INSTITUT FÜR ENERGIE- UND UMWELTFORSCHUNG HEIDELBERG

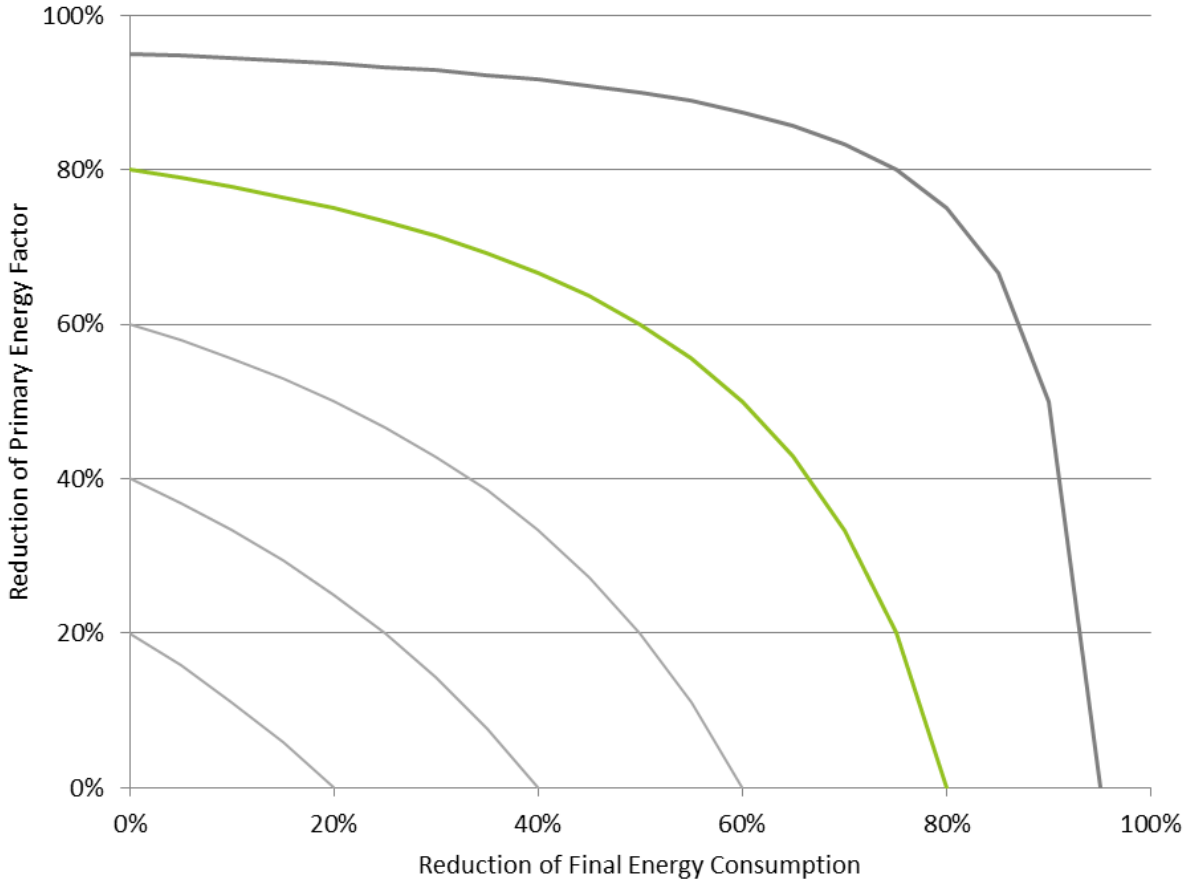
BEUTH UNIVERSITY OF APPLIED SCIENCES BERLIN

Balancing efficiency and renewables in the Federal Building Strategy

Results from modelling potentials and restrictions in a national heat market with high spatial resolution

Background

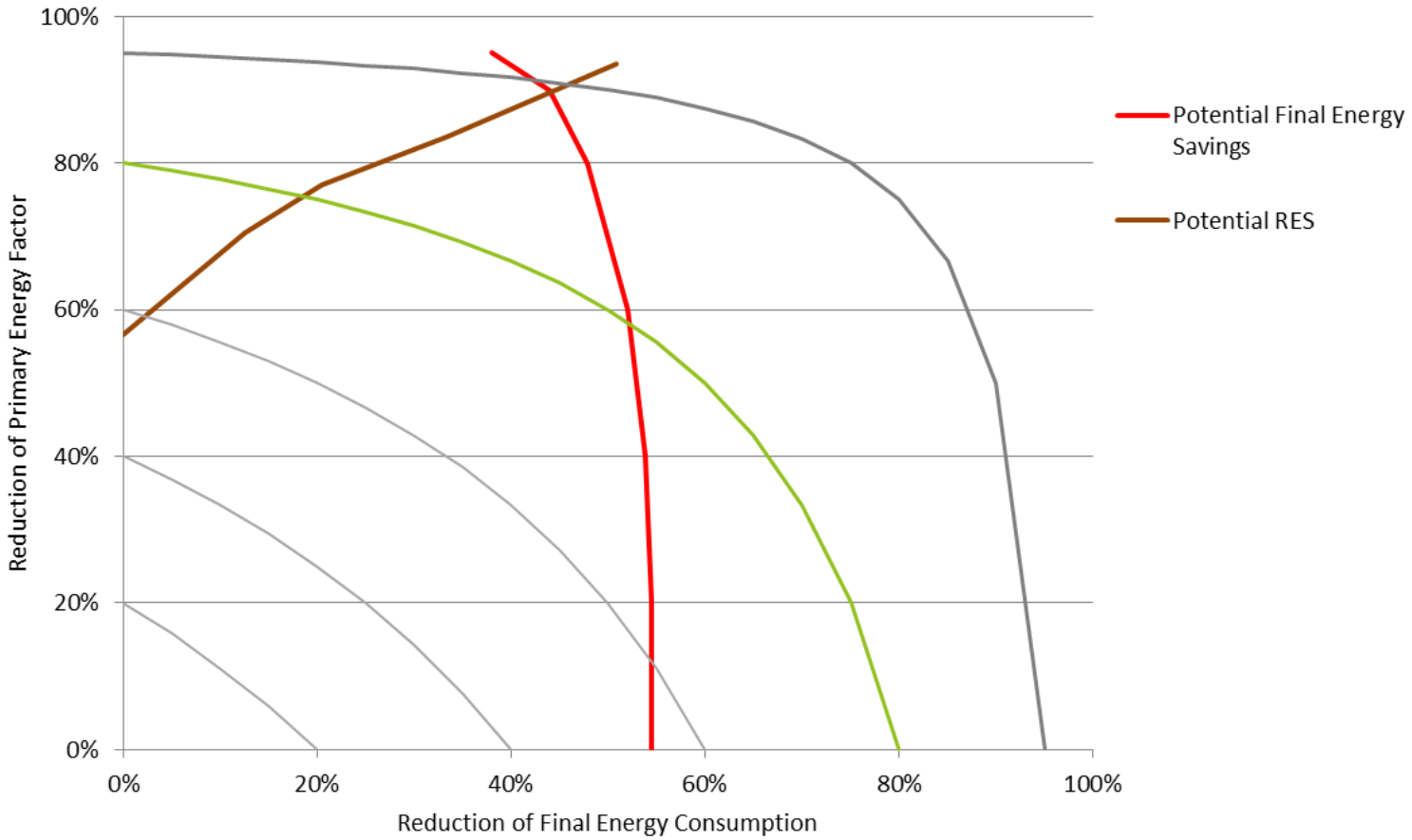
Playing field for reduction of primary energy consumption



Background

Playing field for reduction of primary energy consumption

is limited in both directions

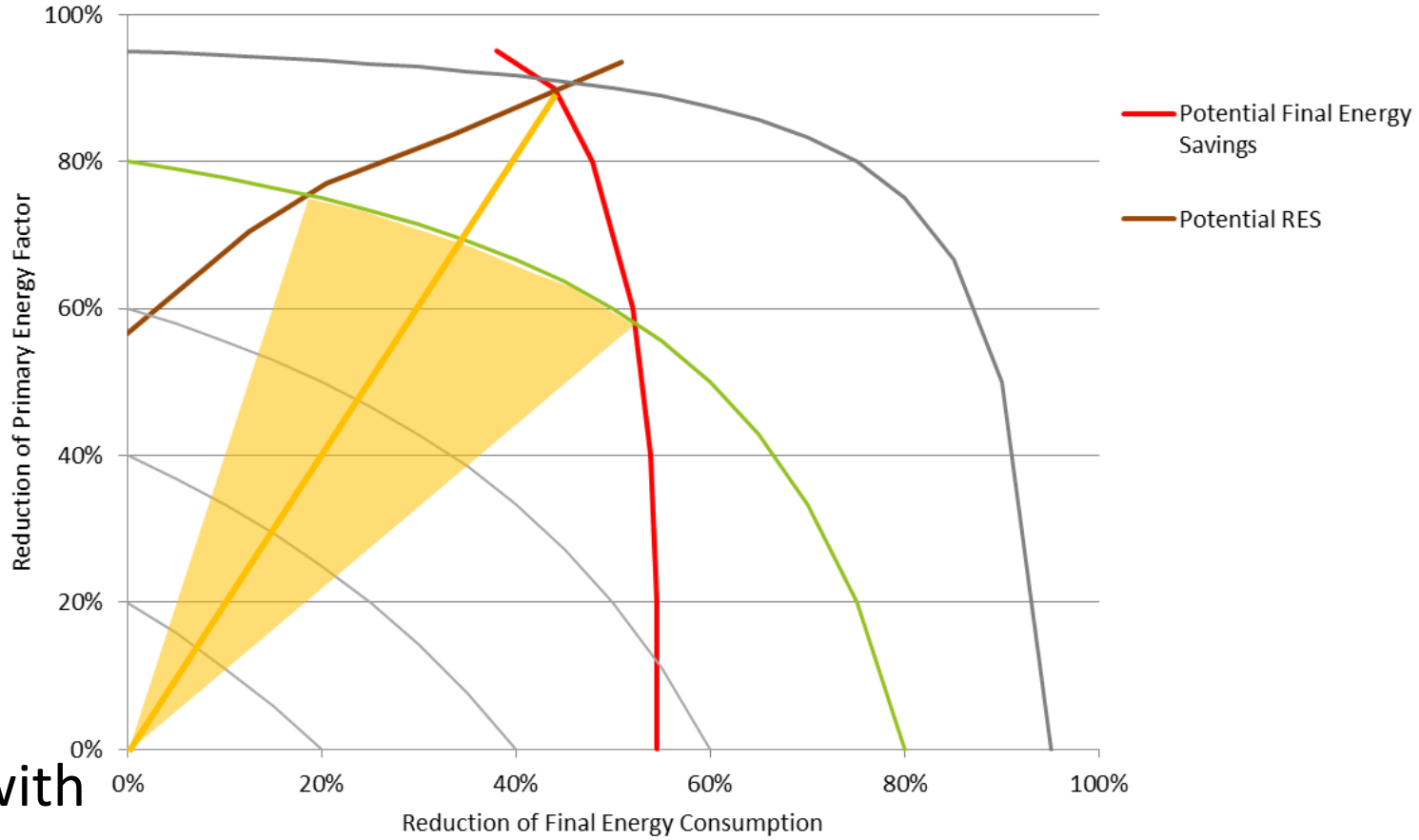


Background

Playing field for reduction of primary energy consumption

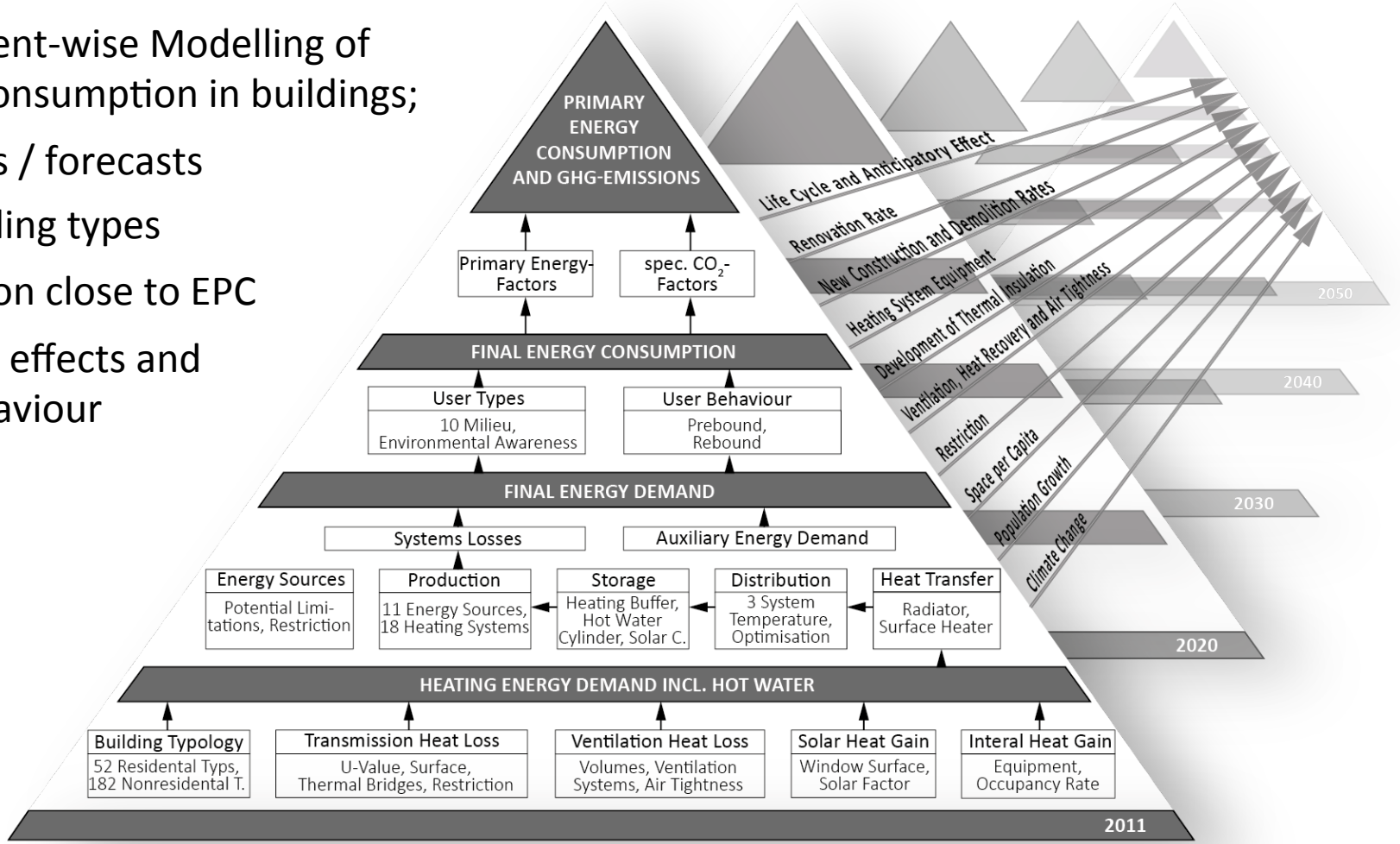
is limited in both directions

and narrows with more ambitious targets

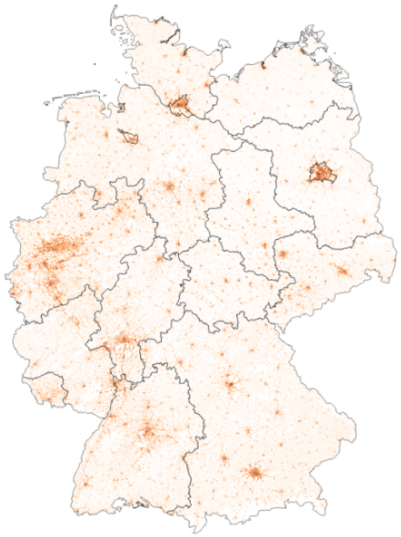


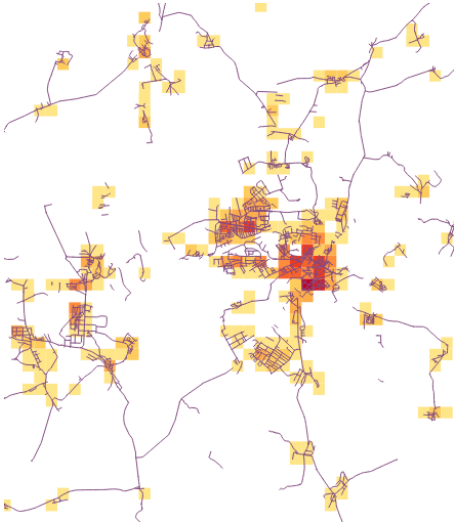
Building Energy Model (GEMOD)

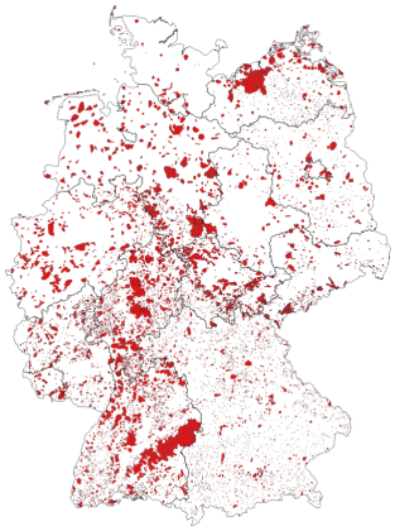
- Component-wise Modelling of energy consumption in buildings;
- Scenarios / forecasts
- 234 building types
- Calculation close to EPC
- Rebound effects and user behaviour

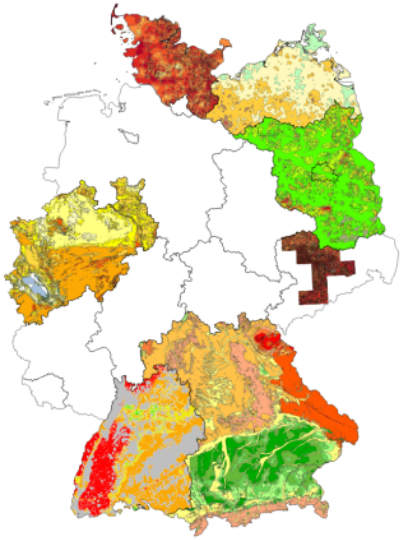


Heat Atlas Germany







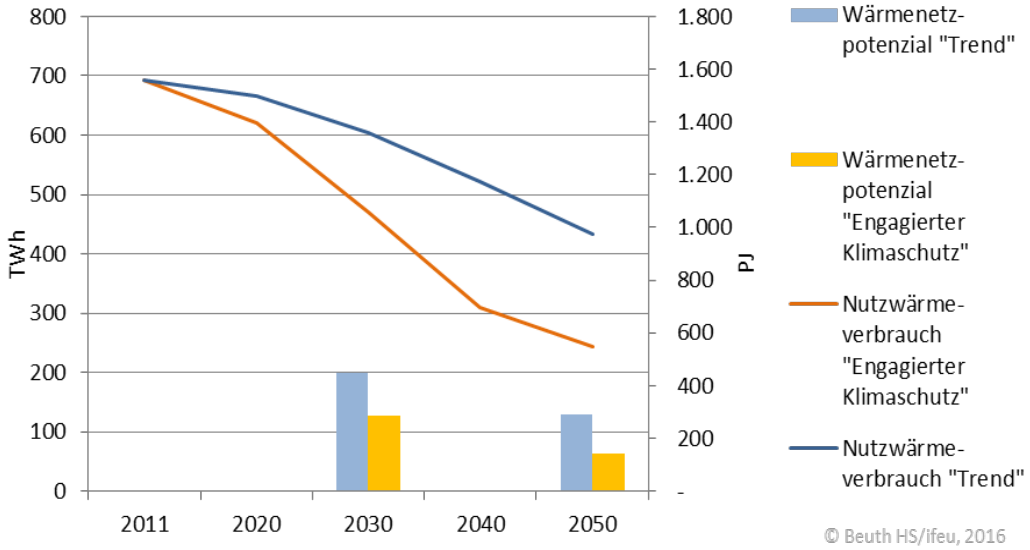


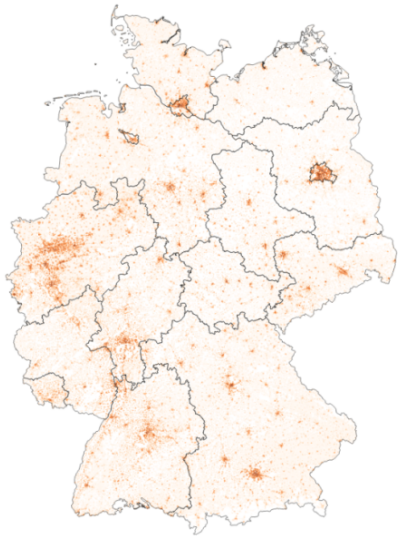
Energy Consumption	Local Heat Density	Combination with Geo-Data	
for different building types and several future developments (scenarios)	with different spatial resolutions (100 x 100 m, municipalities, …)	e.g. water protection areas where probes are not allowed	e.g. local heat extraction potential from the ground

Analyses carried out with the Heat Atlas

Heating network potential depends on:

- Sufficient heat sinks and heat density (today and in the future)
- Costs for heat generation
- Costs for distribution depending on building density

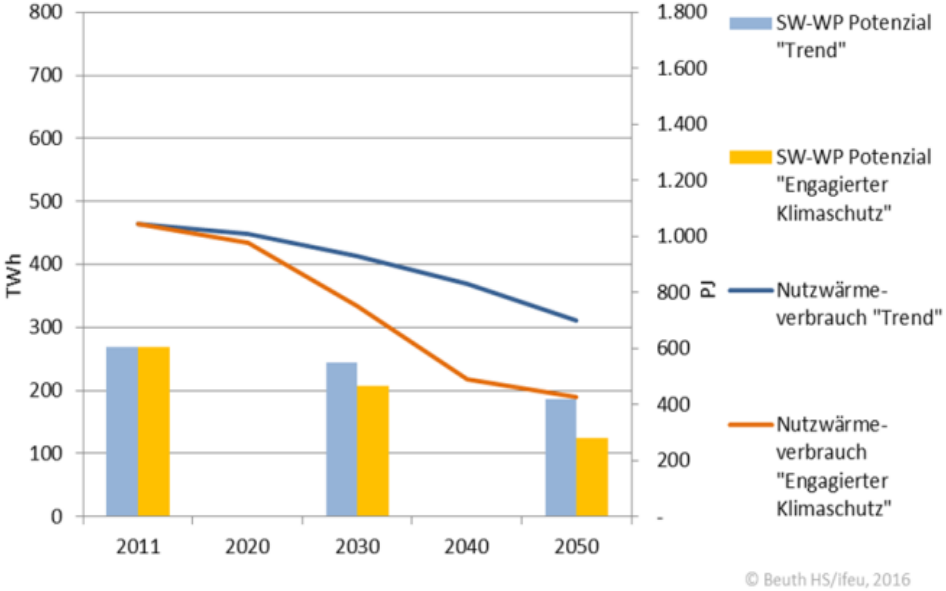


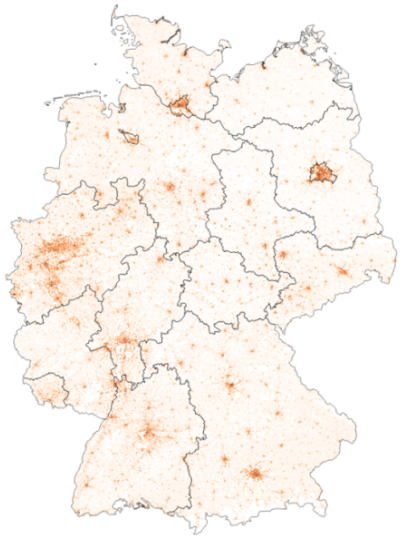


Analyses carried out with the Heat Atlas

Potential of brine-water heat pumps depends on:

- Restricted areas and maximum drilling depth (water protection)
- relation of heat demand to free ground space
- local heat extraction rates and minimum distances between drilling holes
- individual restrictions (trees, fences, pathways)

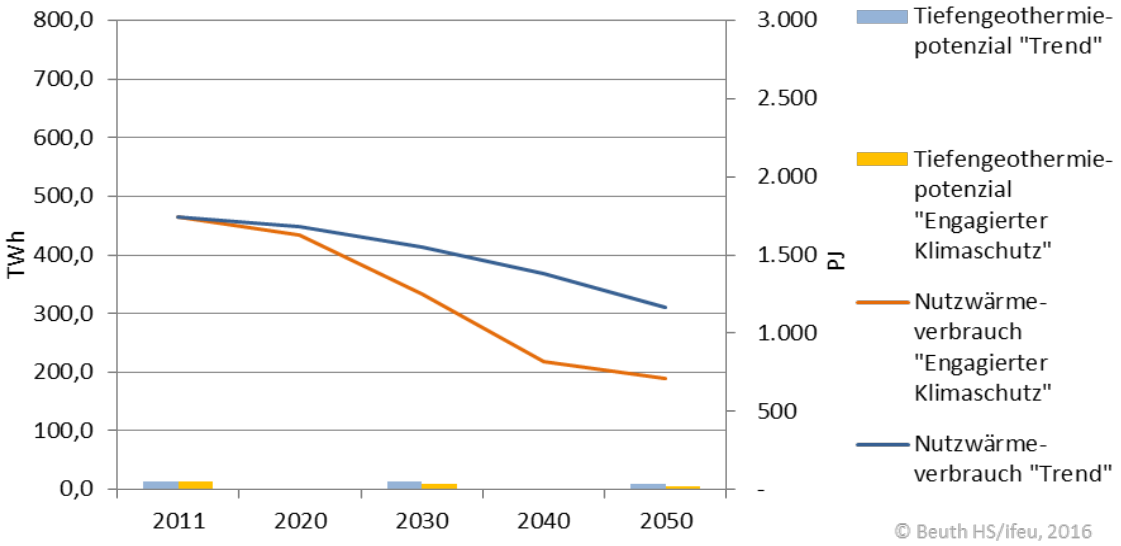


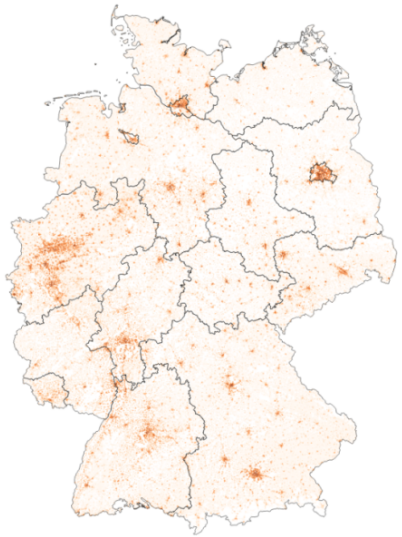


Analyses carried out with the Heat Atlas

Potential of geothermal heat relates to:

- Restricted areas and maximum drilling depth (water protection)
- relation of heat demand to free ground space
- local heat extraction rates and minimum distances between drilling holes
- Heating network potential nearby



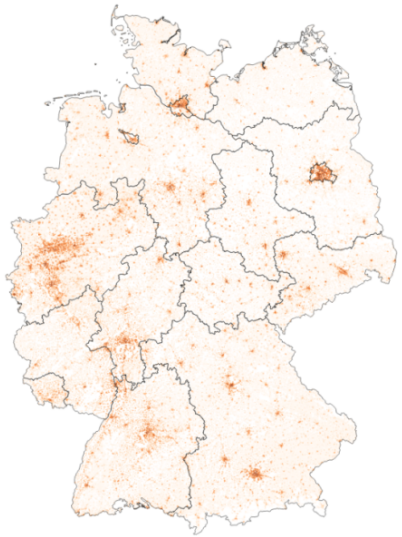


Analyses carried out with the Heat Atlas

Potential of waste heat:

- Local amount of industrial waste heat from emission cadastre
- Heating network potential nearby

Analysis in Process



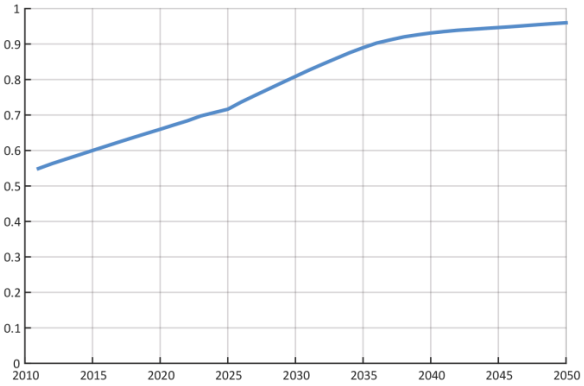
Potential of Heat Pumps

General Restrictions for Heat Pumps:

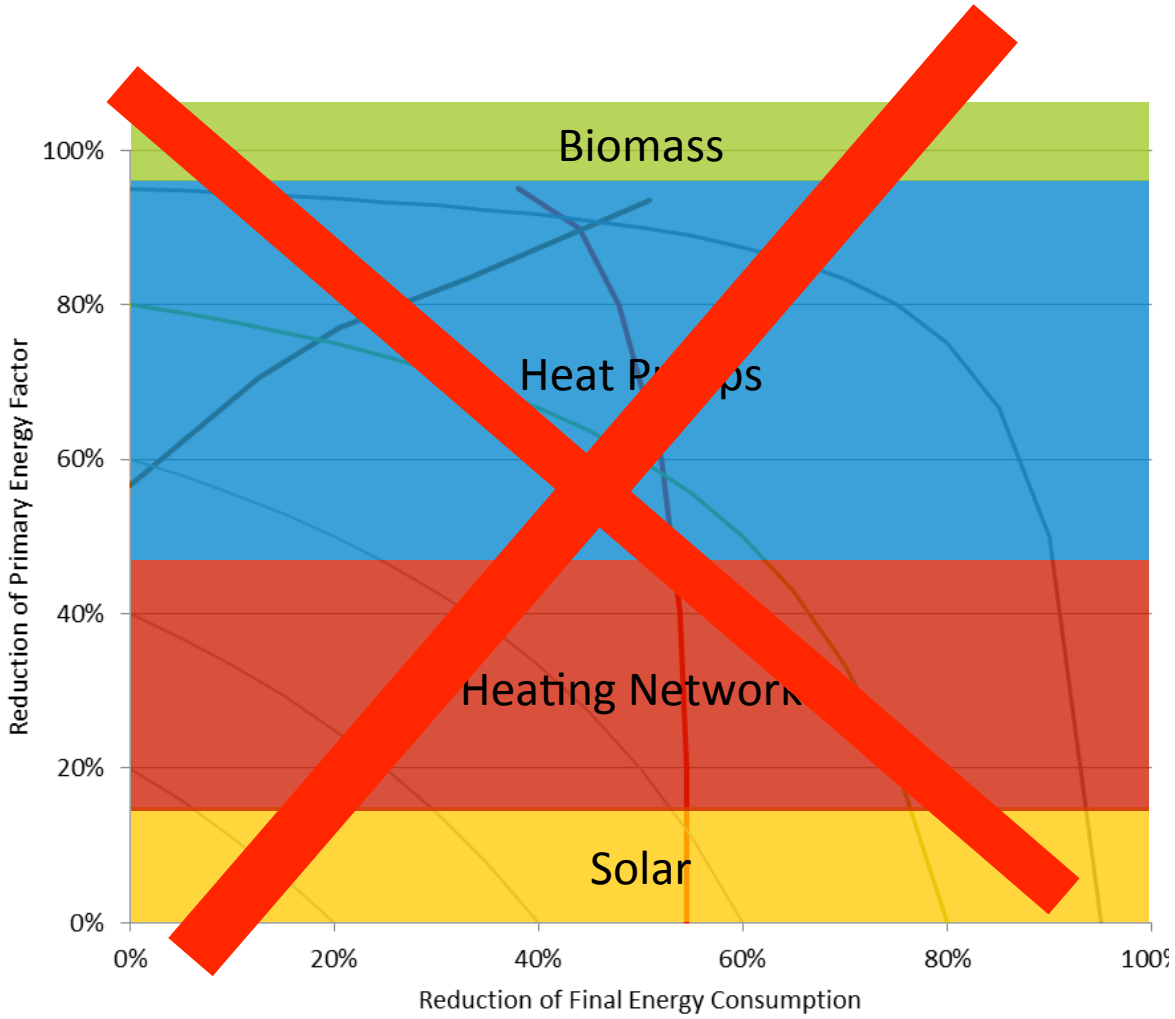
- Efficiency is related to system temperature (SEER)
  (Today floor heating is installed only in 3,3% of older buildings (before 1979))
  max. system temperature 60°C
- Heat pumps can be used in existing buildings
  if critical convectors are changed
  and the energy demand is lowered to 120 kWh/m²a

- Many scenarios see more than half of german heating systems in 2050 as heat pumps. Only 60.000 heat pumps were installed in 2016;

  The max. market growth is presently the most harmful restriction.



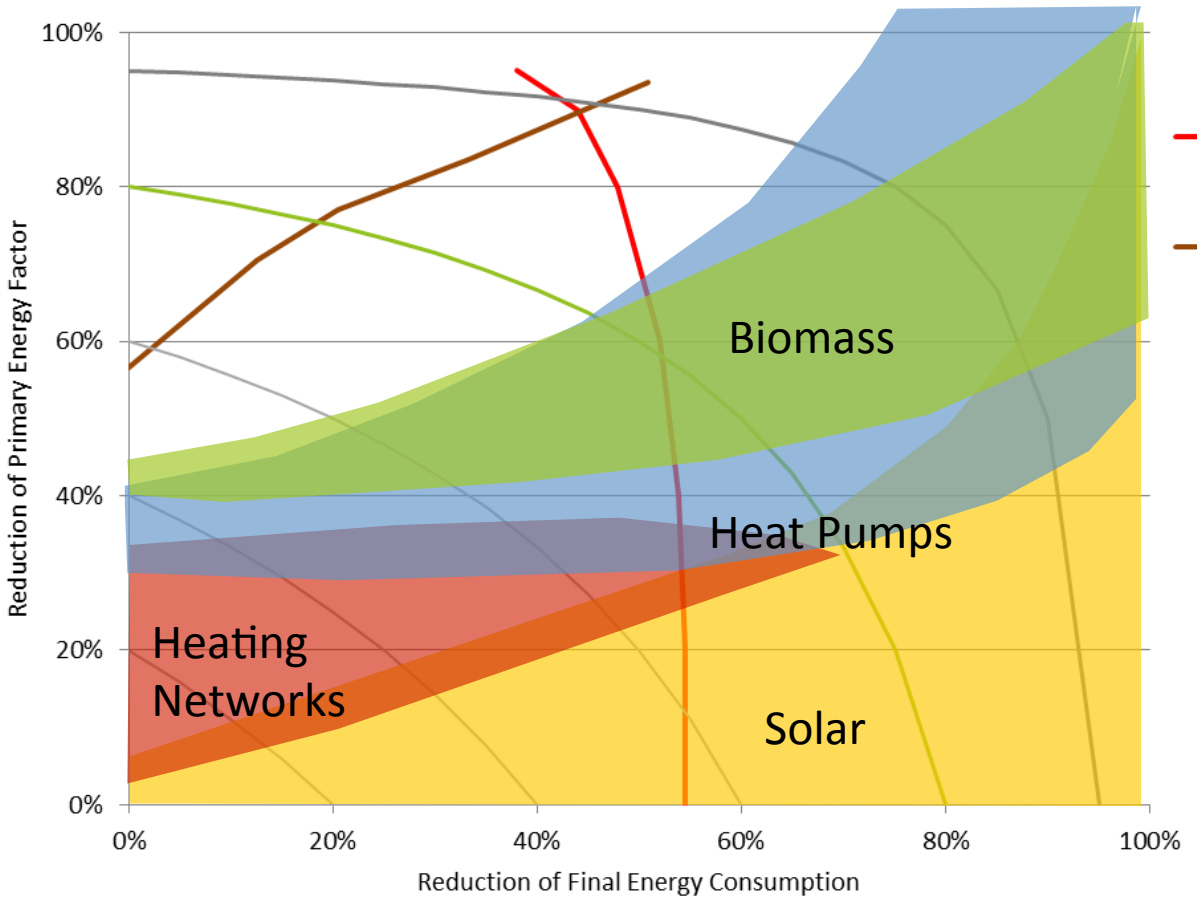
Combinations of RES Potentials



Combinations of RES Potentials

Renewable energy potentials cannot simply be added.

- The potentials of solar energy and heat pumps increase with higher efficiency.
- The heating network potential decreases with higher efficieny.
- Some technologies cannot be combined in the same building, thus the potentials overlap

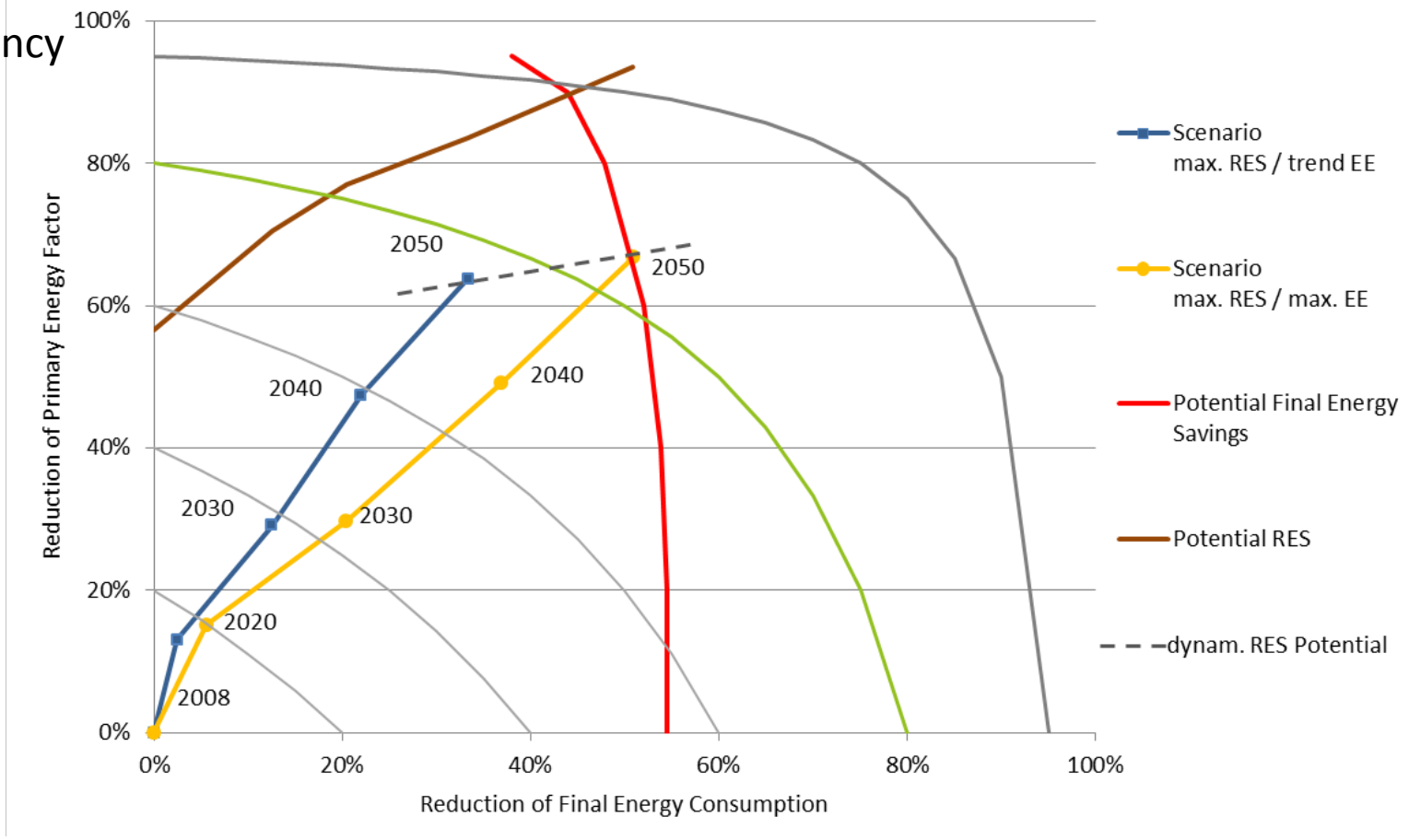


qualitative figure

Growth of RES Potentials

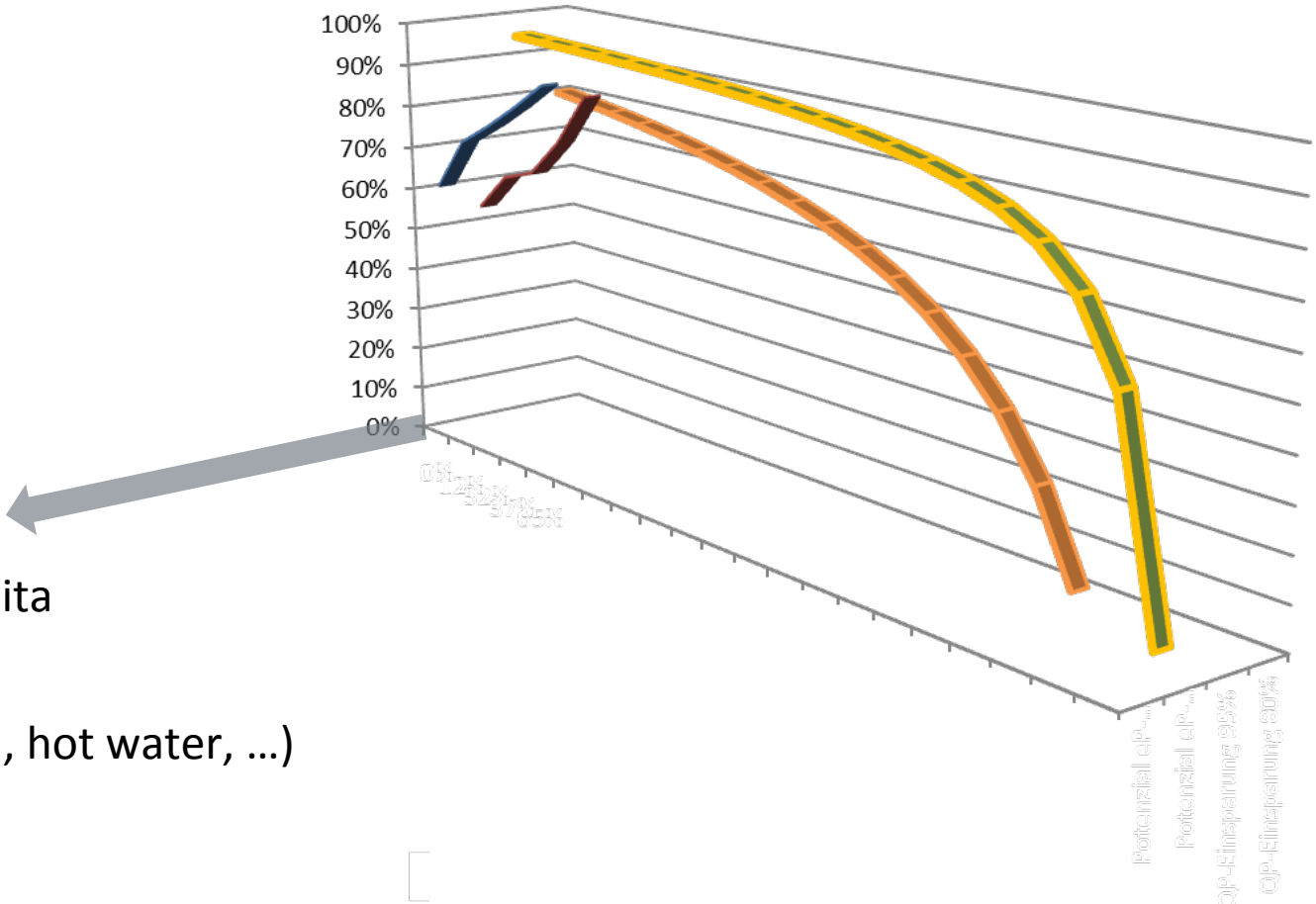
Two efficiency scenarios with the specific maximum dynamic RES Potential

- Trend efficiency
- Max. efficiency



Widening the playing field

Non-technical influences on reaching the targets



- Living space per capita
- behavioral change
  (heating, ventilation, hot water, …)
- Rebound efects
- Climate change

Thank you for listening