Simultaneous optimization of distributed energy systems connected to thermal network considering robust operation

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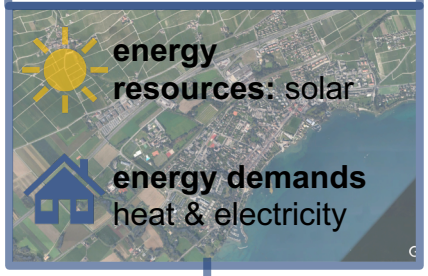
Methodology

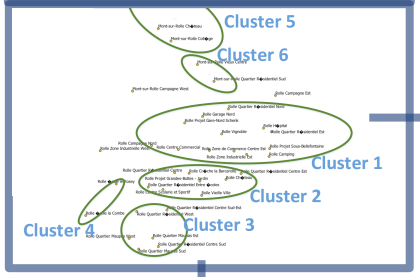
Rolle case data:



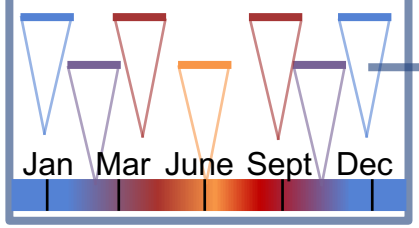
Technology data: Technical parameters of conversion, storage and network technologies

Parameter specifications: Economical parameters of conversion, storage and network technologies

Spatial Aggregation:



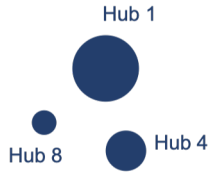
Temporal Aggregation:



Ehub Tool

Individual Hub Analysis

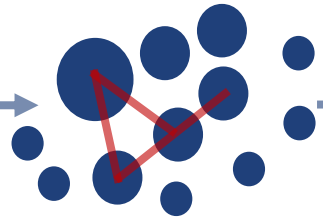
3 typical clusters



12 clusters

Thermal Network Design

4 clusters



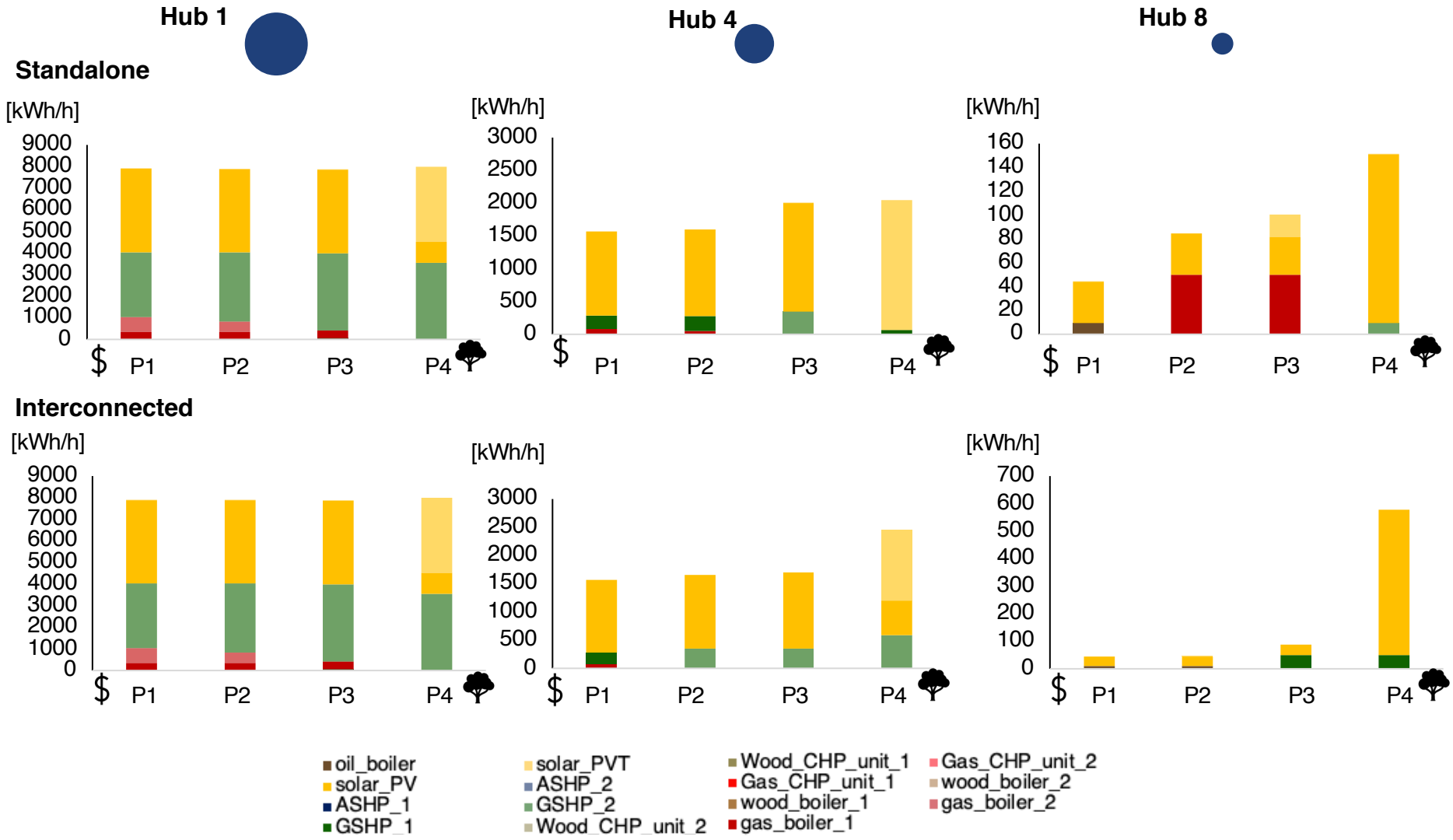
Demand Resilience

4 clusters heat demand

+15% & +30%

- *The following slides will show the results & conclusion of the Individual Hub Analysis with 3 different urban densities*

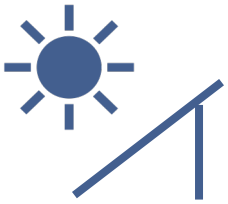
Grid-Dependency with different hub densities



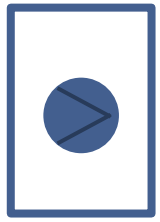
Economic Sensitivities of overall system

Smaller system (3 out of 12 clusters)

electricity export price
[0.05 CHF/kWh]
[0.15 CHF/kWh]



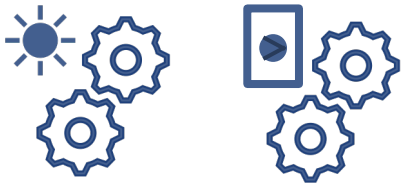
PV-investment cost
15 % and 30% reduced



HP-investment cost
10% and 20% reduced

reduced storage cost
12.5% and 30%

red. and incr. fuel costs
15%

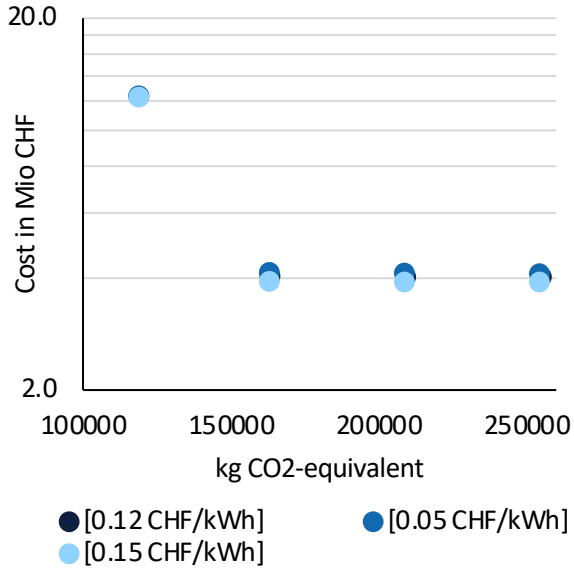


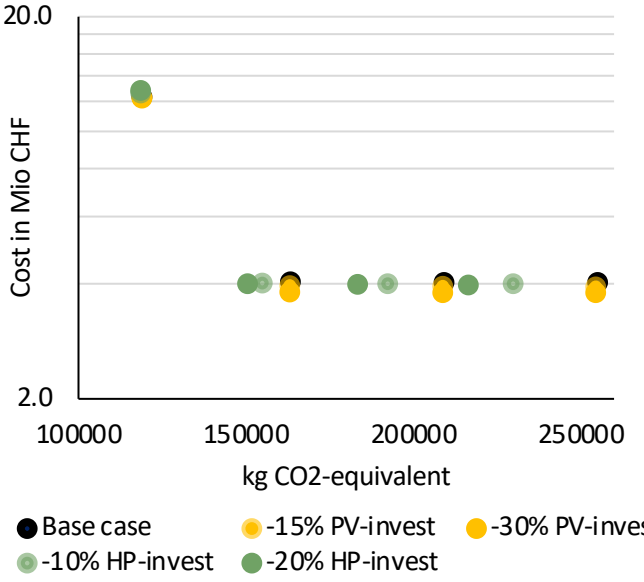
increased efficiency
HP and PV
15%

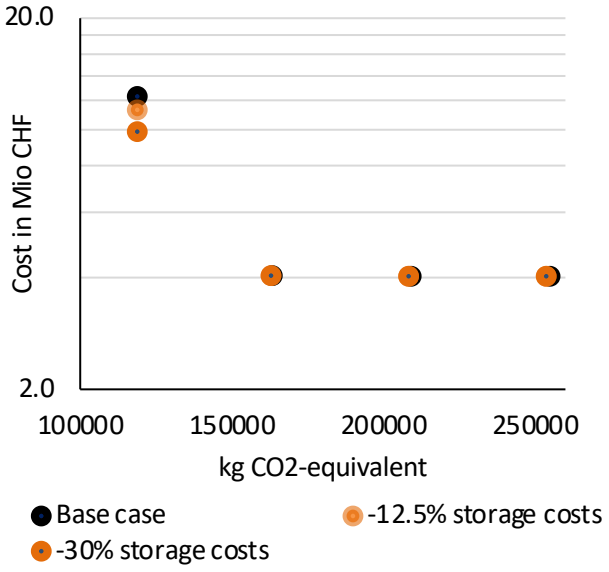
One Combination of several scenarios

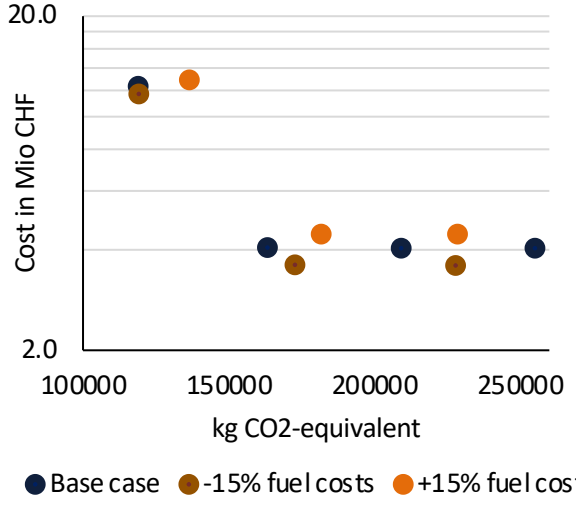
- 30% reduced PV-investment costs
- 30% reduced storage costs
- 15% increase in grid injection & fuel costs
- 20% reduced HP-investment costs
- 15% increase in HP and PV efficiencies

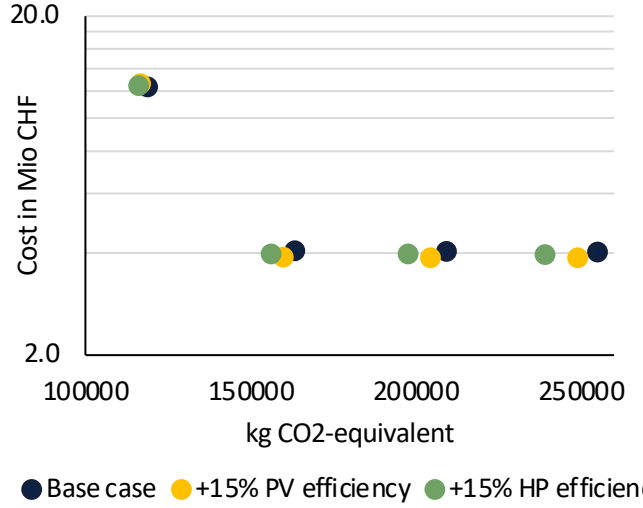
Pareto fronts: economic sensitivities

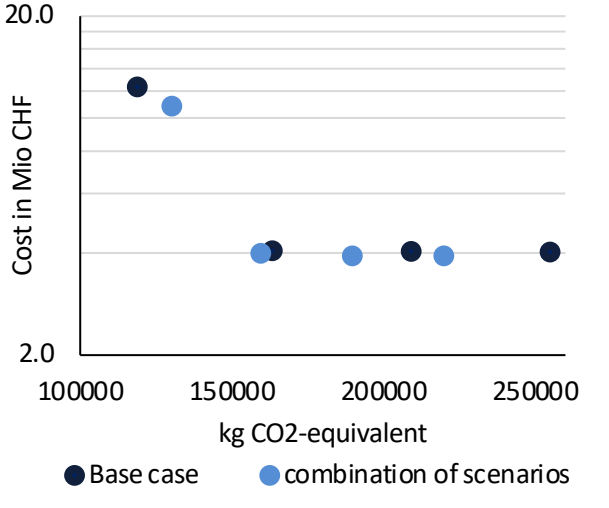












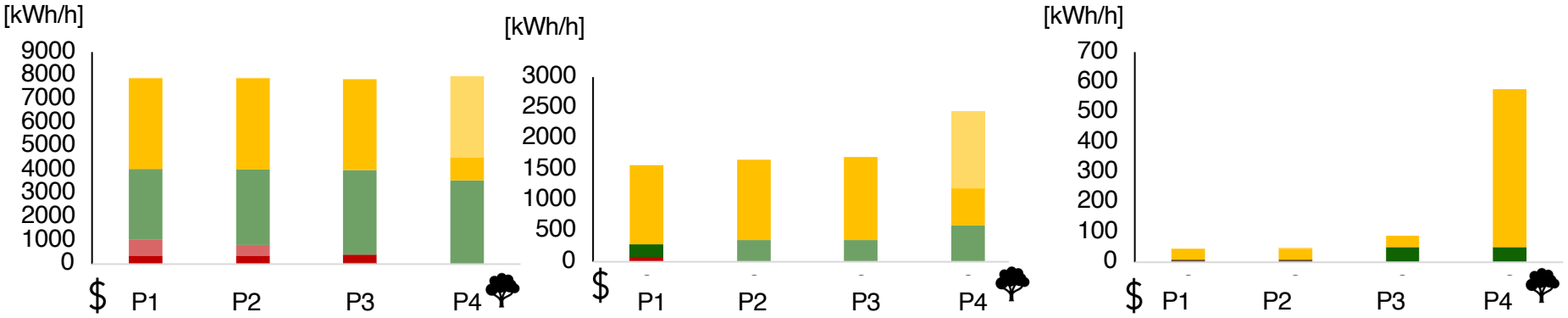
Economic sensitivities of different hub densities

Hub 1

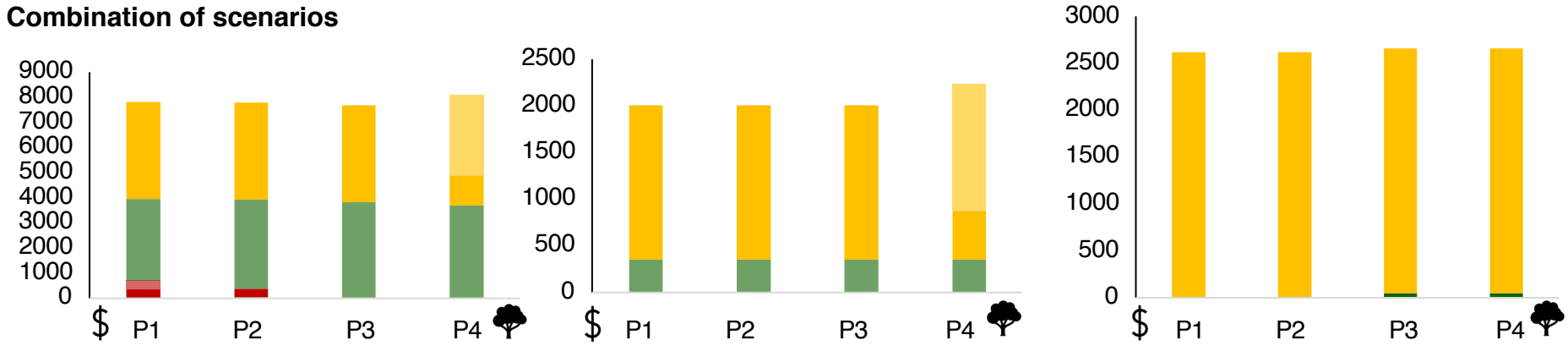
Hub 4

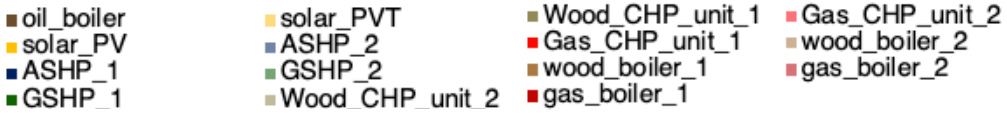
Hub 8

Base case



Combination of scenarios





Conclusion

- Novel approach in suburban areas to estimate impact of different urban densities
- The study reveals that the energy technologies used for each energy hub are notably influenced by the density of the sub urban area.
- The energy hubs that are larger in capacity are less vulnerable to the market changes when compared to the systems that are to be installed in the periphery which are having lower capacity.

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