Institute of
Technical Thermodynamics

Investigation of Model-Region Definitions in Energy System Models Using Aggregated Data

K. Cao
System Analysis and Technology Assessment
Contact: Karl-Kien.Cao@dlr.de

General research question

Which model-region approach is the most appropriate to derive meaningful statements about certain technologies and how far do applicable approaches differ from this?

Model-regions

Objective: Reduction of spatial model complexity

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Definition of borders for geographical regions for which all model data is concentrated at one point (node)

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Neglection or strong simplification of transport related constraints within this node

Basis of model-region definitions

1. Administrative borders (e.g. NUTS[1])
2. Size of geographical areas
3. Demand and generation centers [1]
4. Current electrical grid infrastructure [2, 3, 4, 5]
5. Market Zones [6, 7]

Properties of applied model-region approaches

- Administrative borders (1.) always considered
- Definitions strongly depend on data availability and computation time
- Need for suitable distribution factors
- Strong simplification of transmission systems
- Definitions usually depend on research discipline and are determined heuristically
- Influence of chosen definitions on results is normally not discussed

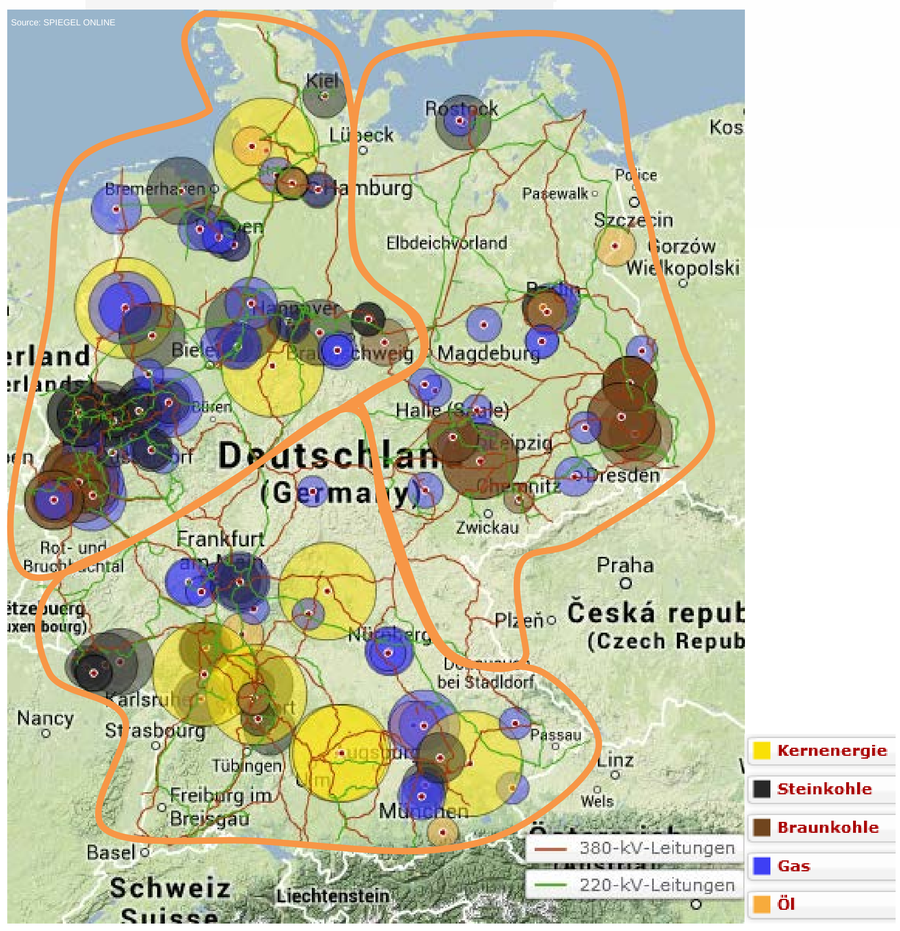
Objective of investigation

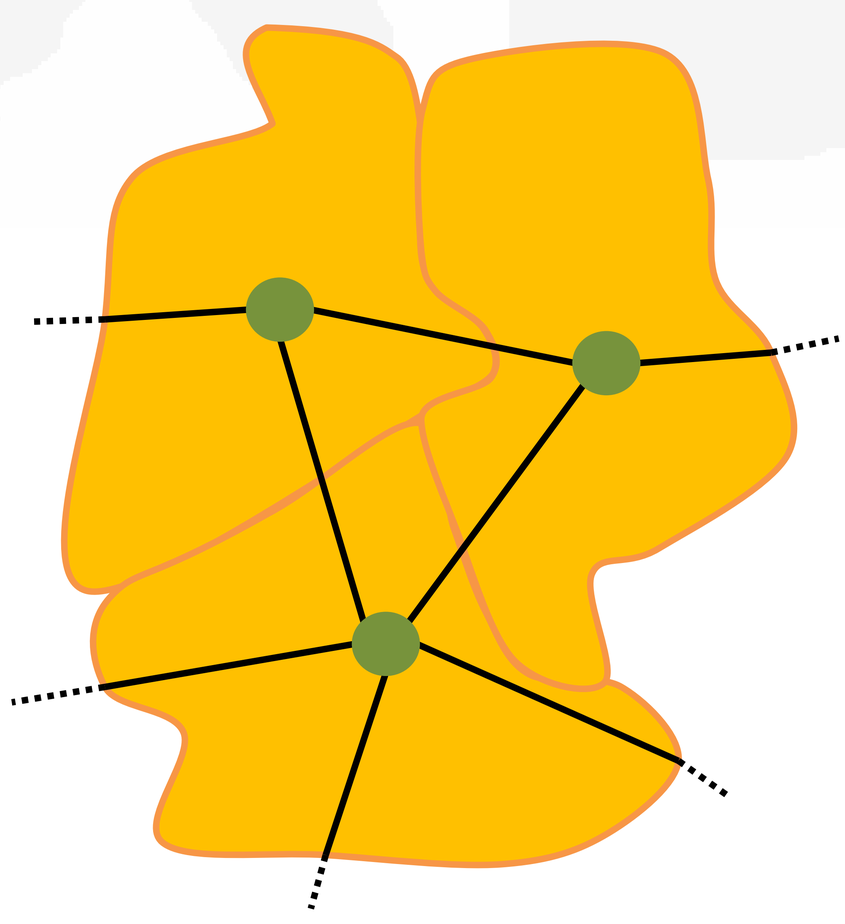
- Determination of criteria for ideal model-region definitions with focus on grid expansion planning
- Comparison with applicable model-region definitions for identification and assessment of deviations
- Determination of the influence of model-region definitions on model behavior and derivation of selection criteria

Next steps

- Determination of necessary and available data sets
- Setting up a simplified energy system model providing the option to modify model-regions automatically
- Performing sensitivity analyses with respect to different model-region definitions
- Derivation of properties of several model-region definitions

Example





Germany divided into three model-regions with respect to fossil fired power plants

[1] Wrobel, P. & Beyer, D.: Local Energy Balancing Demand for Germany, International Renewable Energy Storage Conference and Exhibition, 2012
[2] Waniek, D. et al.: Influences of Wind Energy on the Operation of Transmission Systems, Power and Energy Society General Meeting - Conversion and Delivery of Electrical Energy in the 21st Century, 2008
[3] Tröster, E. et al.: European Grid Study 2030/2050, energynautics GmbH, 2011
[4] Panciatici, P. & Debry, M.: High-level definition of a new methodology for long-term grid planning, e-HIGHWAY 2050 – Modular Development Plan of the Pan-European Transmission System 2050, 2013
[5] 50Hertz Transmission; Amprion; TenneT TSO & TransnetBW: Regionenmodell „Stromtransport 2013“, 2013
[6] ERGEG: The electricity regional initiative: making progress towards a single European market, fact sheet, 2006
[7] Kurzidem, M. J.: Analysis of Flow-based Market Coupling in Oligopolistic Power Markets, PhD Thesis ETH Zurich, 2010

[1] NUTS: Nomenclature des unités territoriales statistiques - geocode standard for referencing the subdivisions of countries for statistical purposes

Knowledge for Tomorrow

Wissen für Morgen

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