

Optimization model requirements

Optimization model requirements

Parameters for Soria

Energy technologies involved

- CHP with different types of prime movers:
 - Internal combustion engine
 - Micro-gas turbine
 - Fuel cell
- Electrolyser
- Natural gas boilers
- Wind energy (Soria)
 - *Wind speed (offers sizing) or wind power profile (negative load)?*
- Solar PV
 - *Irradiance or Power profile?*
- Solar thermal
 - *Thermal power (provided by Raffaele for Soria and Portici)(negative thermal load) or Irradiance?*
 - *Rankine cycle turbine ???→ electricity*
- Reversible heat pump
- Absorption chiller
- Battery
- Hydro pumped energy storage
 - *Options: b) could be modelled as a battery*
- Supercapacitor
 - *Options: a) could be ignored /eliminated b) could be modelled as a battery*
- Thermal storage for heating and cooling
 - *Using a phase-change material?*
- Hydrogen storage

PEVs (only for Optimal management of EVs in multi-carrier energy systems with multi-objective approach tool)

Table 2. Technical and economic information of energy devices for the 4 mEHs

Energy device	Size range (kW - kWh) Maximum area for RES installation (m²)	Specific capital cost	O&M costs (€/kWh)	Efficiency		Lifetime
				Electrical	Thermal	
Wind Power	Fixed size negative load	???	?	(direct power curve like a negative load)		
Solar PV mEH1 mEH2 mEH3 mEH4		2000 €/kWp	0.010	0.14		30
Solar thermal mEH1 mEH2 mEH3 mEH4		200 €/m²	0.0057		0.6	15
Battery		350 €/kWh	0.005	$\eta^{ch} = \eta^{disch} = 0.75$		5
Plasmaed hydro storage	Fixed value (500kW)	???	?	$\eta^{ch-el} = ???$?
Rankine Cycle turbine					$\eta^{th} = 0.05$	20
Thermal storage		20 €/kWh	0.0012		$\eta^{th} = 0.05$	20
H2 storage	0 - 10,000 kWh	25 €/kWh	0.001	$\eta^{ch} = \eta^{disch} = 0.071$		10
CHP NG ICE	20-5000	840 - 1495 €/kW	0.008 - 0.023	0.28 - 0.41	0.40 - 0.68	20

CHP NG MTG	30-300	1630 - 2492 €/kW	0.011 - 0.019	0.26 - 0.32	0.44 - 0.52	20
CHP fuel cell	0 - 100	1800 - 2492 €/kW	0.05	0.55	0.35	10
Electrolyser	20 - 1000	1000 €/kW	0.027	0.5		10
NG Boiler	10-2000	100 €/kW	0.0014		0.9	15
Reversible heat pump	10-5000	460 €/kW	0.0025		COP ^{he} = 3.5	20
Absorption chiller	10-5000	203 - 510 €/kW	0.0020		COP = 0.8	20

Kai Heussen
Formatted: Highlight

Kai Heussen
Formatted: Highlight

Kai Heussen
Formatted: Highlight

Kai Heussen
Formatted: Highlight

Kai Heussen
Formatted: Highlight

Kai Heussen

Find from Literature

Reply

Kai Heussen

ENEa proposed rankine Cycle turbine - why is it not in the model?

January 08, 2025, 11:34

Kai Heussen

Simulink model input is as follows: is a (nominal) thermal power that is to be fed into the rankine cycle turbine (per h). Input thermal power drawn from 'black box' of CSP + thermal storage (ENEa Model).

January 08, 2025, 11:50

Reply

Input data to be added

- ☐ electricity prices for the respective year on Soria location
 - ☐ Get sample input data from Gabriella
- ☐ technology & cost parameters

Run Scenarios

Parameters to be considered:

- Days (4 days, one per season) (as in Gabriella's document)
- Consumption profiles (use both hospital or residential)
- turn on / off storage technologies
 - single storage type vs. hybrid storage type
 - x shiftable consumption (not in optimization model)
 - no storage
 - base case using NG boiler
- Sizing study of different storage types
 - size variations as cost equivalent middle-high-low variants of technology size
 - Battery
 - hydro

- Phase change storage material (? Gabriella: possible?)
- CSP storage size
- technology parameters sensitivity
 - efficiency
 - x investment cost

Scenario definition steps

- ☐ fix the base parameters of the included storage technologies (Marcos)
 - 900 kW for battery stack
 - ☐ What is the meaningful base-case variation of the battery system (# stacks)
 - hypothesis: +-200 kW --> translated to # stacks
- ☐ define a table with the variations (sensitivity) of storage input size parameters, considering
 - ☐ **Study 1** (Sridevi): same cost variation of thermal storage as compared to reference variation of Battery
 - Number of units in Phase change material ? see if you can establish a meaningful range
 - Delivers parameter scenarios in form of an excel table
 - ☐ **Study 2** (Marcos): on-off variations of specific storage technologies:
 - ☐ vary on-off: a) phase change thermal storage, b) battery (describe in email by Friday)
- ☐ Zahra to Define the corresponding study YAML file(s)