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Integrating storages in energy regions and local communities – a range of storage capacities

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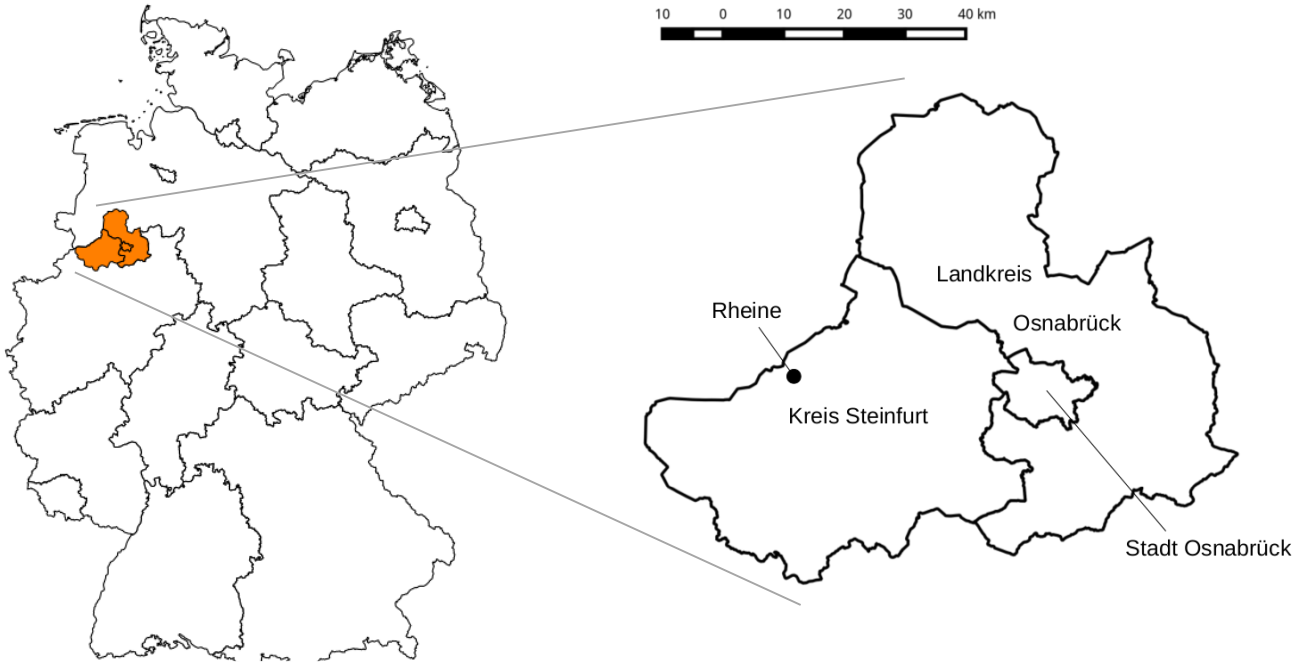
The model region Osnabrück-Steinfurt

Master plan regions with targets regarding:

- Reduction of green house gas emissions: - 95 %
- Reduction of electric energy demand: - 50 % until 2050 (compared to 1990)
- Significant increase of renewable energy supply



The project EOS

evaluates **electricity** storage solutions with regard to

- technical and economic aspects
- the legal framework
- consumer acceptance

(Dec 2013 bis Nov 2018)

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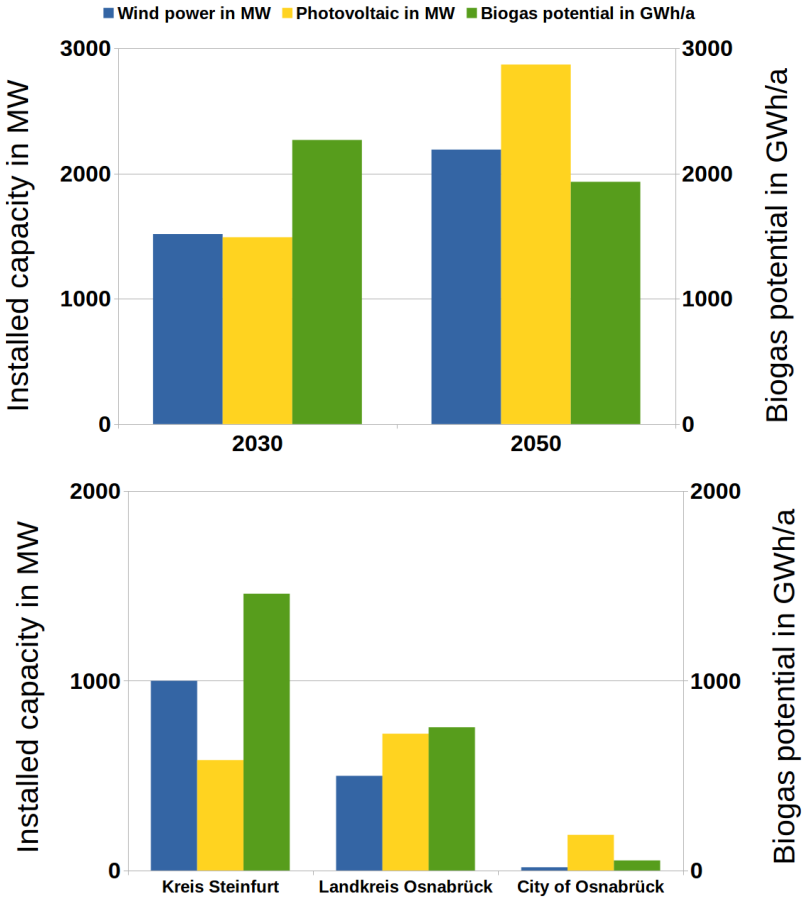
The model region Osnabrück-Steinfurt

- Two rural regions and one city
- Electric energy demand: approx. 6,000 GWh
- Master plan targets for the electricity sector are related to:
  - Reduction of electric energy demand
  - Increase of renewable energies (mainly wind power and photovoltaic)

Master plan targets:



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Research questions

- How do rural and urban regions complement regarding excess and deficit energy?
- What is the storage demand in future energy systems from the perspective of an energy region?
  - Influence of weather data from different years
  - Influence of various renewable energy potential
  - Influence of various combinations of cross-linking regions

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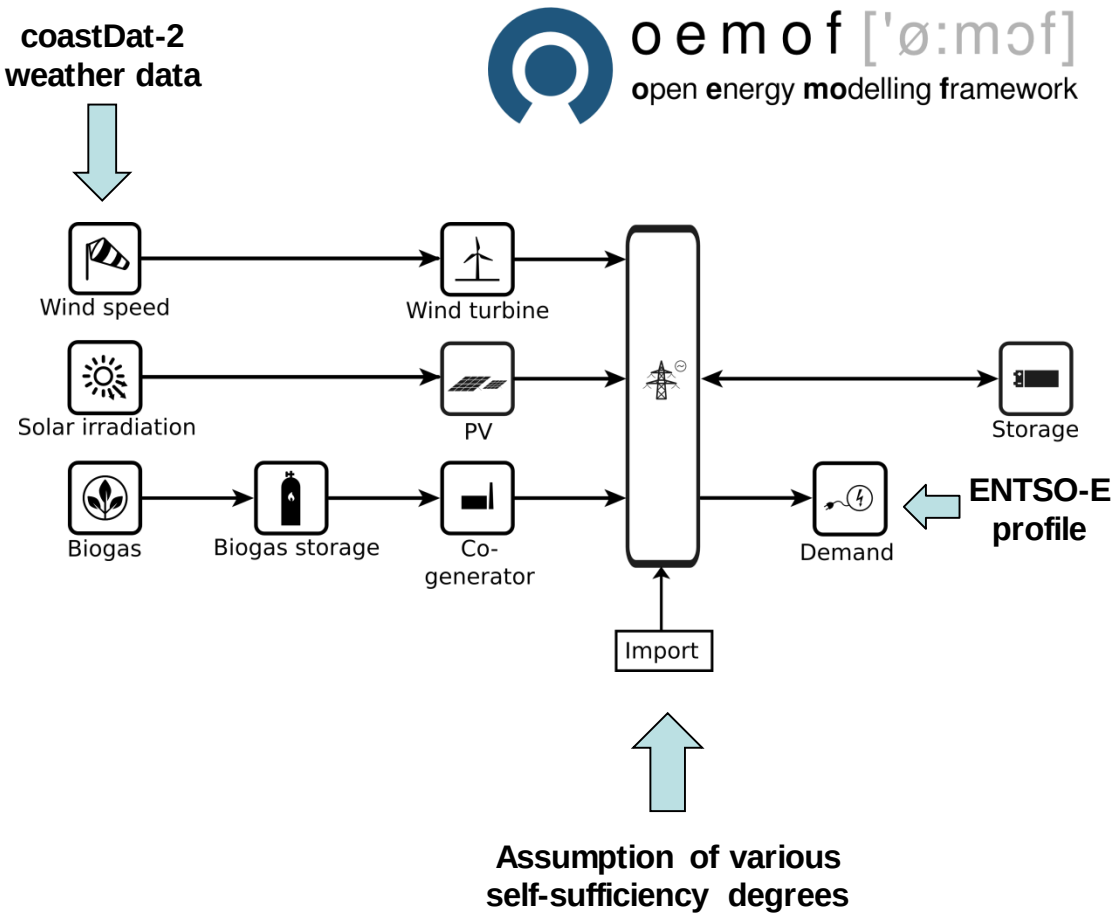
Methods

- Open energy modeling framework „oemof“ → open source and community modeling project
- Simulation of one year in hourly time steps
- Linear invest and dispatch optimization

	Generic Battery Storage
Cycle efficiency	0.80
C-rate	1
Usable range	0 to 100 %



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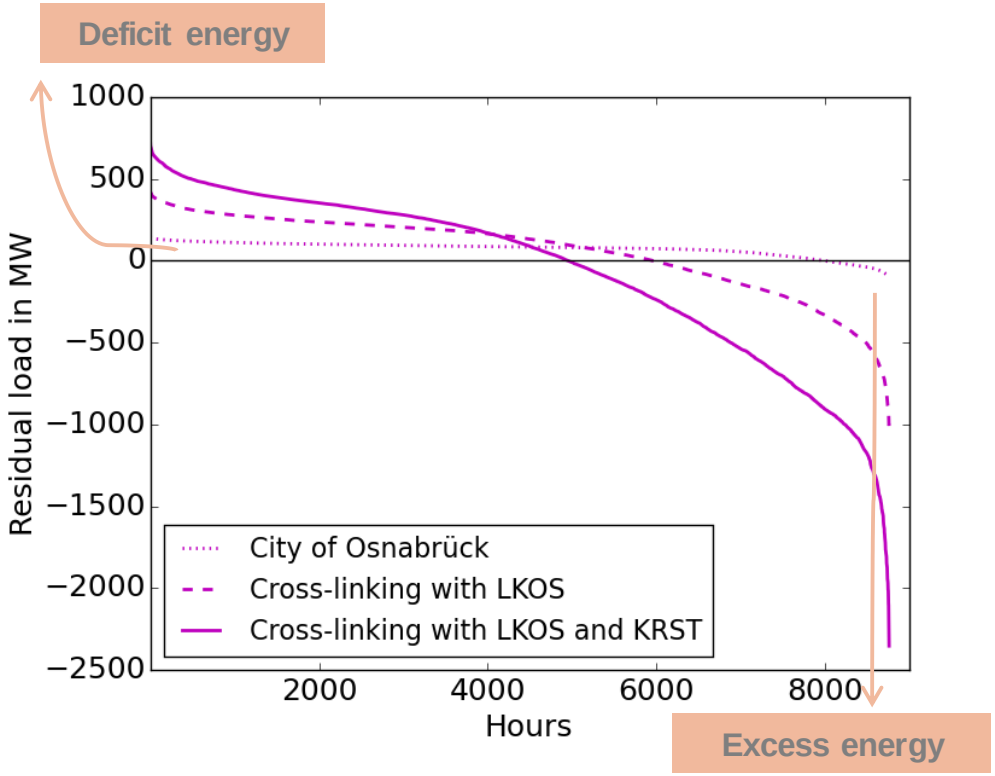
Results

- Cross-linking of the city with the rural surroundings, without storage
- Residual load = demand – production from renewable energies (master plan 2030)

LKOS: Landkreis Osnabrück
KRST: Kreis Steinfurt



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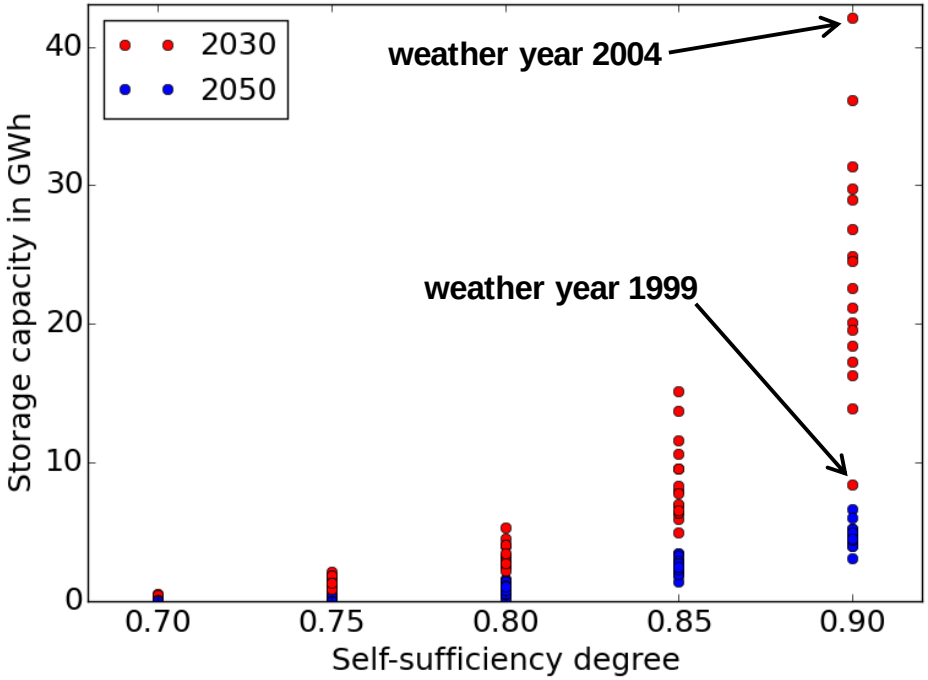
Results

Storage capacity for reaching different self-sufficiency degrees in the master plan region, assuming the master plan targets for 2030 and 2050, weather year range 1998 - 2014

- Broad range of storage capacities depending on self-sufficiency degree and weather year
- Partly immense and not reasonable storage capacities
- But also: self-sufficiency degrees of up to 85 % are achieved without any storage



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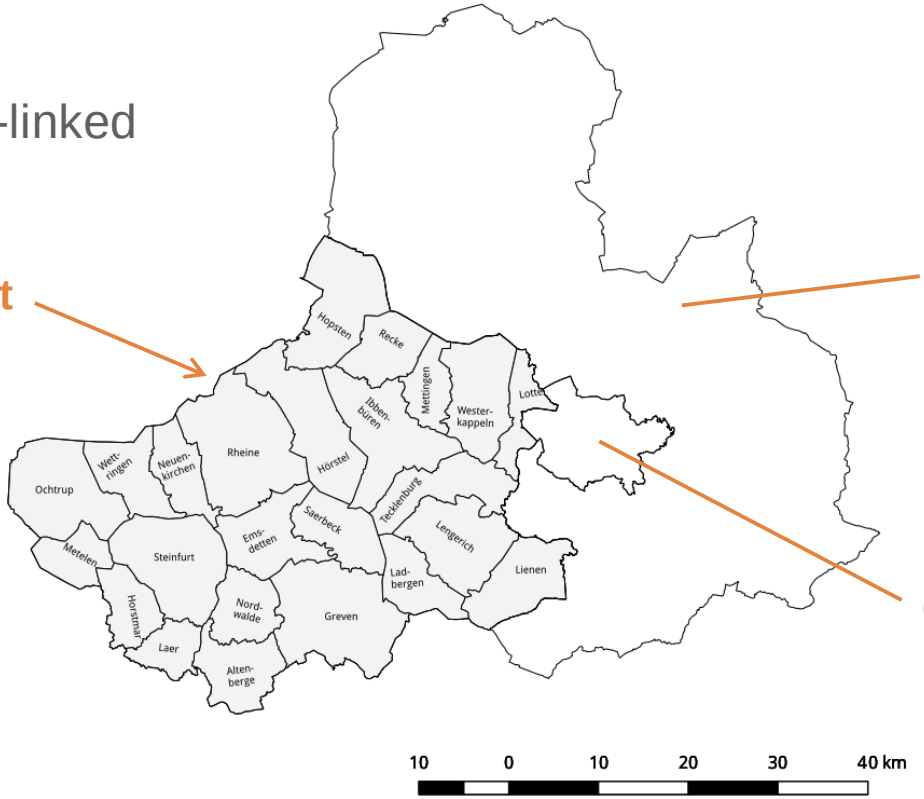
Results

Municipalities of Kreis Steinfurt
→ storage capacity calculated

- individually
- 2 regions each cross-linked



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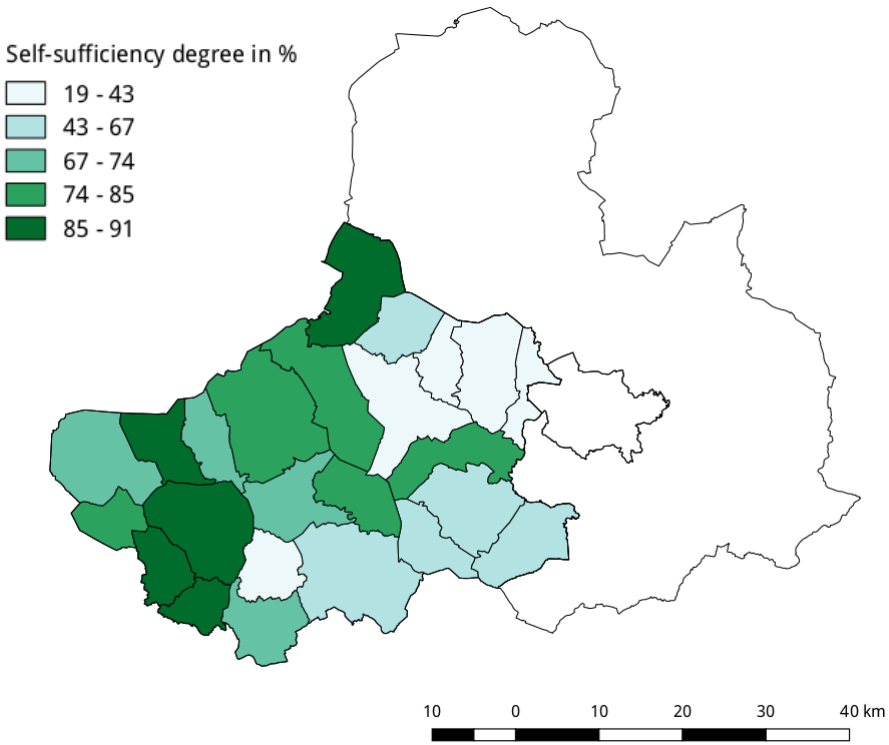
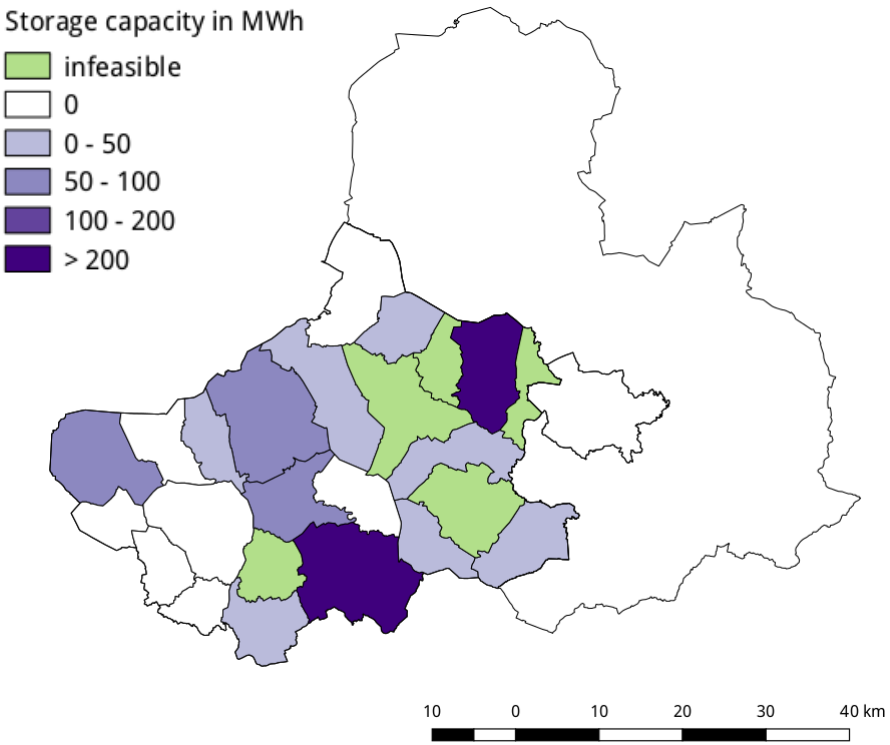
Results

Self-sufficiency degree assuming wind and PV potential (targets 2050)



Storage capacity for self-sufficiency degree of 80 %



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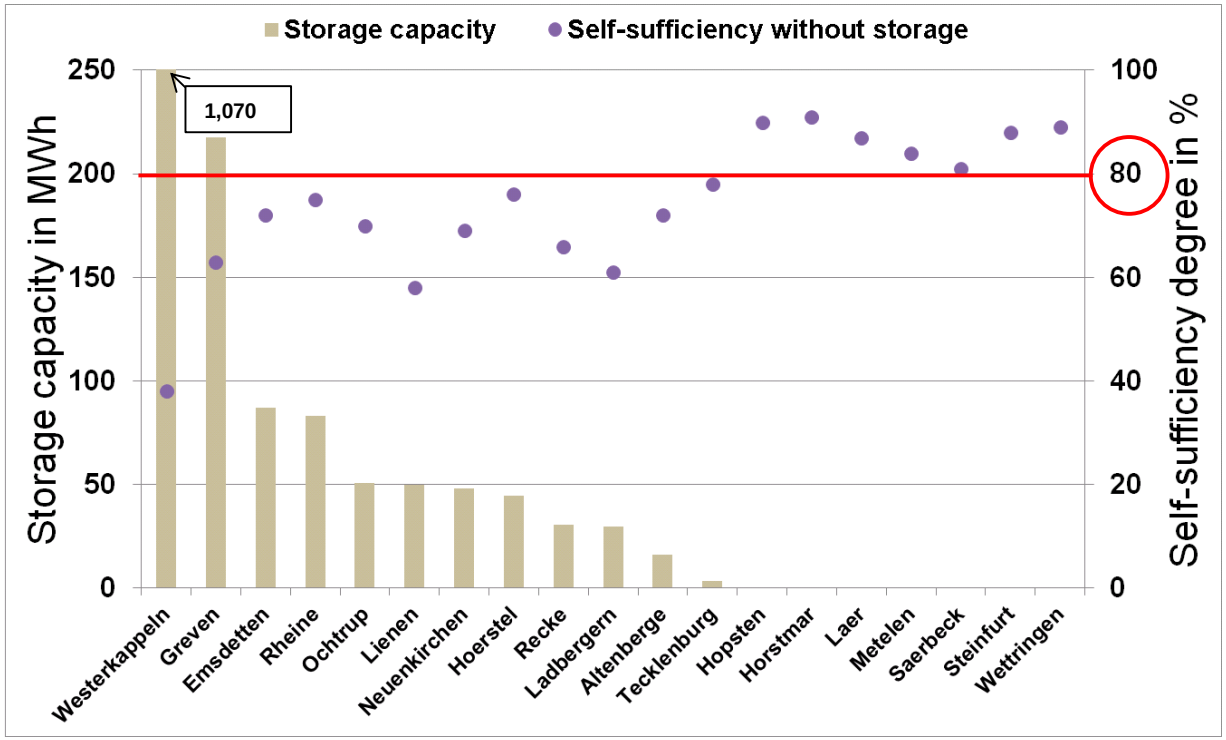
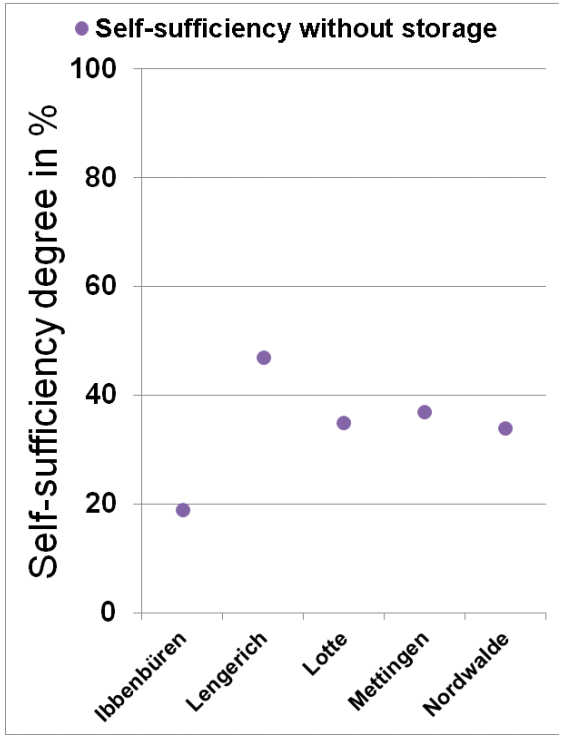
Results

Storage capacity for self-sufficiency degree of 80 % and the self-sufficiency without storage



Regions where 80 % self-sufficiency is impossible



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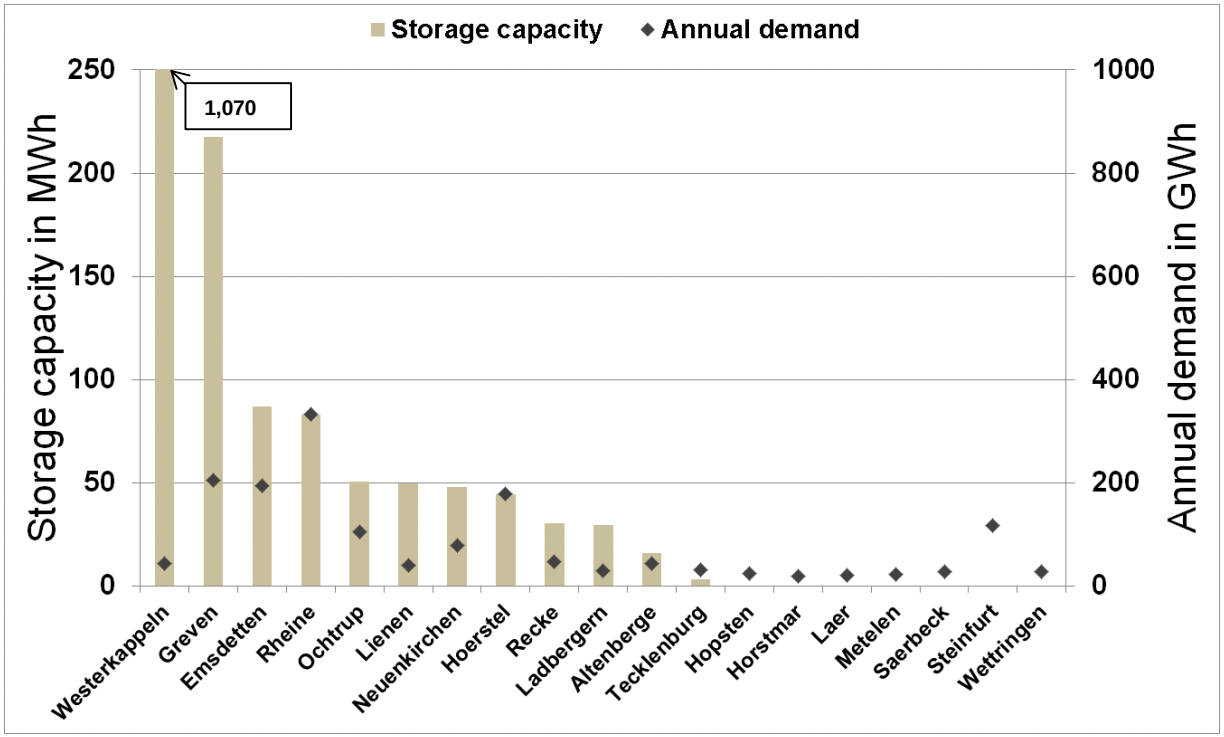
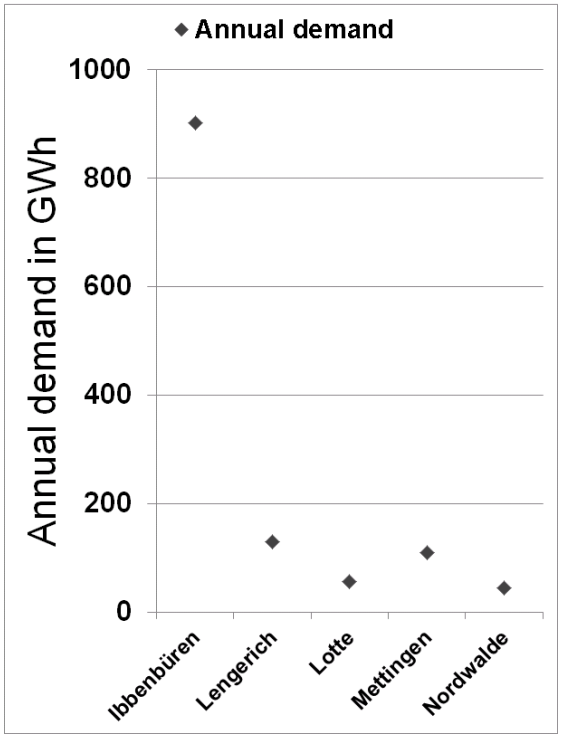
Results

Storage capacity for self-sufficiency degree of 80 % and the annual demand



Regions where 80 % self-sufficiency is impossible



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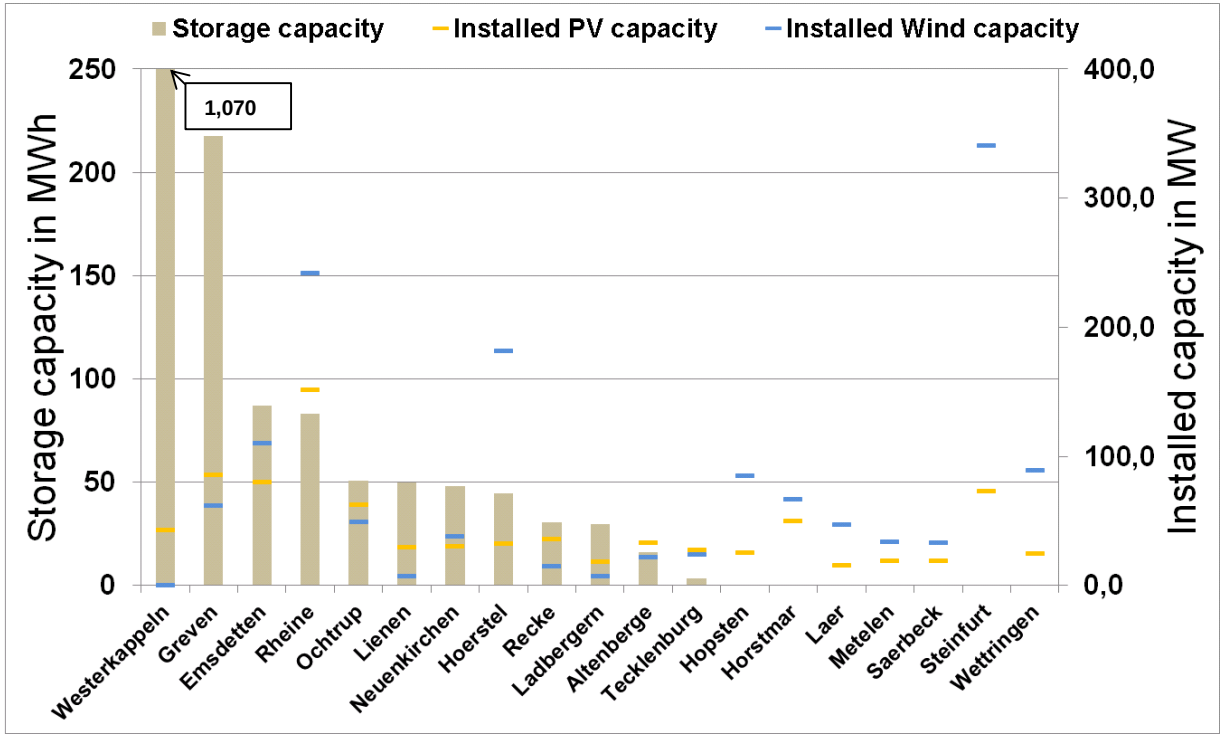
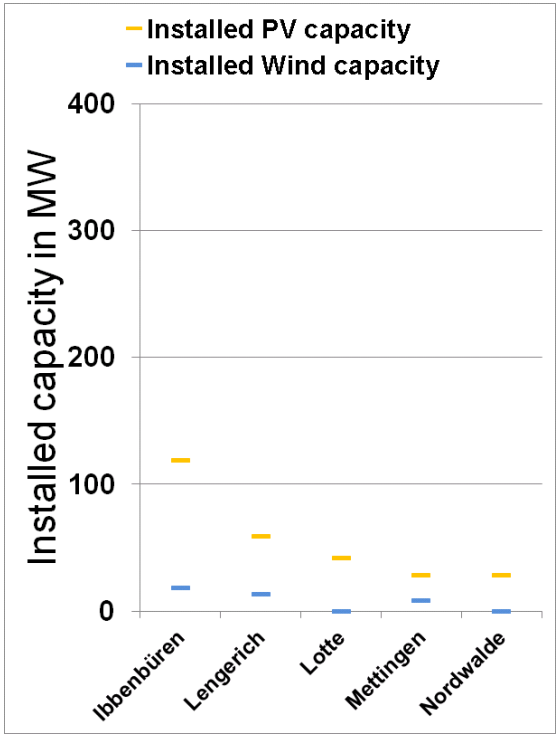
Results

Storage capacity for self-sufficiency degree of 80 % and the installed wind power and PV capacity



Regions where 80 % self-sufficiency is impossible



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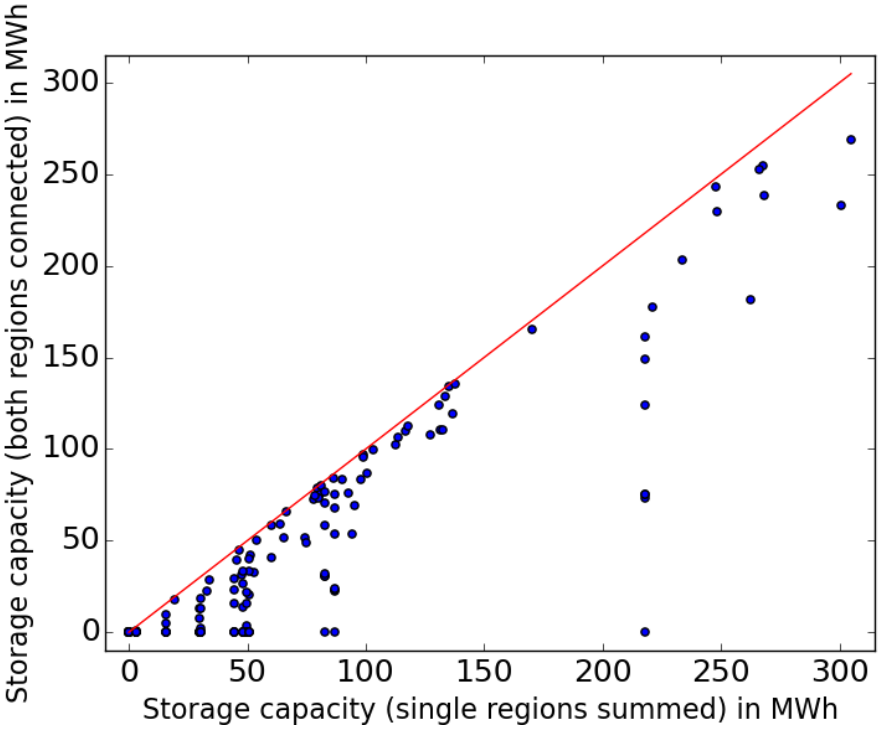
Results

Storage capacity in the municipality regions assuming a self-sufficiency degree of 80 % (153 combinations of 2 regions)

- In 43 region combinations storage capacity decreases to 0
- In 16 region combinations storage capacity decreases less than 5 %



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Summary and Outlook

- Analysis of storage capacity for the electricity sector from the perspective of energy regions
- Wide range in storage capacities depending on assumed parameters
- Especially the weather data have a great influence on calculated storage capacities.
- Outlook: what kind of regions are suitable for an urban-rural cross-linking in energy supply?

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Thank you for your attention!

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Methods

oemof ['ø:mɔf]
open energy modelling framework