Geospatial representation in REMix

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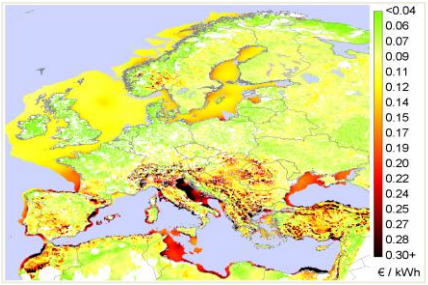
REMix' Energy Data Analysis Tool EnDAT

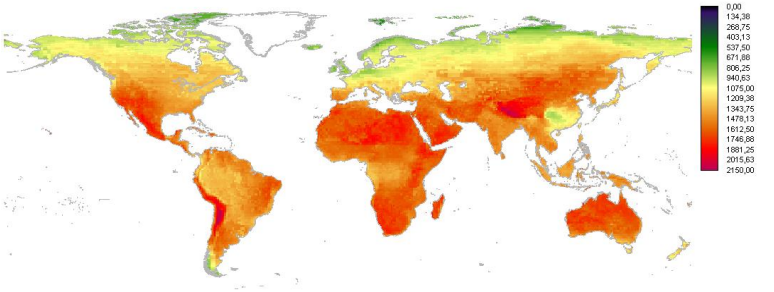
EnDAT(EUNA)

- PV, onshore + offshore wind, CSP, reservoir + run-of-river hydro, geothermal, biomass
- Temporal
  - Resolution: hourly, Scope: up to 10 years (2006-2015)
- Spatial
  - Res.: 0.083°-0.0083° (~10-1 km), Scope: Europe, North Africa

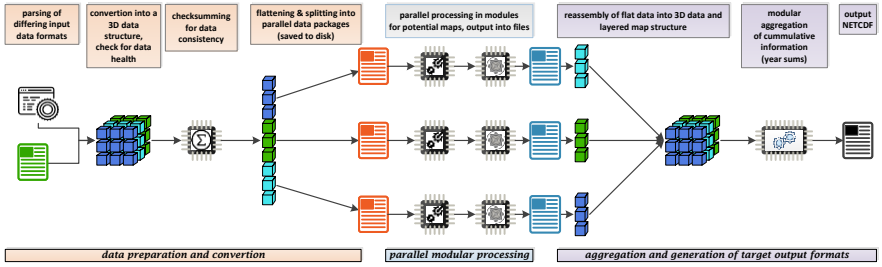


EnDAT(global)

- PV, wind onshore, wind offshore, CSP, run-of-river hydro
- Temporal
  - Resolution: hourly (hydro: monthly), Scope: 21 years
- Spatial
  - Resolution 0.45-0.045° (~50-5 km), Scope: global



New framework: parallel computing in Python

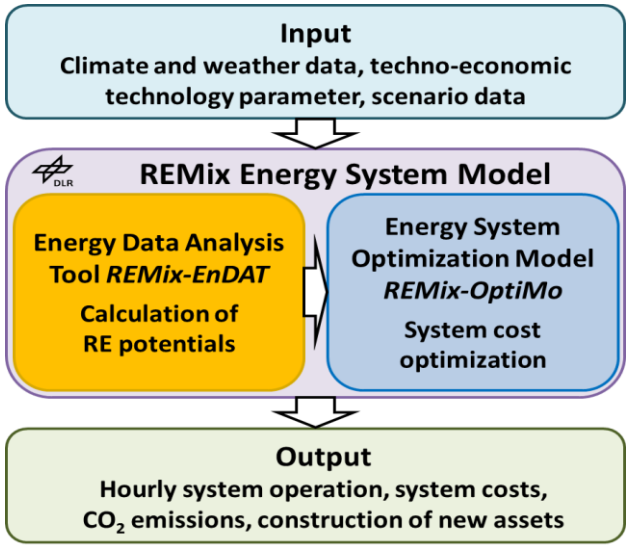


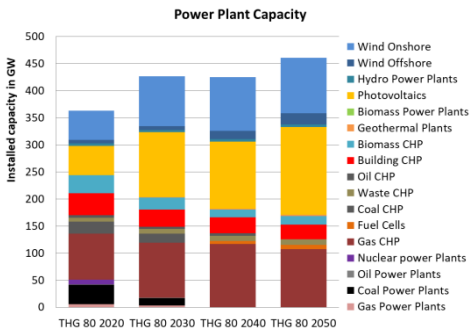
Ongoing Research:

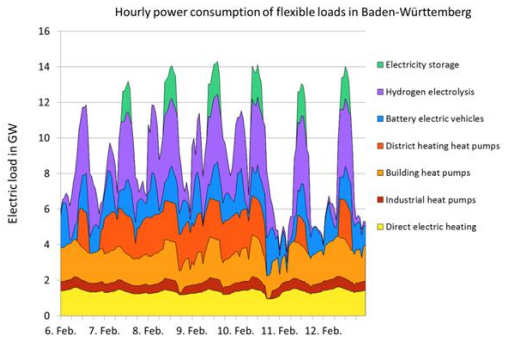
- increasing resolution by statistical downscaling
- extending historical database
- including climate change projections

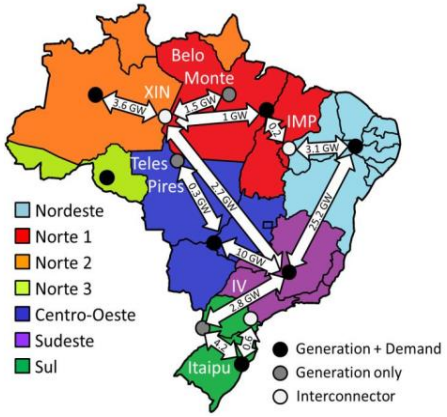
REMix (Renewable Energy Mix)

- Cost-minimizing model from economic planner's perspective
- Hourly resolution, typically perfect foresight for one year
- Simultaneous optimization of plant expansion and operation
- Evaluation of investment and dispatch strategies
- Consideration of all flexibility options









REMix model instances in the BEAM-ME project

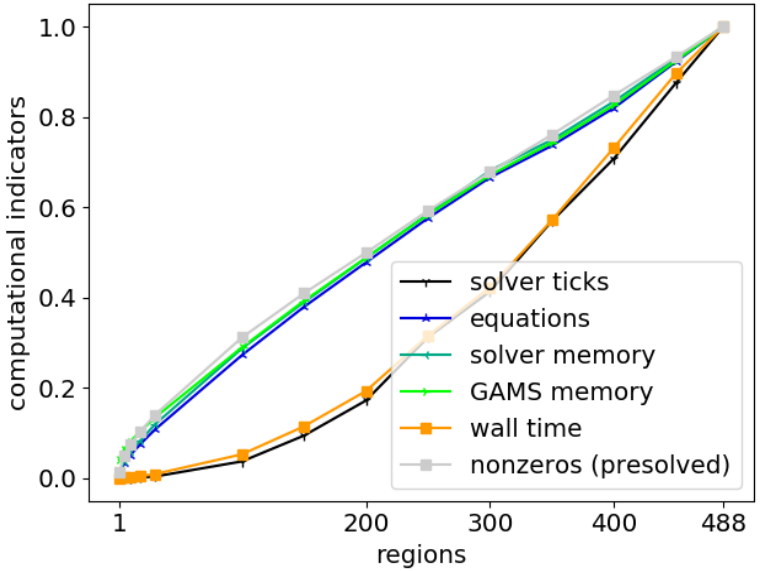
The „**BEAM-ME**“ project: Speeding up energy system models using

- A technical approach (new parallel solver + high performance computing)
- Modelling based strategies
  - evaluated based on a model parametrisation covering Germany in 488 nodes:

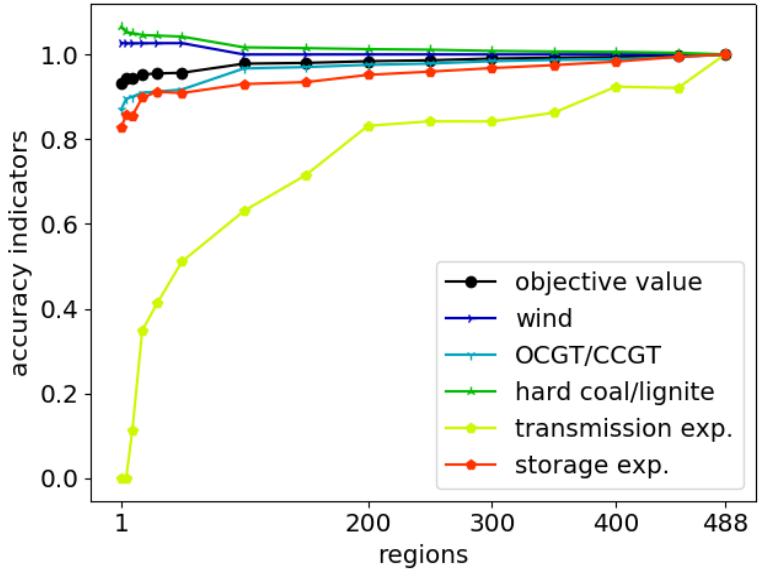
Original model instance name	Applied speed-up approaches	Number of variables	Number of constraints	Number of non-zeros
REMix Dispatch	• spatial aggregation • temporal aggregation • rolling horizon dispatch	30,579,396	9,214,488	69,752,951
REMix Expansion	• spatial aggregation • temporal aggregation • sub-annual temporal zooming	43,169,135	32,805,201	137,967,269

REMix: Computational and accuracy indicators

Spatial resolution variation



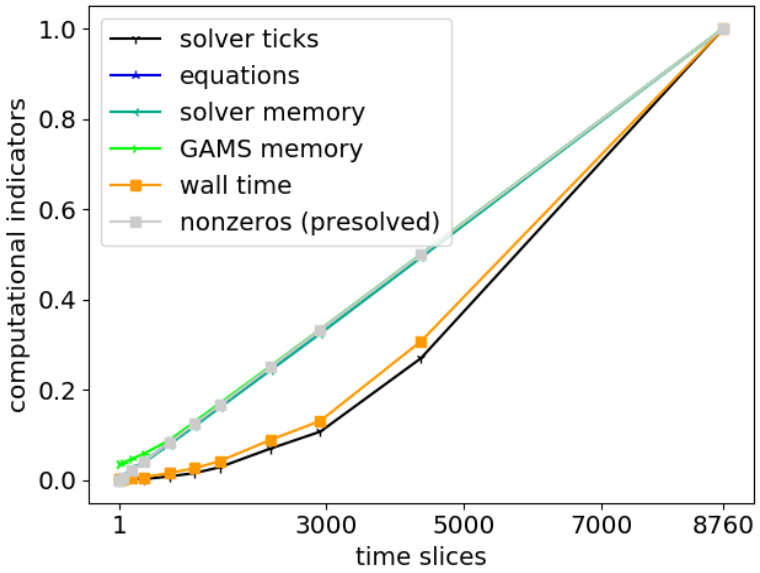
Computational indicators for spatial aggregation of a “REMix Expansion” model. Reference model (only in this experiment): CPLEX ticks 381.3 Mio.; Total memory <256 GB; GAMS time 6.6 h; Total computing time 50.9 h.



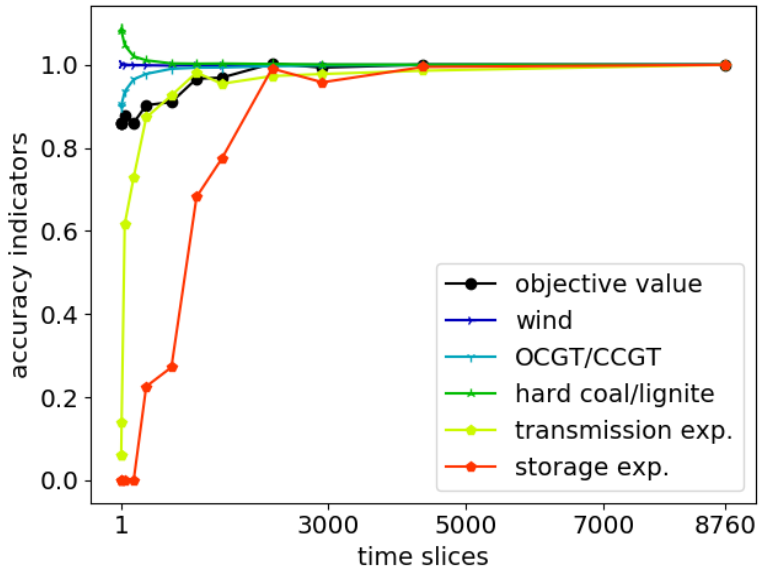
Accuracy indicators for spatial aggregation of the “REMix Expansion” model. Reference model (only in this experiment): Objective value 23.7 Bio €; Wind 175 TWh; Gas 153 TWh; Coal 115 TWh; Storage expansion 123 GWh; Transmission expansion 28.8 GW.

REMix: Computational and accuracy indicators

Temporal resolution variation



Computational indicators for temporal aggregation of the “REMix Expansion” model.
Reference model: CPLEX ticks 534.3 Mio.; Total memory >256 GB; GAMS time 0.6 h; Total computing time 62.3 h.



Accuracy indicators for temporal aggregation of the “REMix Expansion” model.
Reference model: Objective value 22.8 Bio €; Wind 180 TWh; Gas 146 TWh; Coal 117 TWh; Storage expansion 122 GWh; Transmission expansion 29.2 GW.

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Literature

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