sweet swiss energy research for the energy transition

PATHFNDR

Alternative fuels

Flexibility and sector coupling aware site planning of power-hydrogen-power (P2H2P) system

Work package 2
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1 BACKGROUND AND OBJECTIVES

- Seasonal mismatch in energy supply and demand is still a challenge (see Fig. 3)
- P2H2P systems are emerging in urban energy landscape (e.g. Autarkic multi-family house (MFH) in Brütten, ZH (Fig. 1 and Fig. 2)

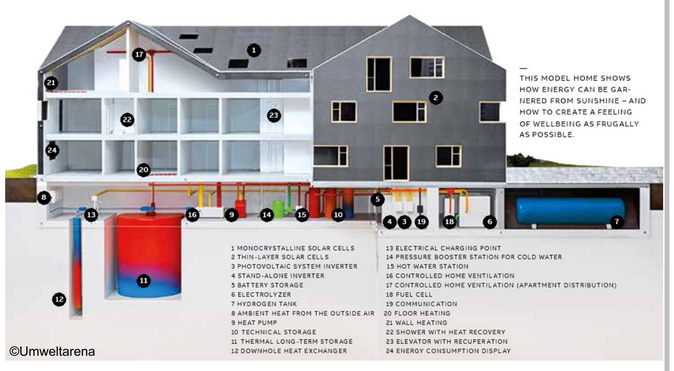

Figure 1: P2H2P system in MFH Brütten

2 CONTRIBUTION TO PATHFDNR

- Flexibility and sector coupling aware site planning of the P2H2P system.
- Quantitative assessment of the performance of the P2H2P system.
- Sensitivity analysis of P2H2P system design.

2 METHODOLOGY

- The ehubX Tool of Empa is used to perform the design optimization of the P2H2P system, including sensitivity analysis (see below).

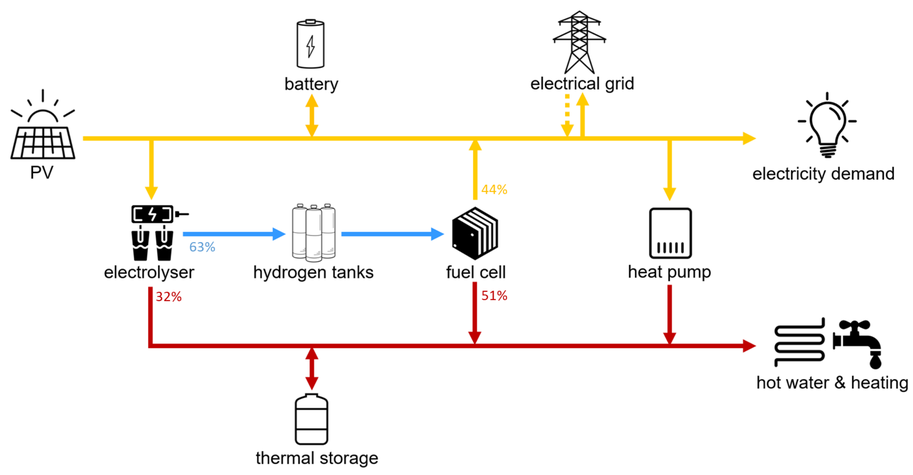

Figure 2: Schematic of P2H2P system

Parameters	Reference	Sensitivity analysis
Grid connection	No connection	Import, Grid exchange
Demand side management	NA	Load shifting, shedding
Electric vehicles	1 EV, V2G	9 EVs (all apartments) , V2G)
Technology learning	Electolysers (0.66), fuel cells (0.51), PV (0.18)	Efficiency (+): +10 % (electrolysers, fuel cells, PV)
CAPEX	Electrolyser (2000 CHF/kWh), PV (401 CHF/m2)	CAPEX (-): -25% CAPEX(--): -50% (electrolyser, PV)

3 RESULTS AND CONCLUSIONS

- Flexibility and sector coupling aware planning help improve the system design (see Fig. 3).
- P2H2P can provide short-term and long-term flexibility in the multi-energy system.
- Sector coupling enabled through P2H2P system including seasonal storage can mitigate seasonal imbalance in energy supply and demand.
- Among the parameters considered in sensitivity analysis, interactions with the grid have largest impact on the system design followed by e-mobility with V2G functionality, and technology learning (efficiency gain and CAPEX improvements), see Fig. 4

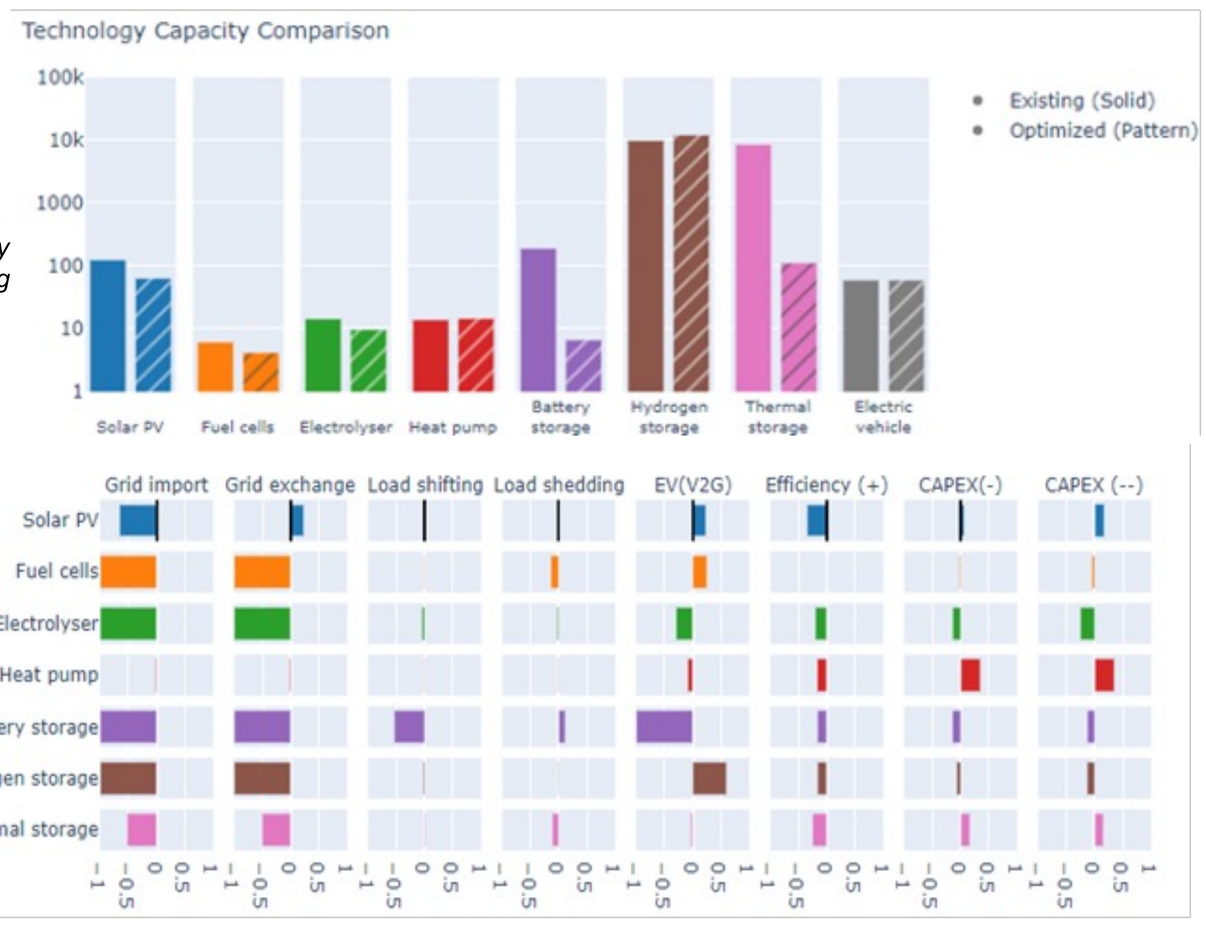

Figure 3: Flexibility and sector coupling aware design improvements of P2H2P site

Figure 4: Sensitivity analysis of the P2H2P system design

REFERENCES

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ACKNOWLEDGMENTS

This work was performed by the PATHFNDR consortium, which is sponsored by the Swiss Federal Office of Energy's SWEET programme.