FLEXIBLE OPERATION OF TECHNOLOGIES THROUGH SECTOR COUPLING

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- DISTRICT Optimization Model

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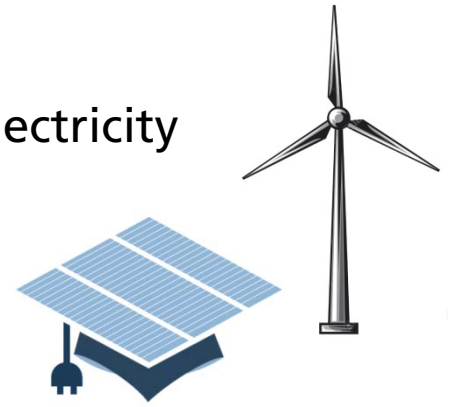
Flexible operation = flexible electricity technology?

- Flexibility required due to fluctuating renewable electricity generation technologies



- Flexible Technologies:
  - Storage systems
  - Demand side management
  - Combined heat and power generation
  - Heat pumps
  - Thermal storage systems

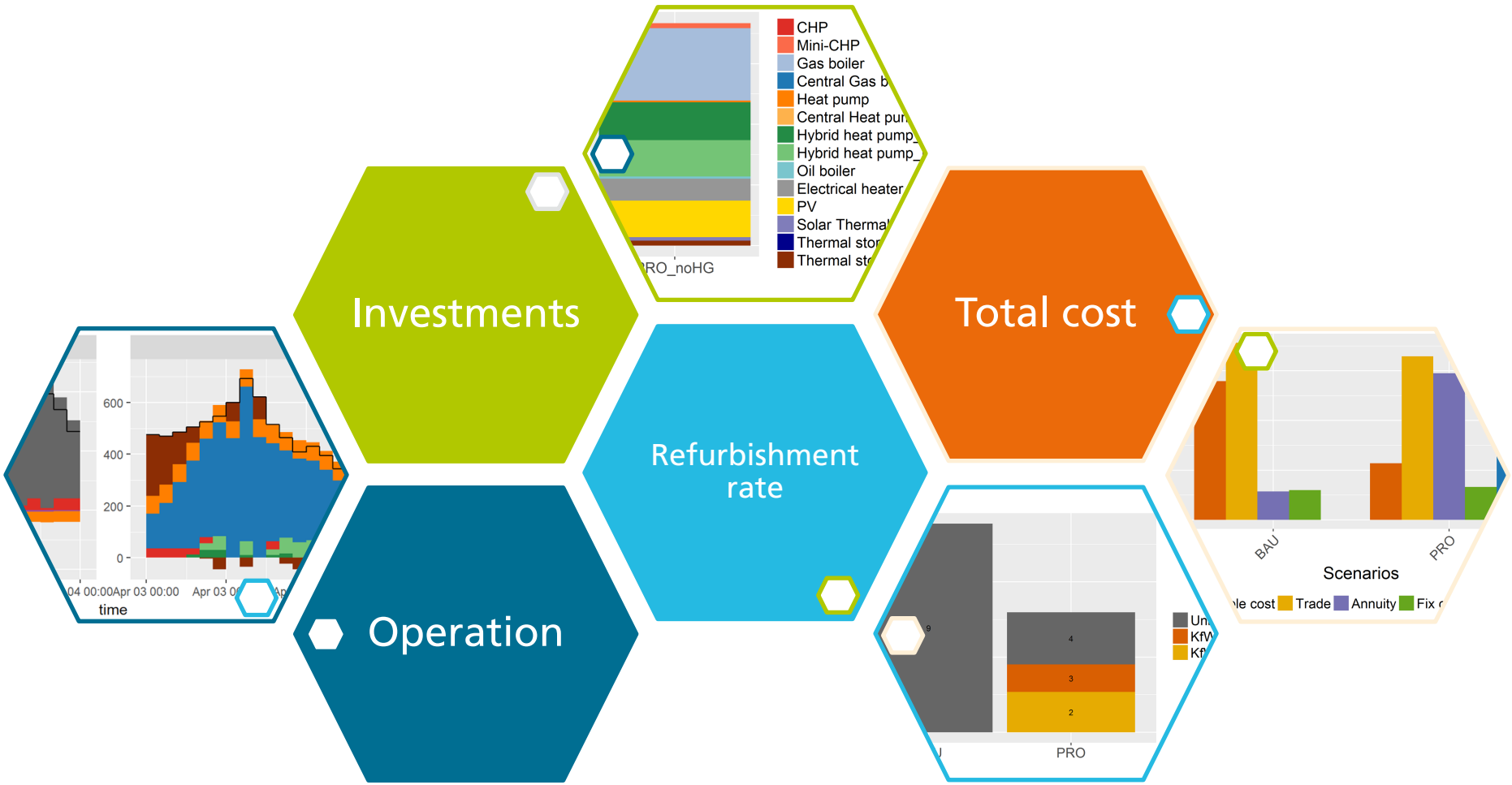
Restrictions to electric flexibility technologies

- Storage Systems:
  - Difficult to achieve seasonal storage at low cost
  - High invest cost

- Demand Side Management
  - Potential rather in the industrial and commercial sector
  - Very dependent on user behavior
  - Different targets for DSM – adapting demand to generation by price signals or support grid stability

What we offer

DISTRICT Optimization Model



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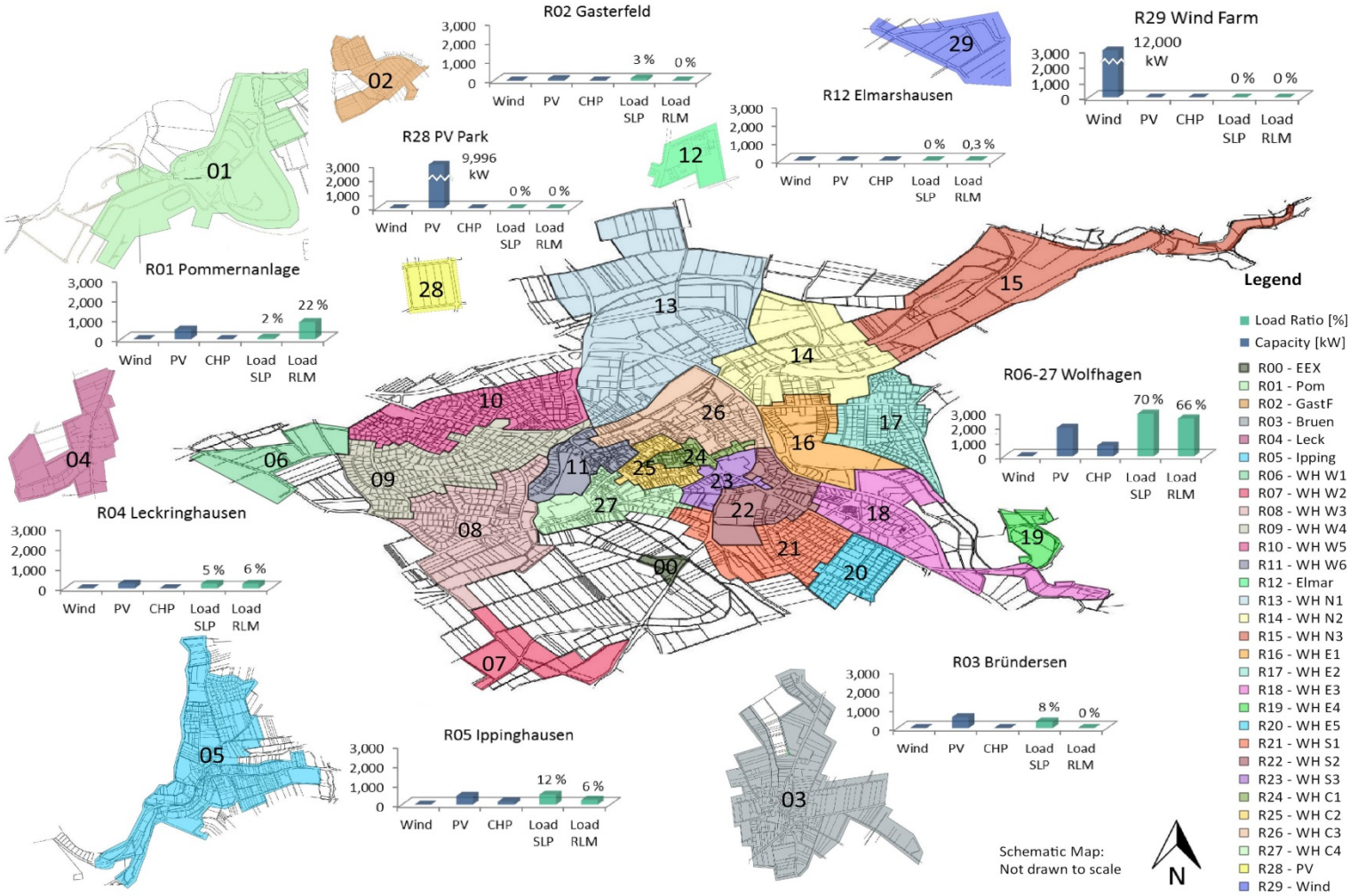
Examining flexibility potentials for regional energy systems – Case One



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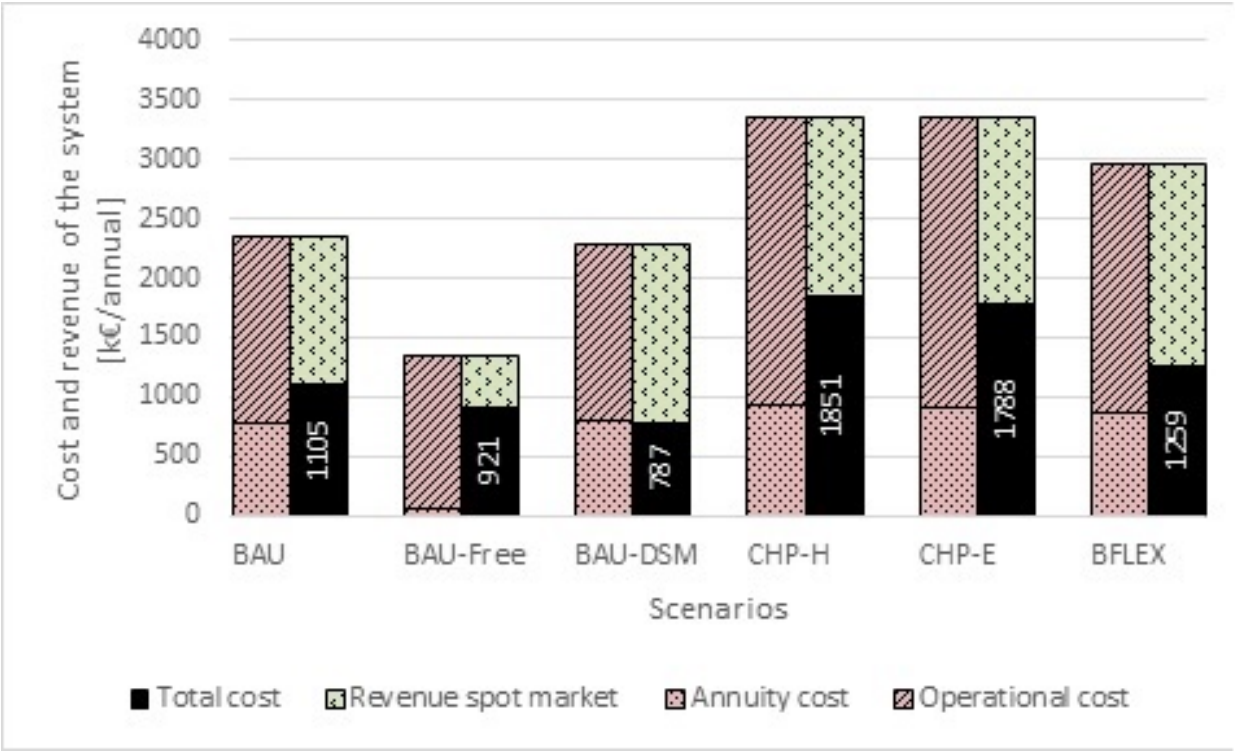
Potential of flexible technologies for regional energy systems – Case One



	targets					
	RES	CHP	Self consumption	CHP plant heat driven	CHP plan hybrid mode	DSM enabled
BAU-Free	x			x		
BAU				x		
BAU-DSM	x			x		x
CHP-H	x	x		x		
CHP-E	x	x			x	
BLEX	x		x		x	x

- Targets increase the total costs:
  - RES targets: 20-45%
  - CHP targets: 68%
  - Self consumption target: 60%
- Flexibility options reduce costs:
  - DSM: 29-41%
  - Curtailment: 9%
  - CHP Hybrid operation: 3%

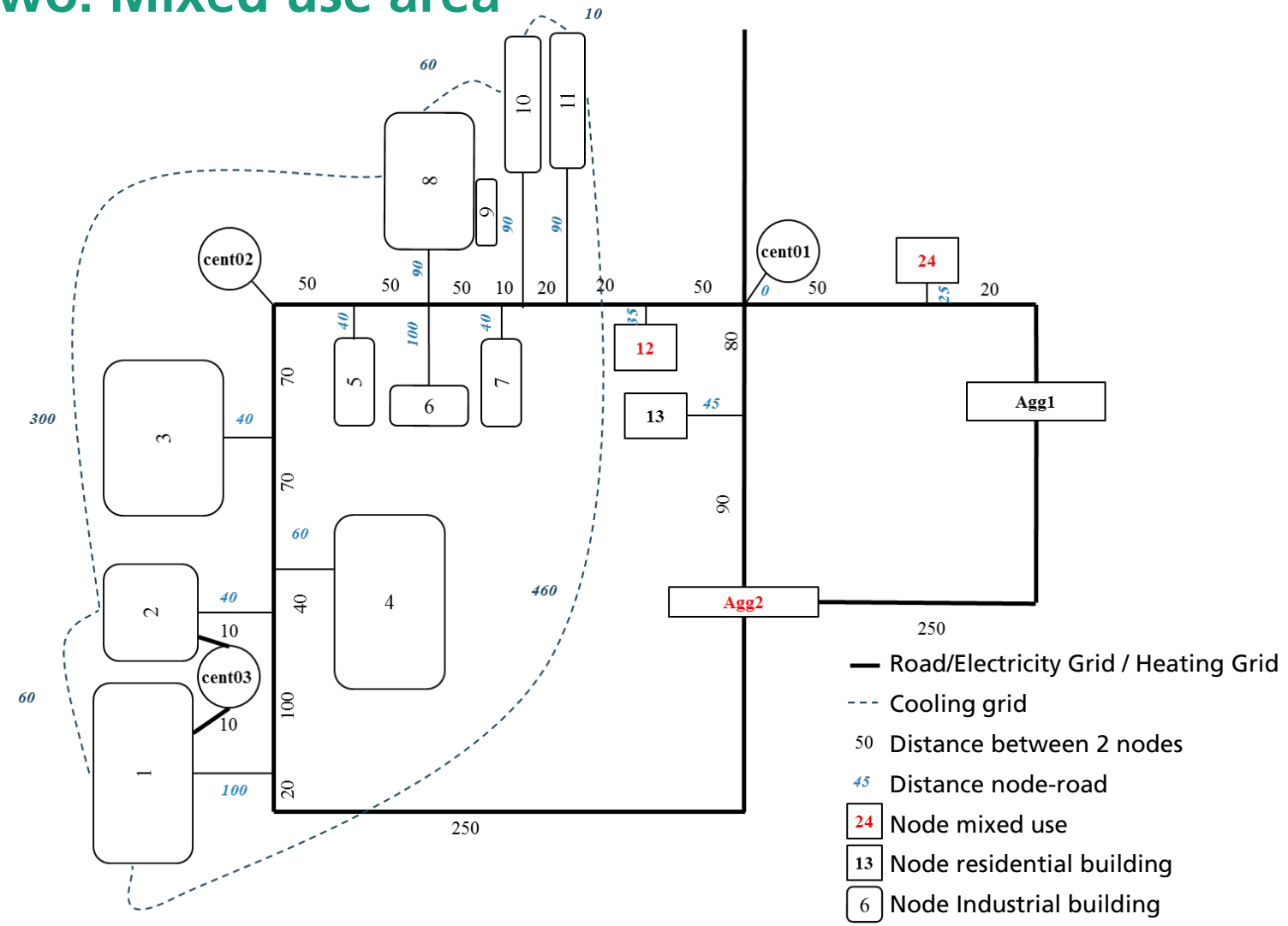
Is it sufficient to examine flexibility for the electricity sector alone?

- CHP already very common
- Heat pumps very efficient for heat supply
- Thermal storage efficient and cheap, high volumes can be stored

- Heat demand has not to be met as exactly as electricity -> inherent flexibility

Interplay between DSM and energy efficiency measures

Case two: Mixed use area



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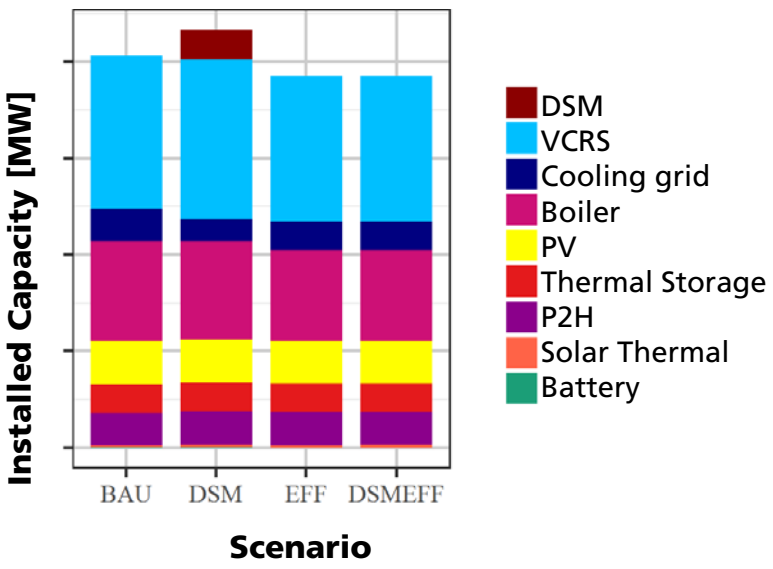
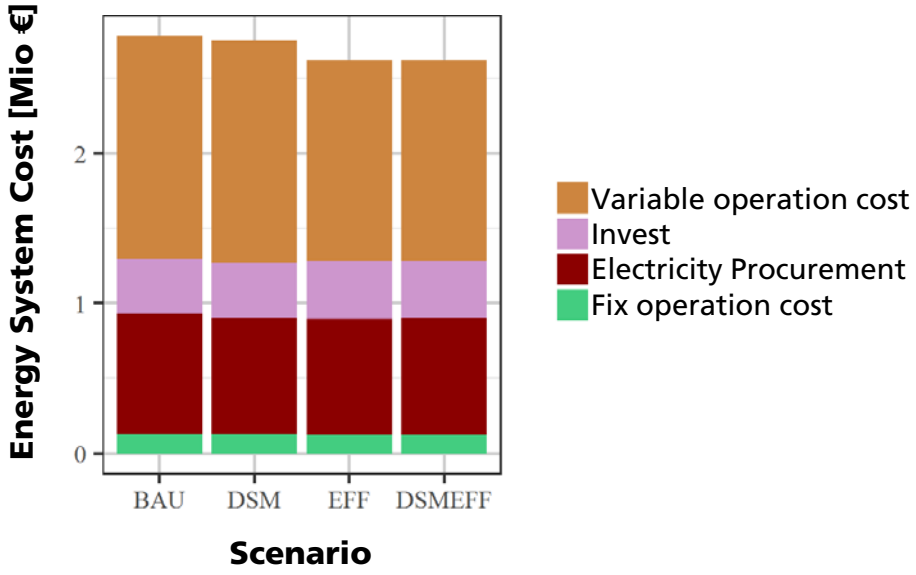
Interplay between DSM and energy efficiency measures

Cost and installed capacities



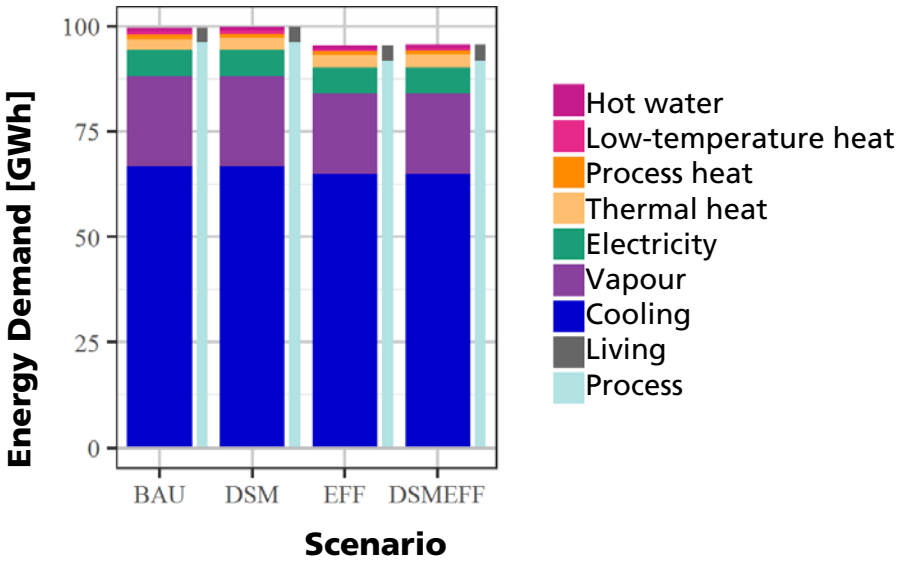


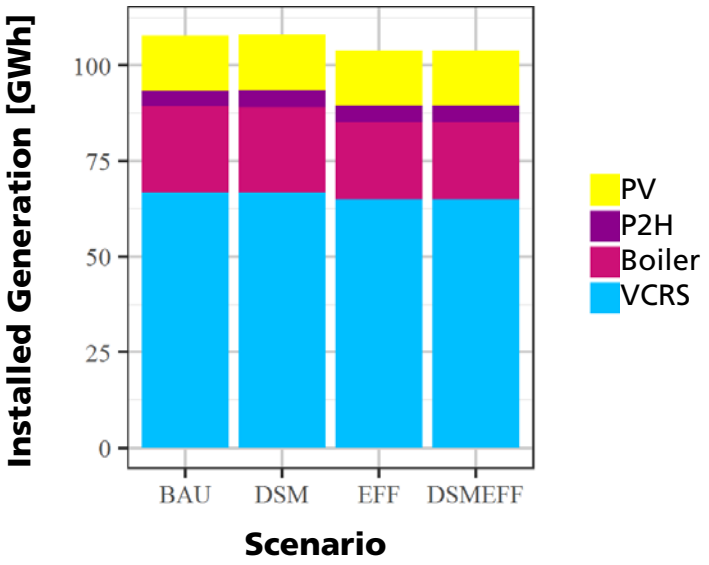
- DSM reduces energy system cost by 1.1 %
- Energy efficiency reduces energy system cost by 5.8 %

- A combination does not lead to further cost reductions!

Interplay between DSM and energy efficiency measures

Demand and Generation





- Energy efficiency reduces energy demand
- ➢ reduction of energy generation

- Demand Side Management does not affect sum of energy demand or generation

Conclusion

- Thinking „flexibility“ only for the electricity sector is not sufficient anymore
- Including sector coupling affects the potentials and usage of flexible technologies:
  - DSM is driven by price signal and local must-have electricity generation
  - For industrial users, Energy Efficiency shows a higher potential for cost reductions than DSM
  - Combining DSM and Energy Efficiency has no additional cost saving potential
  - Energy efficiency measures restrict heat and electricity demand and thus DSM potentials
- ➢ Further research on flexibility operation of different technologies and their influence factors should be done considering both sectors

Thanks for your Attention!

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