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Downscaling integrated assessment model results of the residential and commercial heating sector

An open-source approach accounting for energy generation technologies‘ infrastructure requirements

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Brief background and motivation

My Phd thesis elaborates on…

- Local energy systems focussing on multiple-energy carrier systems
- System analysis of microgrids/energy communities (ECs)
  - Energy communities enable, among others, energy-sharing mechanisms without being necessarily physically constrained
- Energy infrastructure planning focussing on the distribution grid

Involved in the openENTRANCE project

….aims at developing, using and disseminating an open, transparent and integrated modelling platform for assessing low-carbon transition pathways in Europe. (https://openentrance.eu/)

- Global energy system models and integrated assessment models (e.g., GENeSYSMOD and MESSAGEix) (Deliverable NO. 3.1.)

Core objective and main research question

(1) Scientific novelties

- Which downscaling method for energy generation technologies comes closer to predicting the local heat generation in the residential and commercial sector accounting for energy generation technologies‘ infrastructure needs on a high spatial granularity?
- What, if any, are the implications of such downscaling techniques on benchmarking network-based heat service provision?

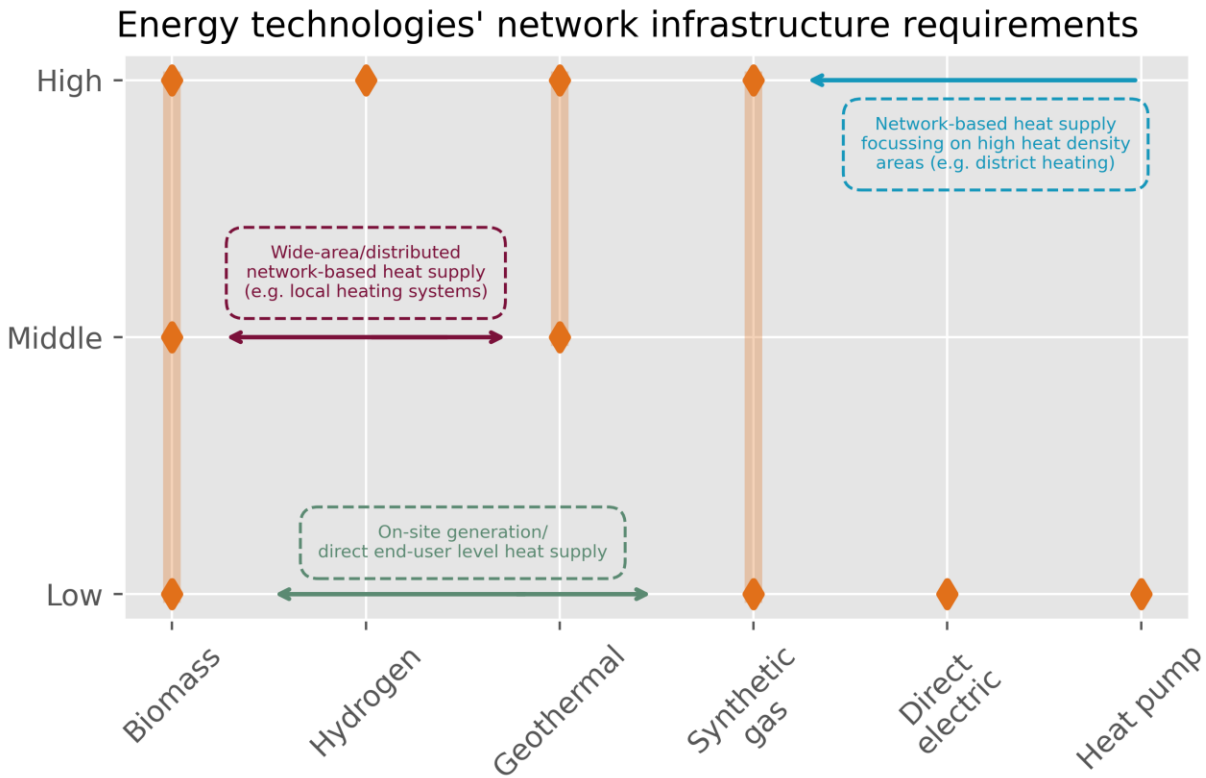
(2) Software implementation

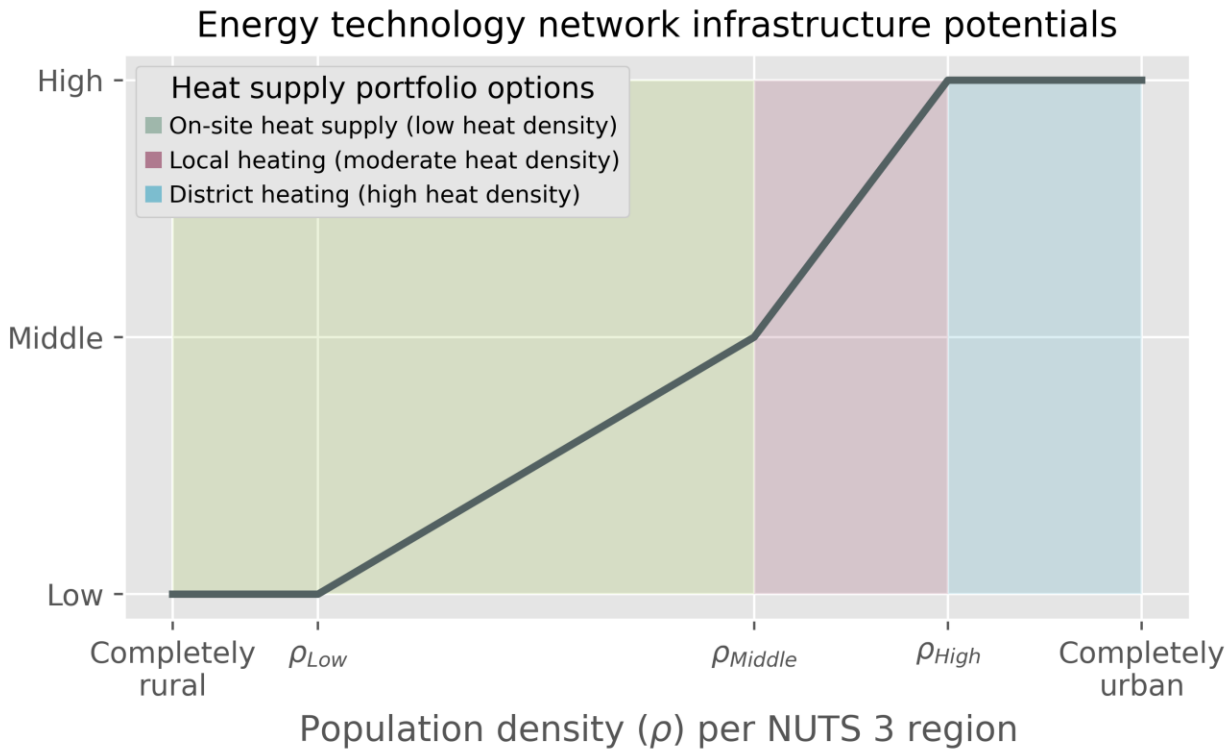
- Extension of the Python open-source scenario analysis and visualization tool *pyam* (https://github.com/iamconsortium/pyam)
- In particular further developing the existing function *downscale_region()*
- Used in the IPCC AR6 and several Horizon 2020 projects

Methodology (1/2)

- Development of an empirical-based sequential linear downscaling algorithm using population density as an additional criteria
- Split energy generation technologies into different categories accounting for their energy infrastructure requirements
  - E.g. geothermal and large-scale biomass plants are technologies that require for proper network infrastructure
  - Hydrogen-based heat generation requires also network infrastructure
  - Direct electric-based heat supply is with limited adaption related to the electricity grid possible as a result of the electricity grid already „in the area“
- Benchmarking the resulting network-based heat supply of the different energy generation technologies by key performance indicators
  - Capability and resource KPIs
  - Technological/economic KPIs
  - Sustainability KPIs

Methodology (2/2)





Thank you for your attention.

Any questions ☺

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