THE IMPACTS OF PROPULSION TECHNOLOGIES ON A SECTOR-COUPLED ENERGY STORAGE SYSTEM WITH 100% RENEWABLE ENERGIES

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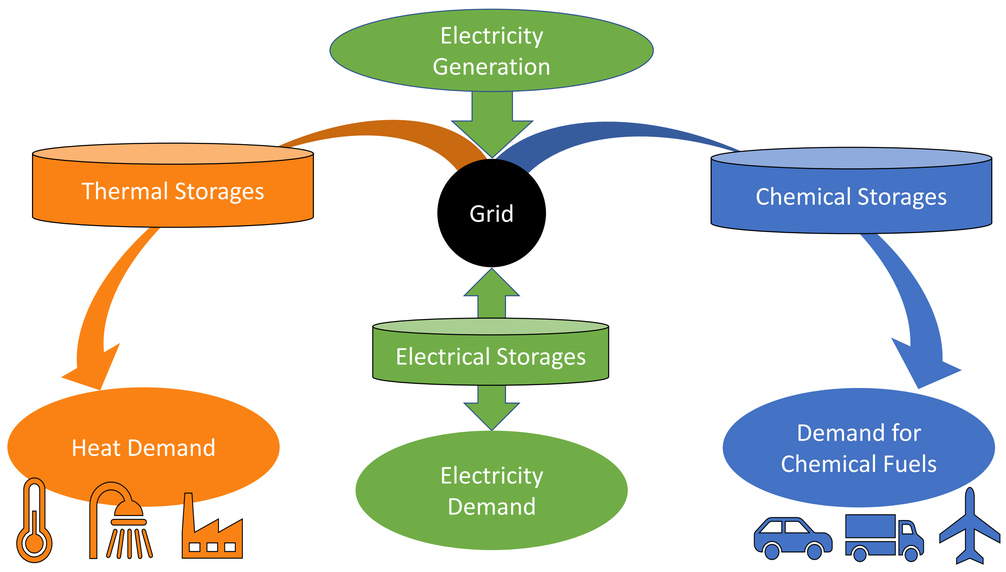
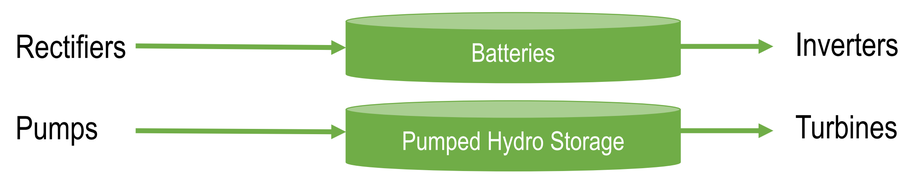
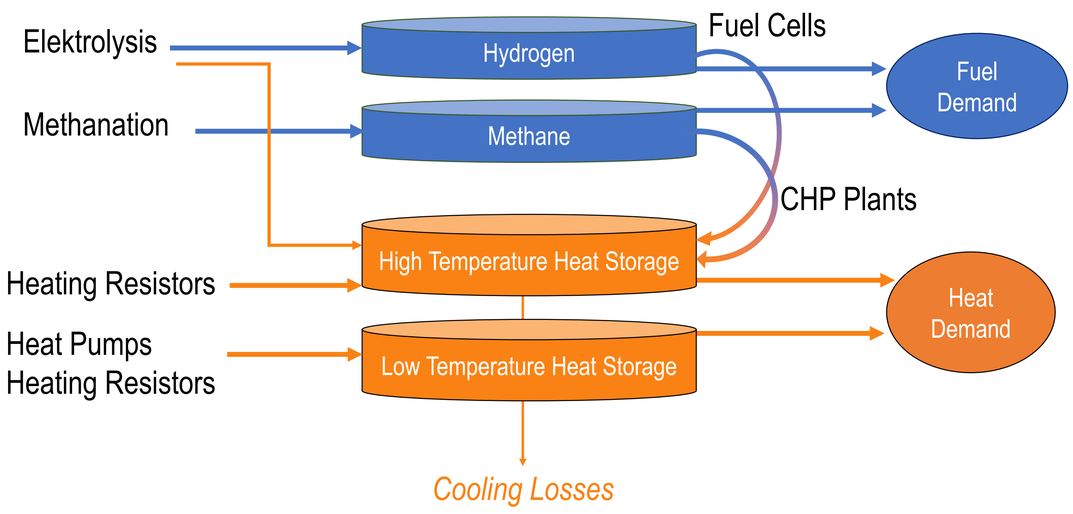
ENERGY SYSTEM MODELLING



STORAGE AND CONVERSION TECHNOLOGIES

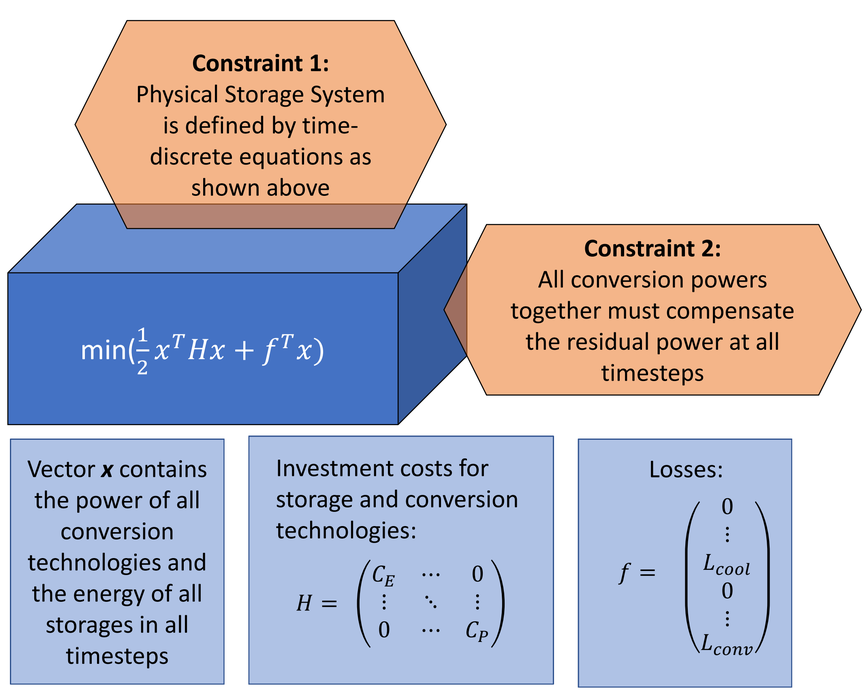




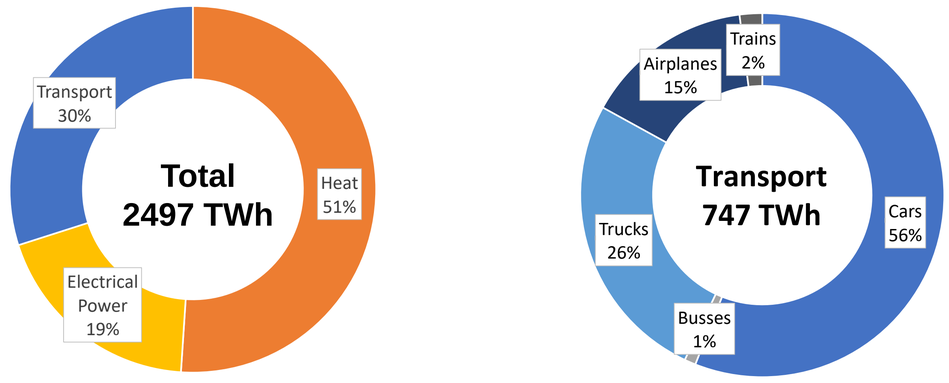
Modelling of the Physical Storage System exemplary for Hydrogen Storage:

$$e_{H2,t+1} = e_{H2,t} + \Delta t * \left(\eta_{Ely,H2} * p_{Ely,t} - \frac{1}{\eta_{FC}} * p_{FC,t} \right) - d_{H2,transport,t}$$

OPTIMIZATION



ENERGY DEMAND OF GERMANY

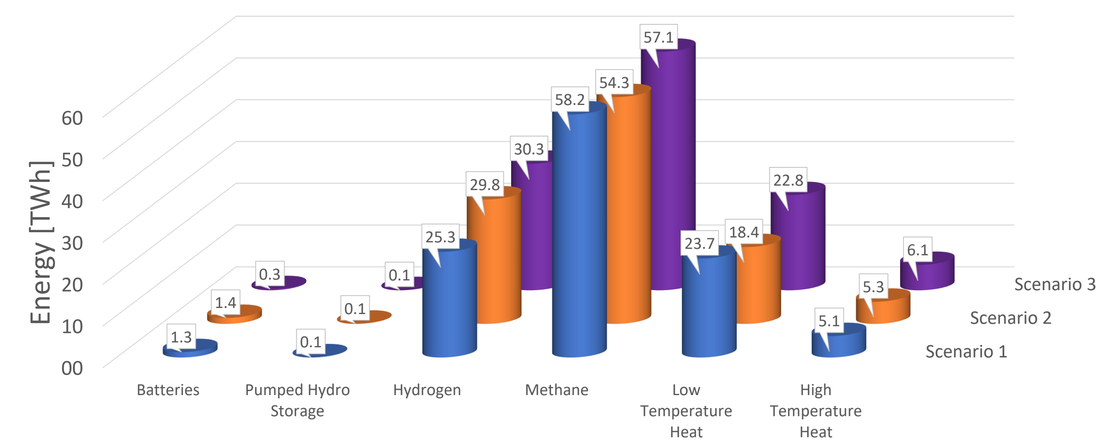


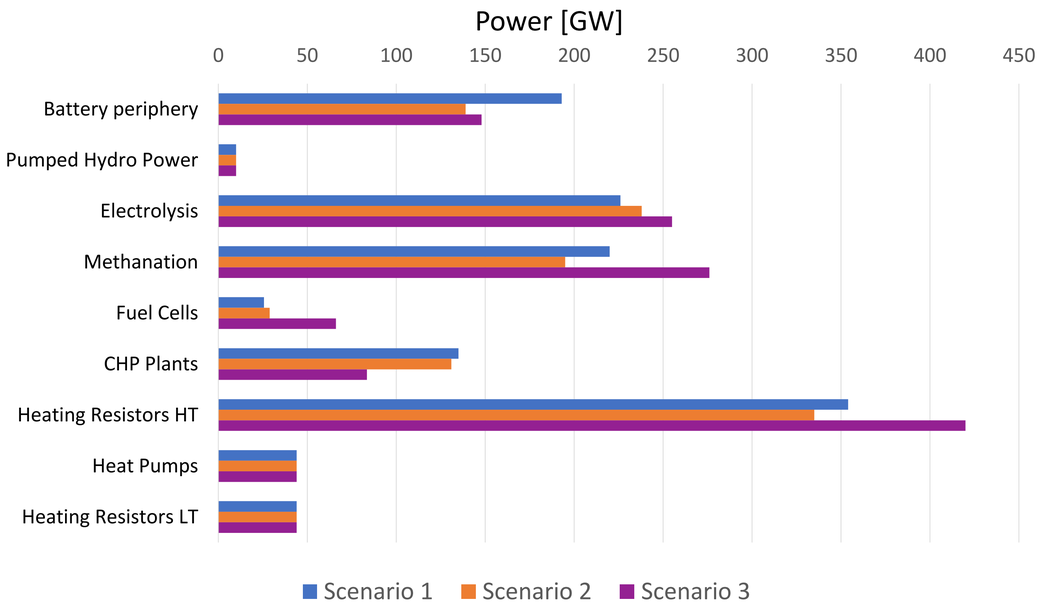
Data Sources:
[1] BMWi, 2018 “Energiedaten: Gesamtausgabe“; [2] BMV, 2018, “Verkehr in Zahlen“; [3] BnetzA, 2018, “SMARD Strommarktdaten“

THREE SCENARIOS FOR TRANSPORT

	Scenario 1	Scenario 2	Scenario 3
Propulsions of Cars	100% BEV	50% BEV 50% FCEV	10% BEV 40% FCEV 50% ICE
Propulsions of Trucks/Busses	100% BEV incl. overhead wires	90% FCEV 10% BEV	30% FCEV 70% ICE
Propulsions of Airplanes	10% batteries 90% hydrogen	100% hydrogen	100% PtL (based on methane)
Energy Demand for Transportation	**488 TWh**	**614 TWh**	**965 TWh**
Second Life Batteries if 80 % capacity can be used	**2.469 TWh**	**1.437 TWh**	**0.283 TWh**

RESULTS





- Propulsion technologies highly affect the **total energy demand**. The use of synthetic fuels leads to nearly twice as much energy demand for transportation as the use of battery-electric drives.
- The availability of stationary **second-life batteries** could be higher than the demand for stationary batteries.
- In the present model it cannot be seen that the use of hydrogen or synthetic fuels lowers the **demand for stationary storages**.

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