (3-4, up to 6 times NEP (ca. 40GW in 2035)) and the west (2-3, up to 7 times NEP)
    → land use!
  - Of lesser importance: High expansion PV in the south (2-3 times NEP)
- No significant impact of coal combustion in 2035

Regionalization assumptions in comparion
Wind energy 2030

Öko-Institut, 2018

85% REG bis 2030
grid expansion as in NEP necessary



ÖI: Transparenz Stromnetze 85% 2030
ÖI: Transparenz Stromnetze Dezentral 2030
RLI: Dezentral 2030
RLI: Offshore 2030
RLI: Zentral 2030
Fraunhofer ISI: LFS Basis 2030
ÖI/Prognos: WWF Fokus PV 2030
NEP 2017: B2030
Ist 2016
Potenzialgrenzen

Dezentrale Optimierung
grid expansion as in NEP not necessary

85% REG bis 2030
theoretical potential limit reached

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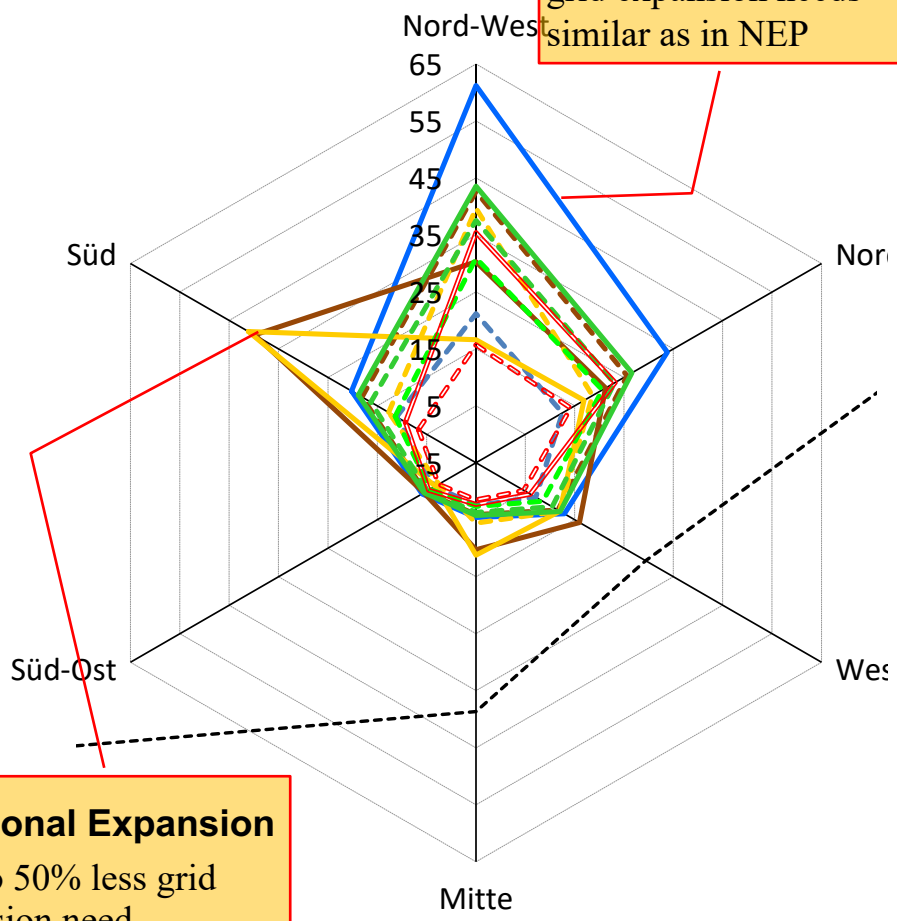
Regionalisierungsansätze im Vergleich Windenergie 2035

Öko-Institut, 2018

Coal Exit and replacement by wind in the north, grid expansion needs similar as in NEP



Regional Expansion
Up to 50% less grid expasion need

- Consentec: Stresstest - 100% kohlefrei
- Consentec: Stresstest - DEzentral
- Prognos/FAU: Dezentralität - FB EE&EM
- Prognos/FAU: Dezentralität - FB
- FAU: Regionalkomponenten - MG_OPT1
- FAU: Regionalkomponenten - MG_UNIV
- 50 Hertz: EWO Wettbewerb. EW
- 50 Hertz: EWO EEG EW
- 50 Hertz: EWO Prosumerorientierte EW
- NEP 2017: B2035
- Ist 2016
- Potenzialgrenzen

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Findings lead question 4:
And what is missing to render the current discussion more fact-based?

- Need for further research: Are decentral / cellular coordination mechanisms a sound option for grid planning?
- Which assumptions for regional wind- and solar potential are robust, if factors such as land use and acceptance are considered?
- How to develop a standardized assessment framework for costs and land use requirements for ensuring the comparability of future studies?
- Which metric can describe the need for grid expansion in a comparable way?

Thank you for your attention!

Questions, ideas, need for discussion?

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https://renewables-grid.eu/Metastudie/

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