Abstract: The energy transition to decentralized intermittent renewable energy sources is increasing the demand for energy storage systems. Hydrogen systems consisting of an electrolyzer, storage tanks and fuel cells/gas turbines are technically mature, but are not profitable if operated solely for electricity storage. At the same time, the lack of refueling stations has been a major obstacle for hydrogen powered fuel cell vehicles. Dual-purpose hydrogen storage systems, configured for both vehicle fueling and stationary energy storage, may provide cost or emissions reduction benefits.

In this work, a simulation model has been built that calculates the cost-optimal energy system for a community based on hourly demand time series (electricity, heat/AC, mobility BEVs/FCVs) and RES availability. The model considers power and energy capacities and hourly dispatch of each process to perform a linear cost optimization. This provides a detailed assessment of the economic feasibility of certain processes and storage systems. By calculating different scenarios it is further possible to determine the relation between additional costs and CO2 reduction per capita in the community. In future work, different BEV/FCV penetration scenarios will be modeled to determine if these hydrogen storage systems will play an important role on our way to a clean and sustainable energy future both on and off the road.

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