Summary of 10 examples
technical and economic analysis

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Introduction

- Several Key Performance Indicator developed in B7

- Excel Tool for evaluation of systems
- B7 Tool (Version 3.6)
  - Technical assessment
  - Indicative economic analysis

- 10 examples were collected

B7 Tool: KPIs

- Saisonal Perfomance Factor
  - SPFel
  - SPFth

$$SPF_{th} = \frac{\sum Q_{out}}{\sum Q_{in}}$$

$$SPF_{el} = \frac{\sum Q_{out}}{\sum Q_{el,in}}$$

- Primary Energy Ratio
  - PER
  - PERref

$$PER = \frac{\sum Q_{out}}{\sum \left(\frac{Q_{el,in}}{\varepsilon_{el}} + \frac{Q_{in}}{\varepsilon_{in}} \right)}$$

$$f_{sav.PER} = 1 - \frac{PER_{ref}}{PER_i}$$

- fsav
- SPFequ

$$SPF_{equ} = \frac{PER_{NRE}}{\varepsilon_{el}}$$

- Incremental Figures
  - $\Delta E_{equ.C}$
  - ΔSPF_{SHC}
  - CAP_{SHC}

$$\Delta SPF_{SHC} = \frac{Q_{WD.system} + Q_{HD.system} + Q_{hloss} - Q_{HB.system} * (1 - \%_{HB.C}) + Q_{HP.system}}{\frac{Q_{HB.system} * \%_{HB.C} * \varepsilon_{el}}{\varepsilon_{EC} * \eta_b} + E_{aux.SHC}}$$

$$CAP_{solar} = \frac{\left(\frac{Q_{\mathrm{CD.system}} + Q_{closs} - Q_{\mathrm{CB.system}}}{EER_{ref}(f(kW))} - \frac{Q_{\mathrm{HB.system}} * \%_{HB.C} * \epsilon_{el}}{\epsilon_{EC} \eta_b} - \Delta E_{aux.C} \right)}{t}$$

- Economic analysis
  - Levelized costs of energy
  - Avoidance costs

→ each KPI for 5 subsystem

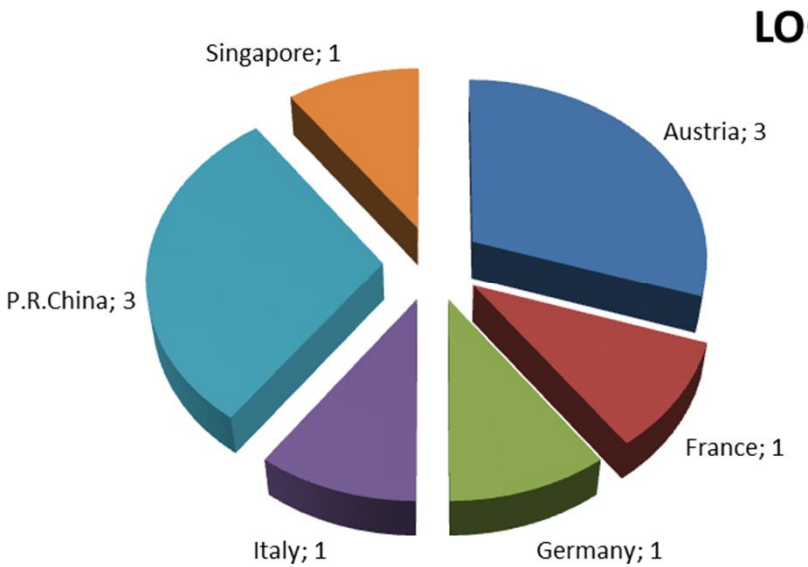
B7 Tool: Indicative economic analysis

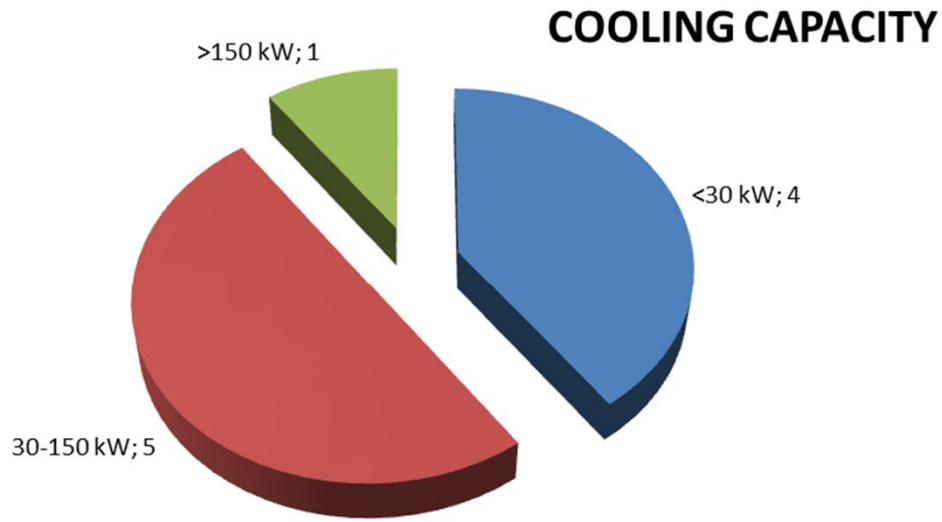
- Annualized cost for
  - Investment, replacement & residual value
  - Maintanance
  - Operational costs (energy, water)

- On the bases of VDI 2067, EN 13798

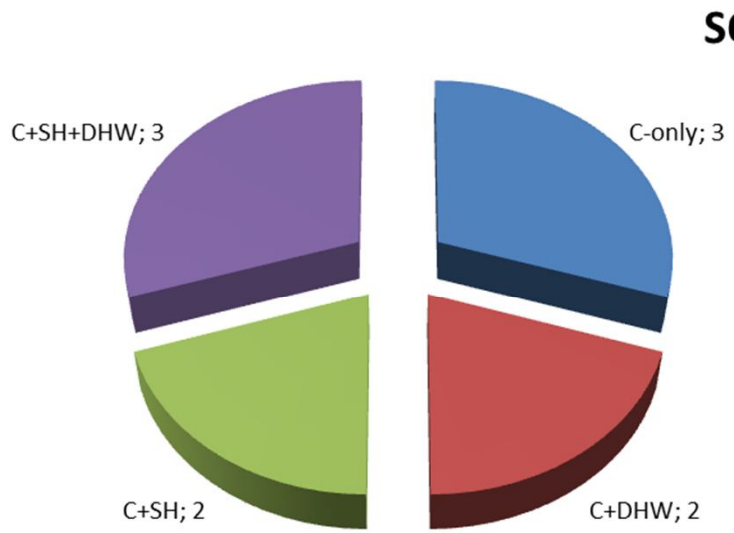
- Levelized costs of energy (C+SH+DHW) [€/kWh]
- Avoidance costs (CO_2 and PE)

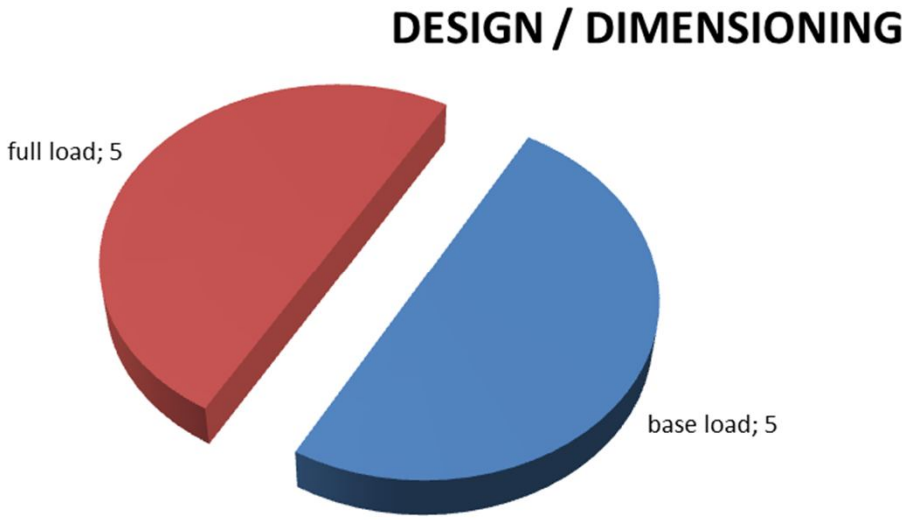
Overview


LOCATION
Singapore; 1
Austria; 3
P.R.China; 3
France; 1
Italy; 1
Germany; 1

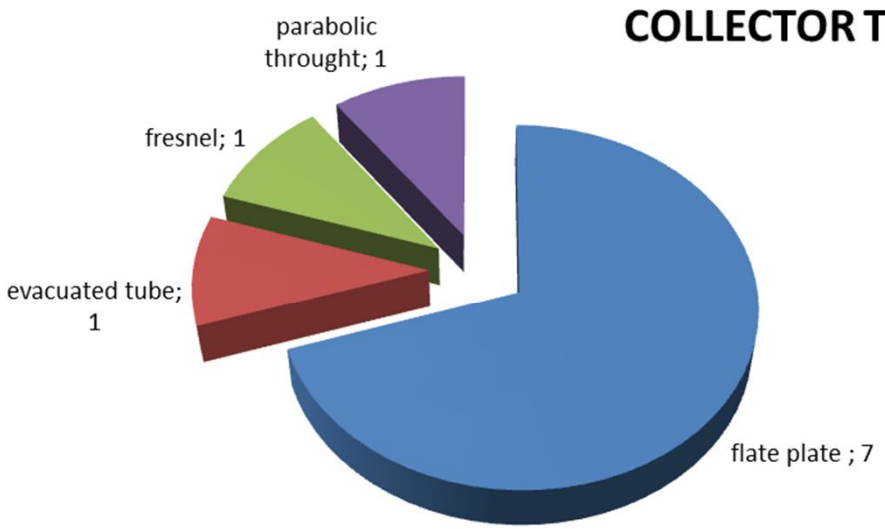

COOLING CAPACITY
>150 kW; 1
<30 kW; 4
30-150 kW; 5

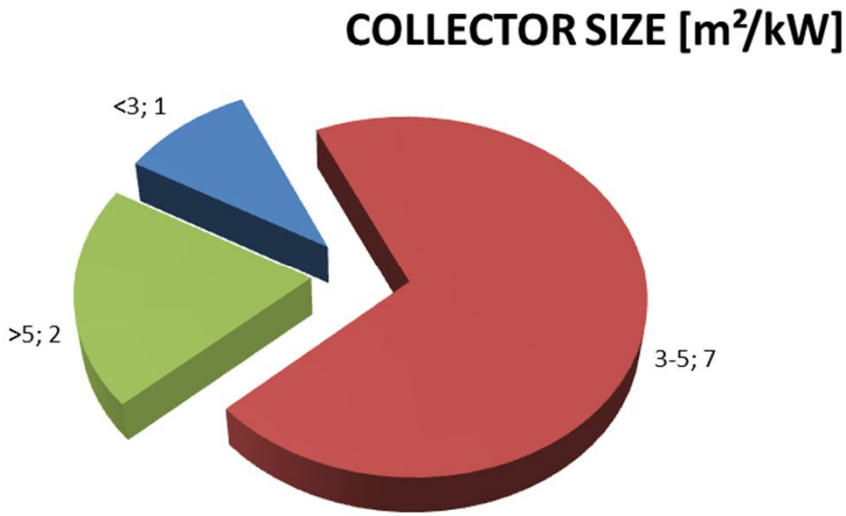
Overview


SOLAR USE
C+SH+DHW; 3
C-only; 3
C+SH; 2
C+DHW; 2

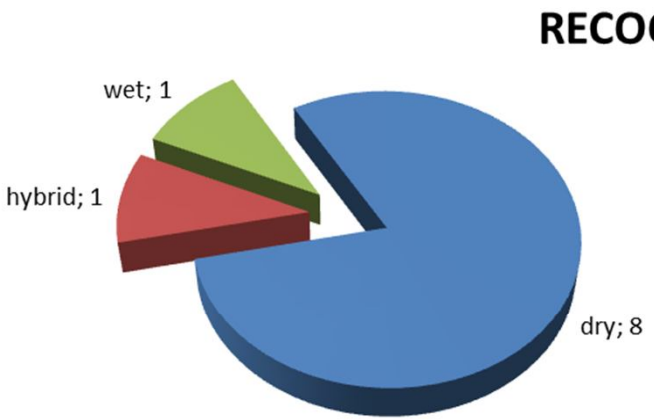

DESIGN / DIMENSIONING
full load; 5
base load; 5

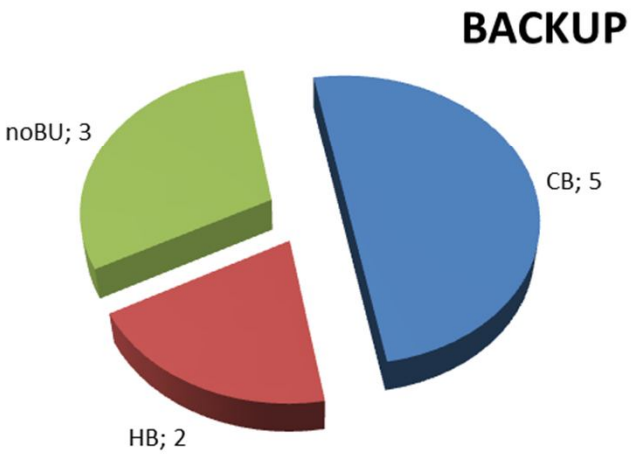
Overview

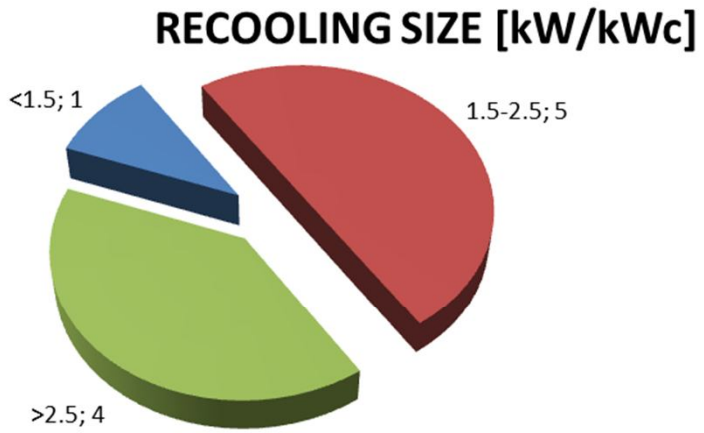

COLLECTOR TYPE
parabolic throught; 1
fresnel; 1
evacuated tube; 1
flate plate ; 7


COLLECTOR SIZE [m²/kW]
<3; 1
>5; 2
3-5; 7

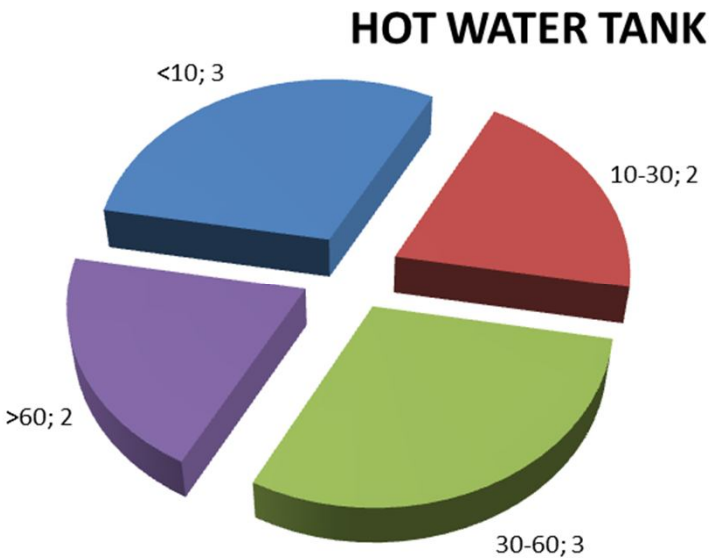
Overview

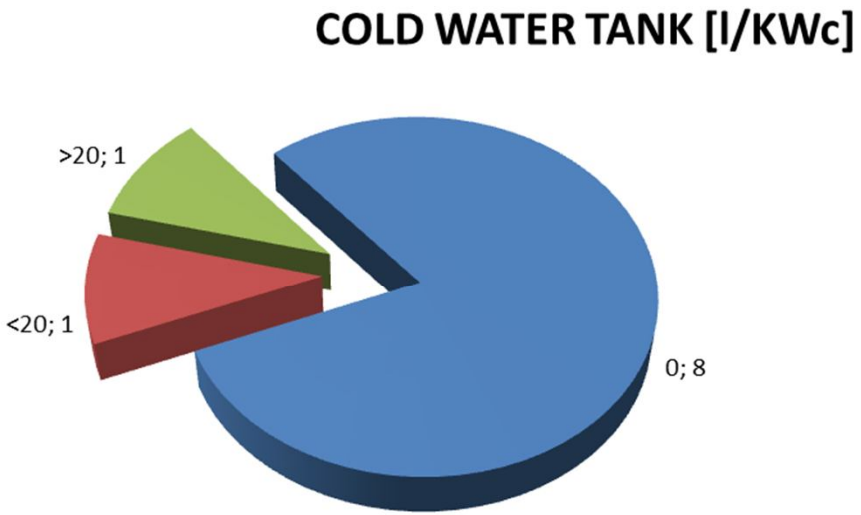

RECOOLING
wet; 1
hybrid; 1
dry; 8


BACKUP TYPE
noBU; 3
CB; 5
HB; 2

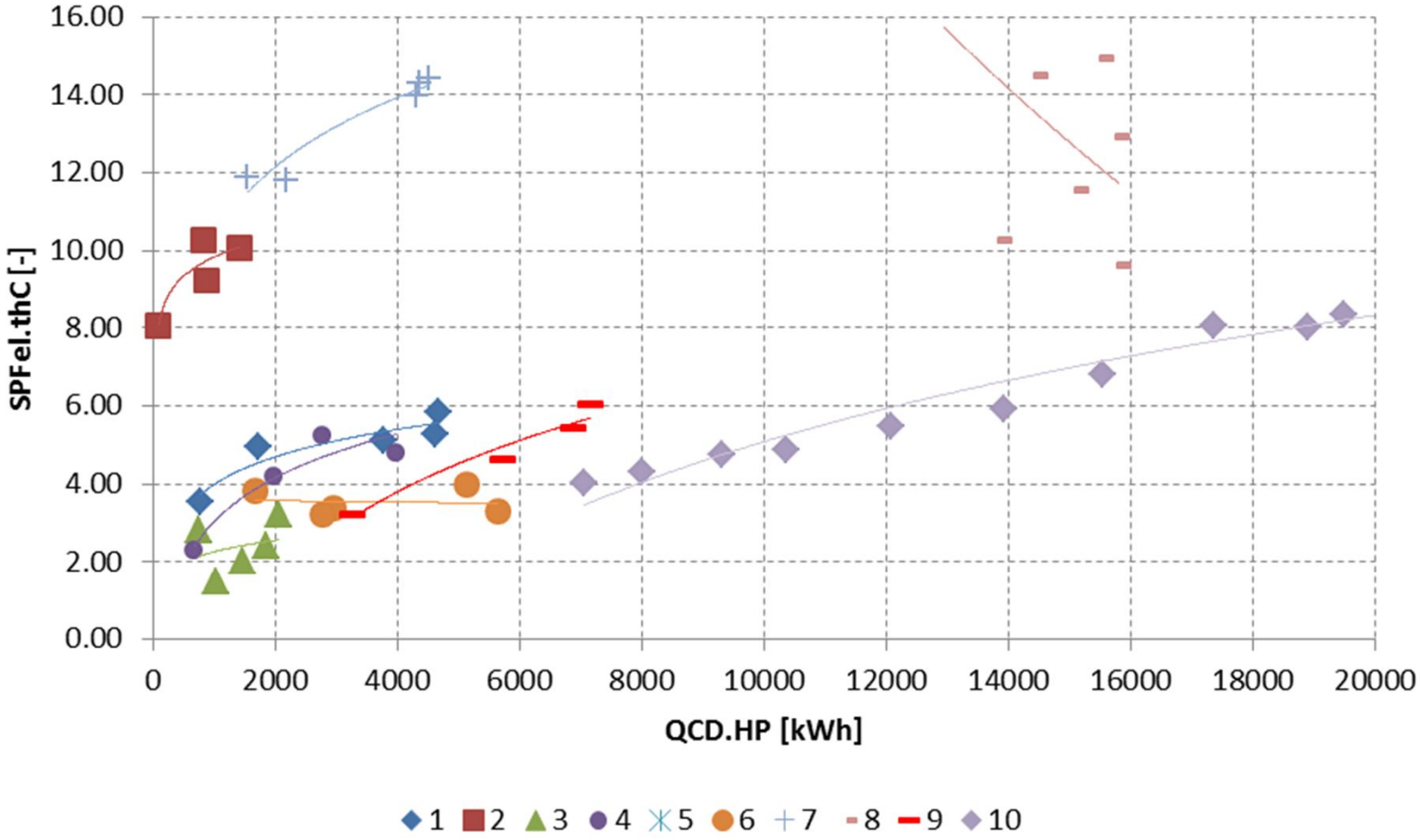

RECOOLING SIZE [kW/kWc]
<1.5; 1
1.5-2.5; 5
>2.5; 4

Overview

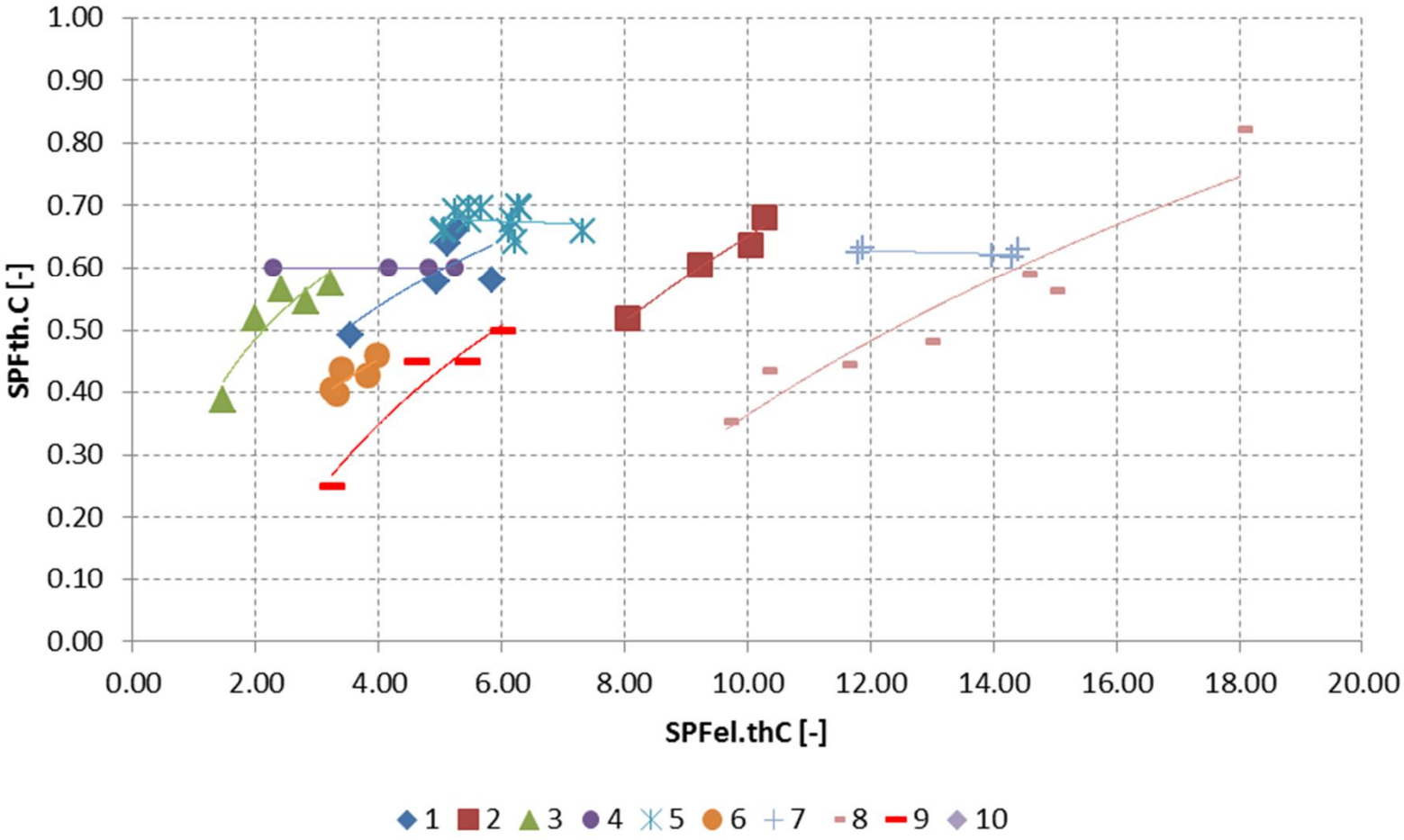

HOT WATER TANK [l/m²]
<10; 3
10-30; 2
>60; 2
30-60; 3


COLD WATER TANK [l/KWc]
>20; 1
<20; 1
0; 8

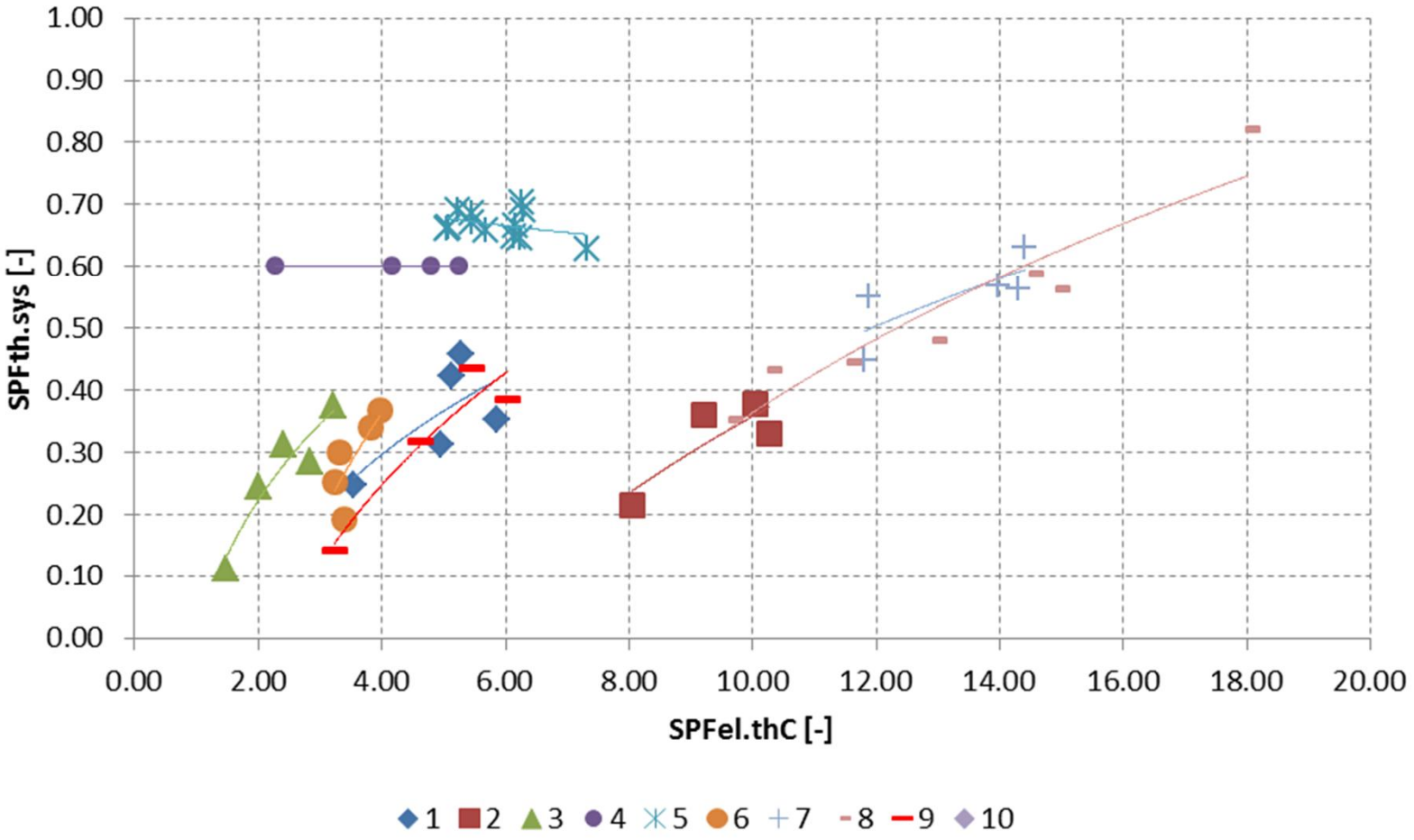
Results: electrical efficiency - SPFel.thC



Results: SPFel.thC vs. SPFth.C

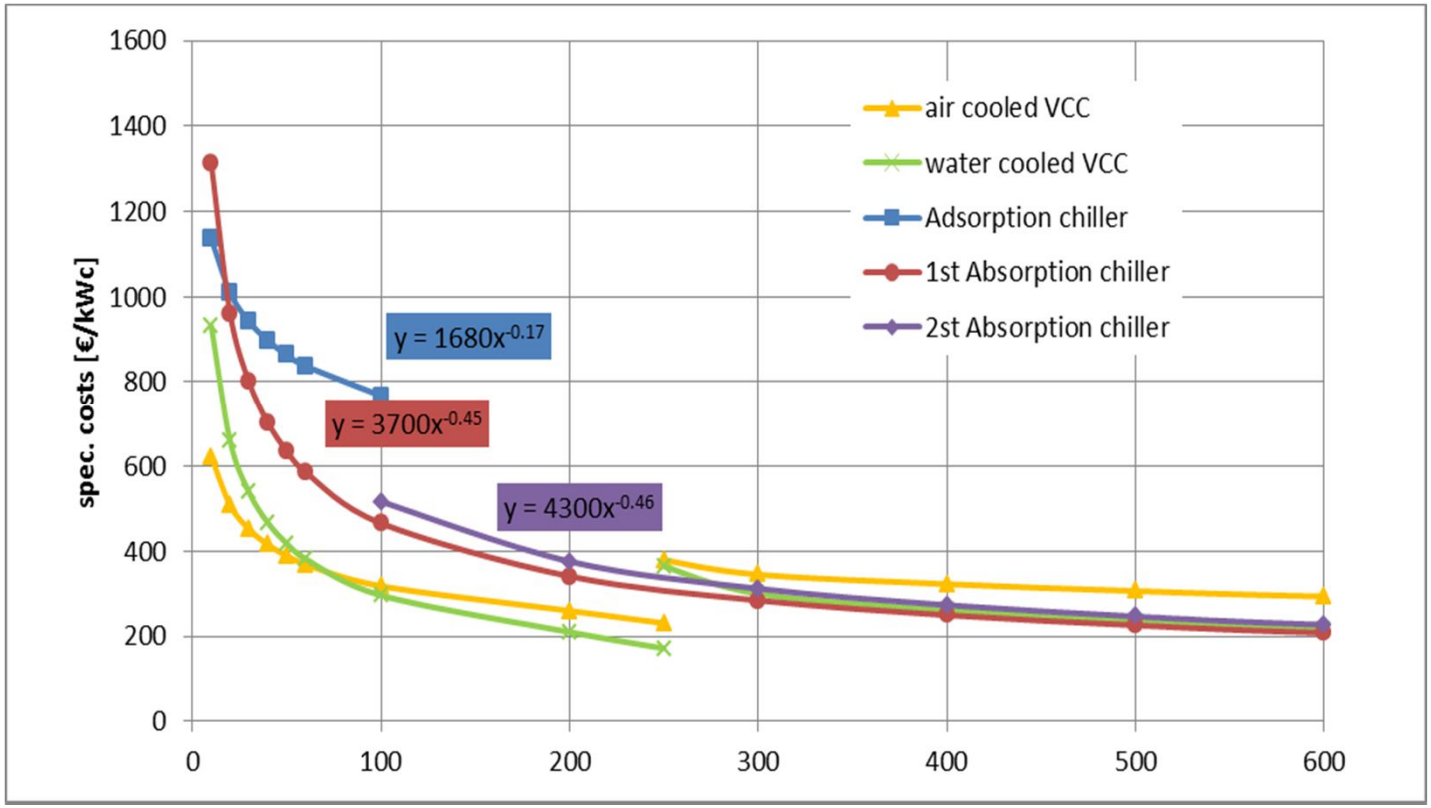


Results: SPFel.thC vs. SPFth.sys



Tool: Indicative economic analysis

- Standard costs for main components / energy



Results: costs

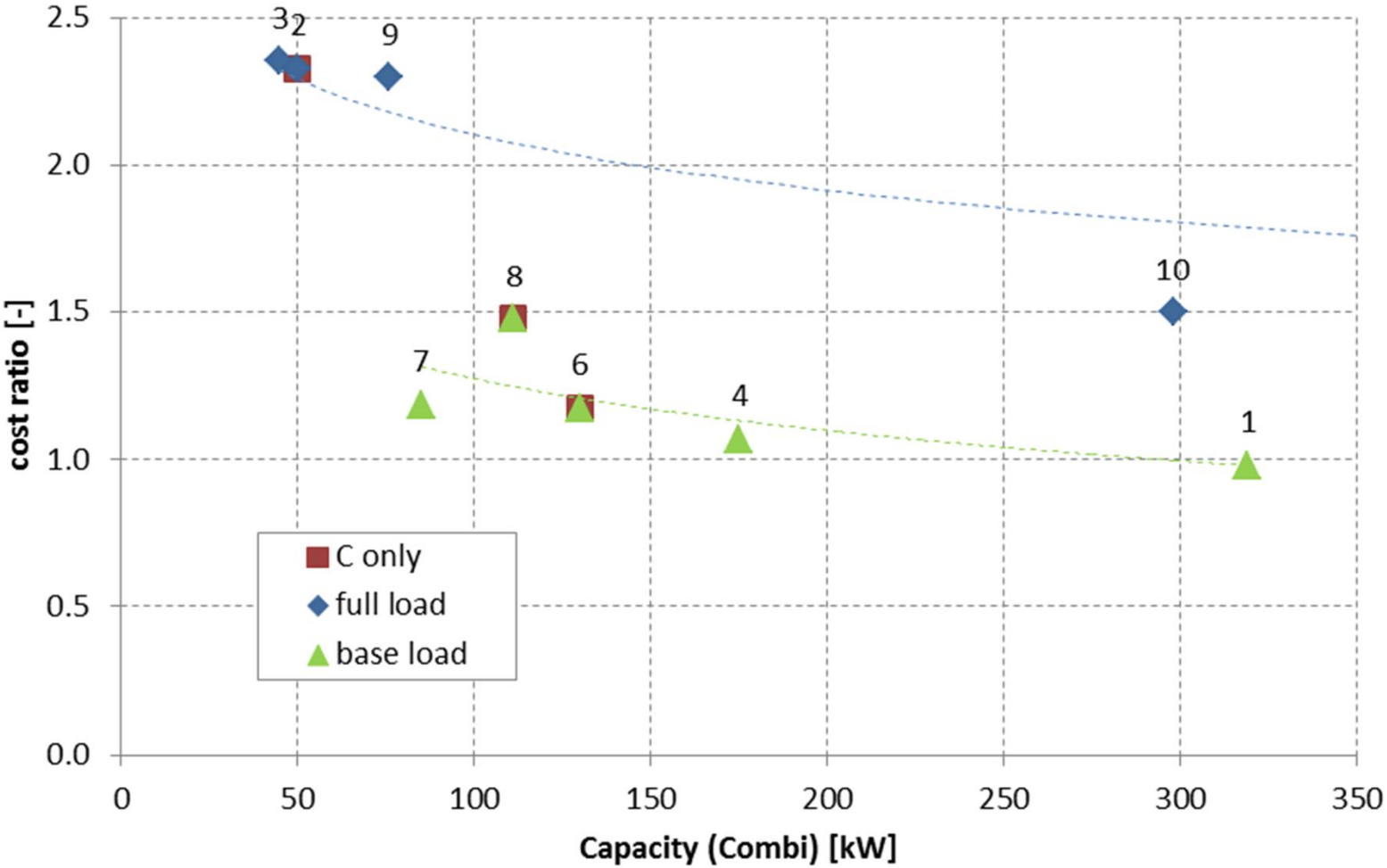
- Only compared withT48 Standard costs
- Analysis of yearly balance

- Feedback from examples
  - ASIC: +5%
  - SOLID: +40% (piping, problems with sub contracters,…)
  - TECSOL: +25%

→ T48 should show cuttoff values

→ Cost ratio between SHC and REF is relevant

Results: cost ratio (SHC/REF)



Summary

- Several KPI and subsystem division is necessary
  - Different views (consumer, politician, technical stuff,…)
  - Mixing up C+SH+DHW misleading
- Summary of 10 examples shows effects of
  - backup‘s
  - System configuration (C, SH, DHW)
  - Cold back up efficiencies
  - ….
- Cost competiveness!?
  - Possible with base load

Thank you for your attention!

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