IEA SHC Task Meeting
Task 53
10th & 11th of October 2016, UIB, Palma de Majorca, Spain

Solar PV Cooling

Polysun simulation and validation
on going work

Lukas Omlin, Paul Gantenbein
E-Mail: lukas.omlin@spf.ch, paul.gantenbein@spf.ch
Institute for Solar Technology SPF
University of Applied Sciences Rapperswil

HSR
HOCHSCHULE FÜR TECHNIK
RAPPERSWIL
FHO Fachhochschule Ostschweiz

SPF
INSTITUT FÜR
SOLARTECHNIK

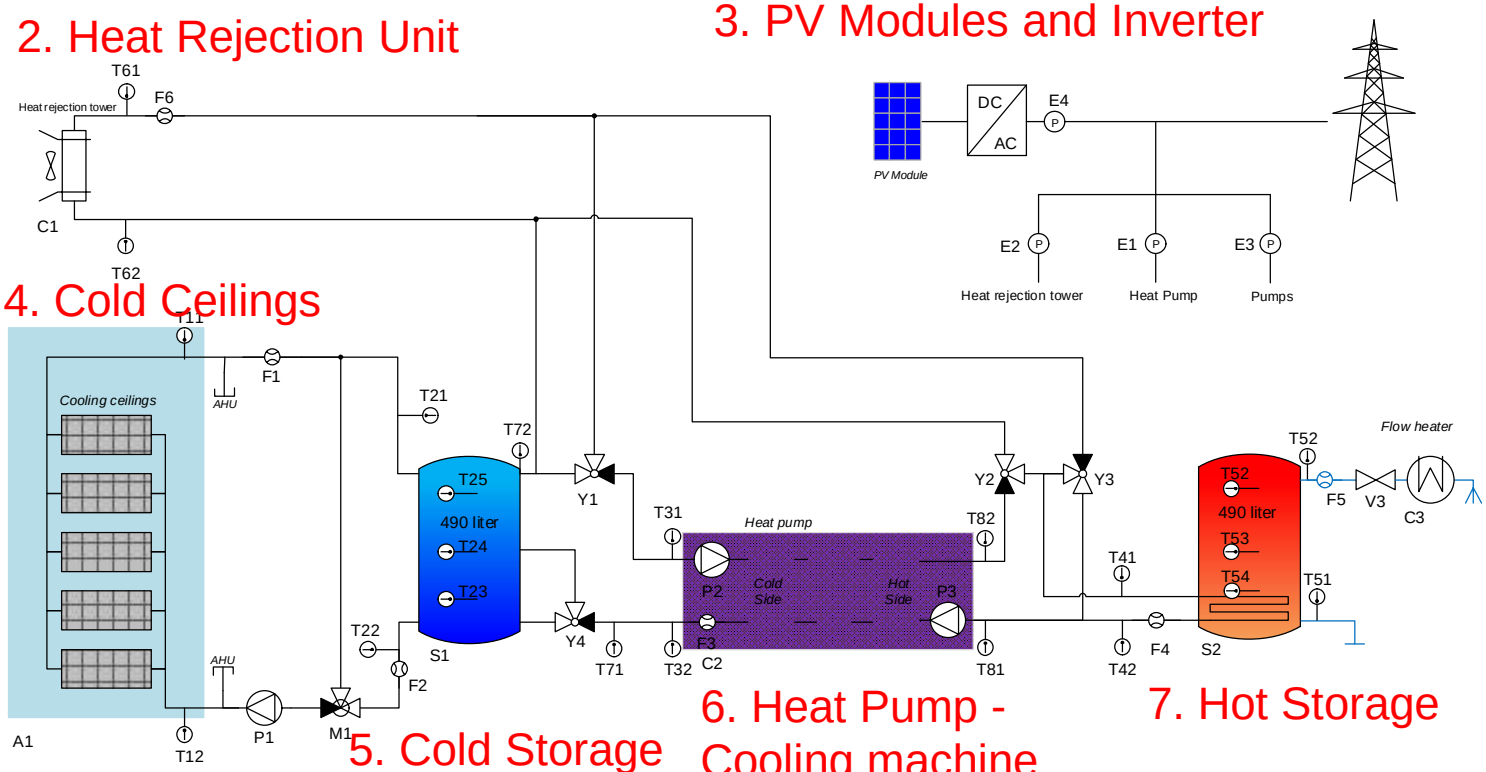
System

- **Hydraulic schematic**
  apparatus, tubes (sensors & DAQ)

1. Measurement Equipment and Data Acquisition

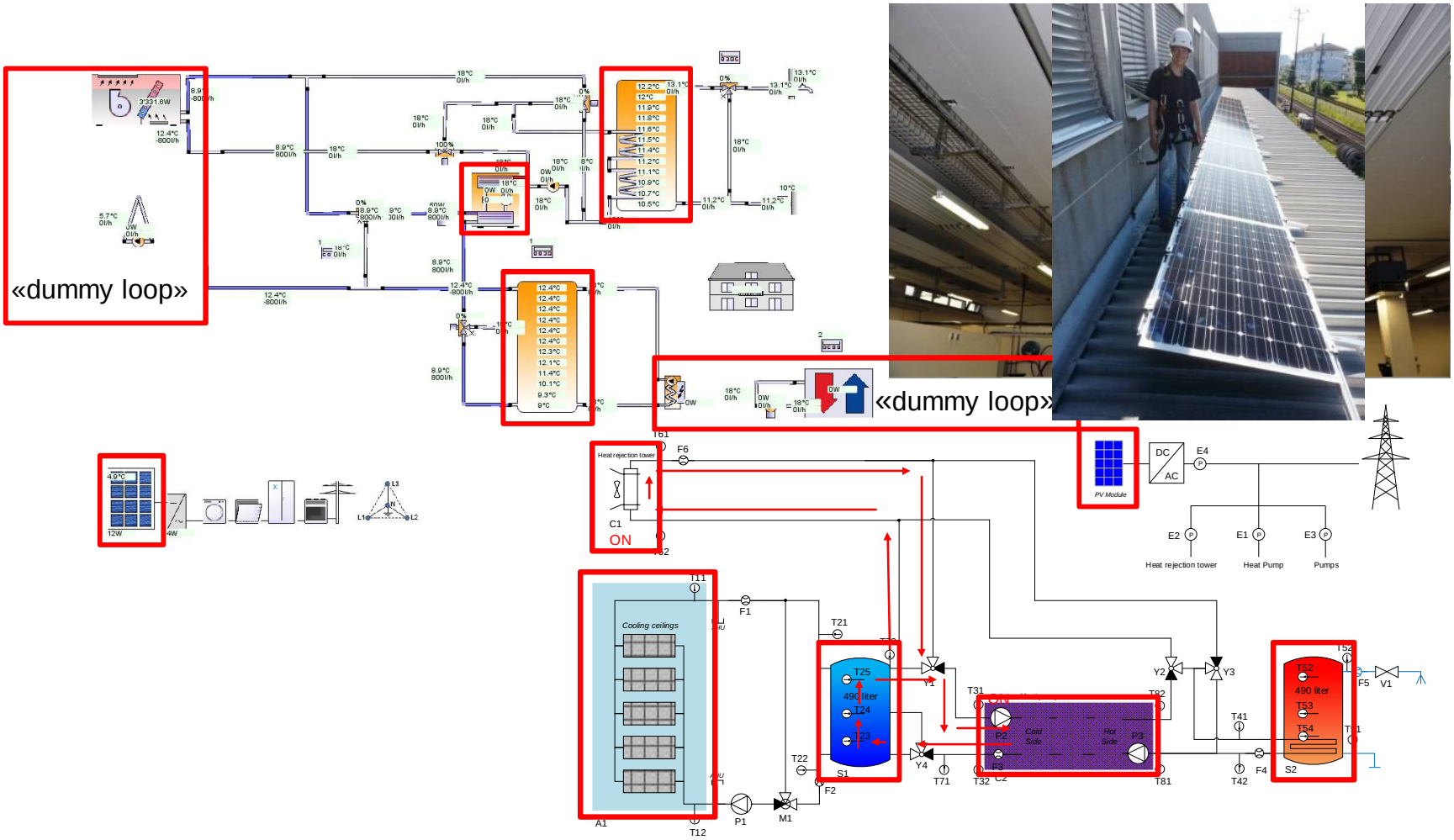
2. Heat Rejection Unit

3. PV Modules and Inverter



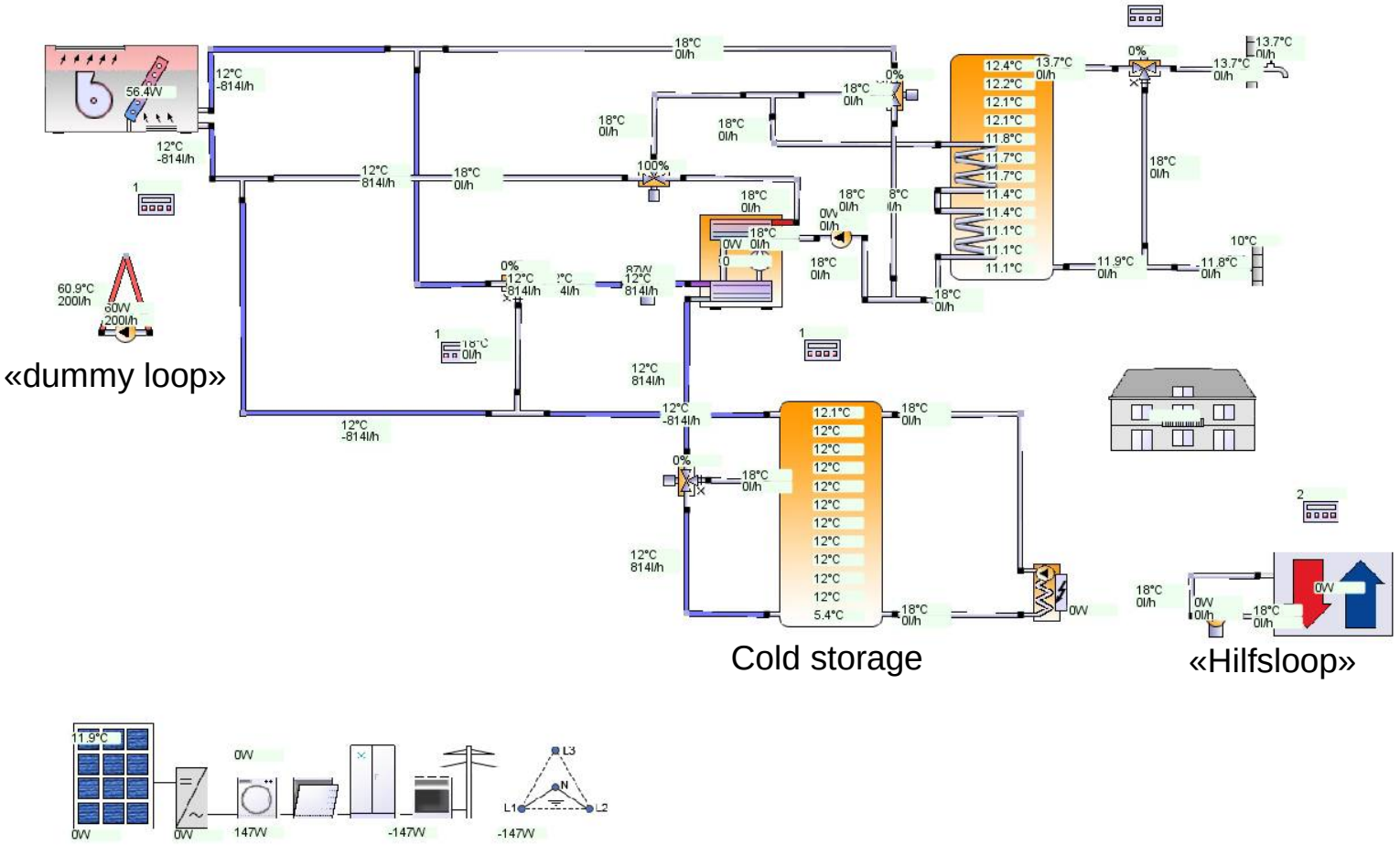
Polysun simulation

- **Polysun simulation and validation of the simulation results**



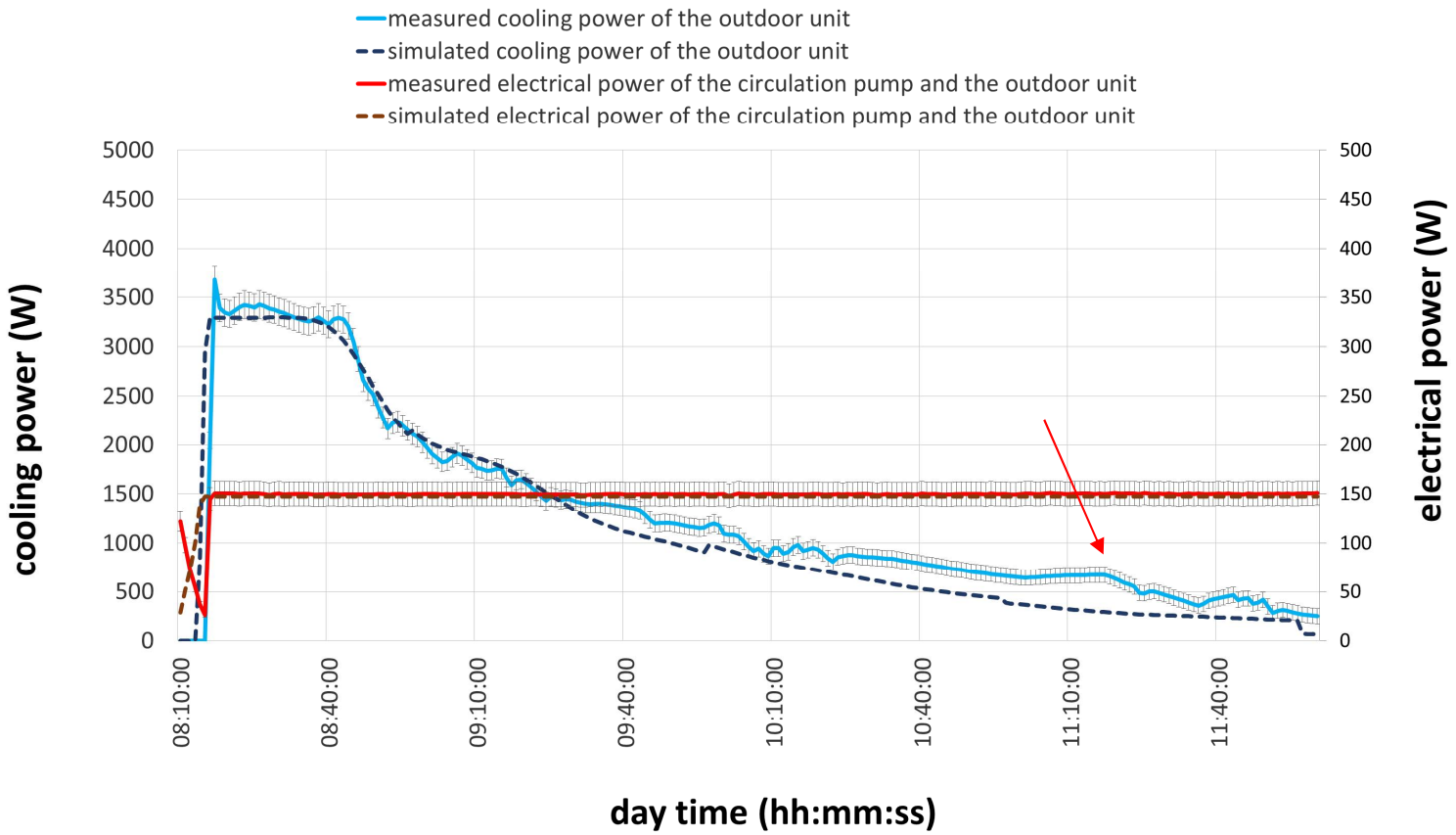
Polysun simulation «passive cooling»

- «free-cooling»



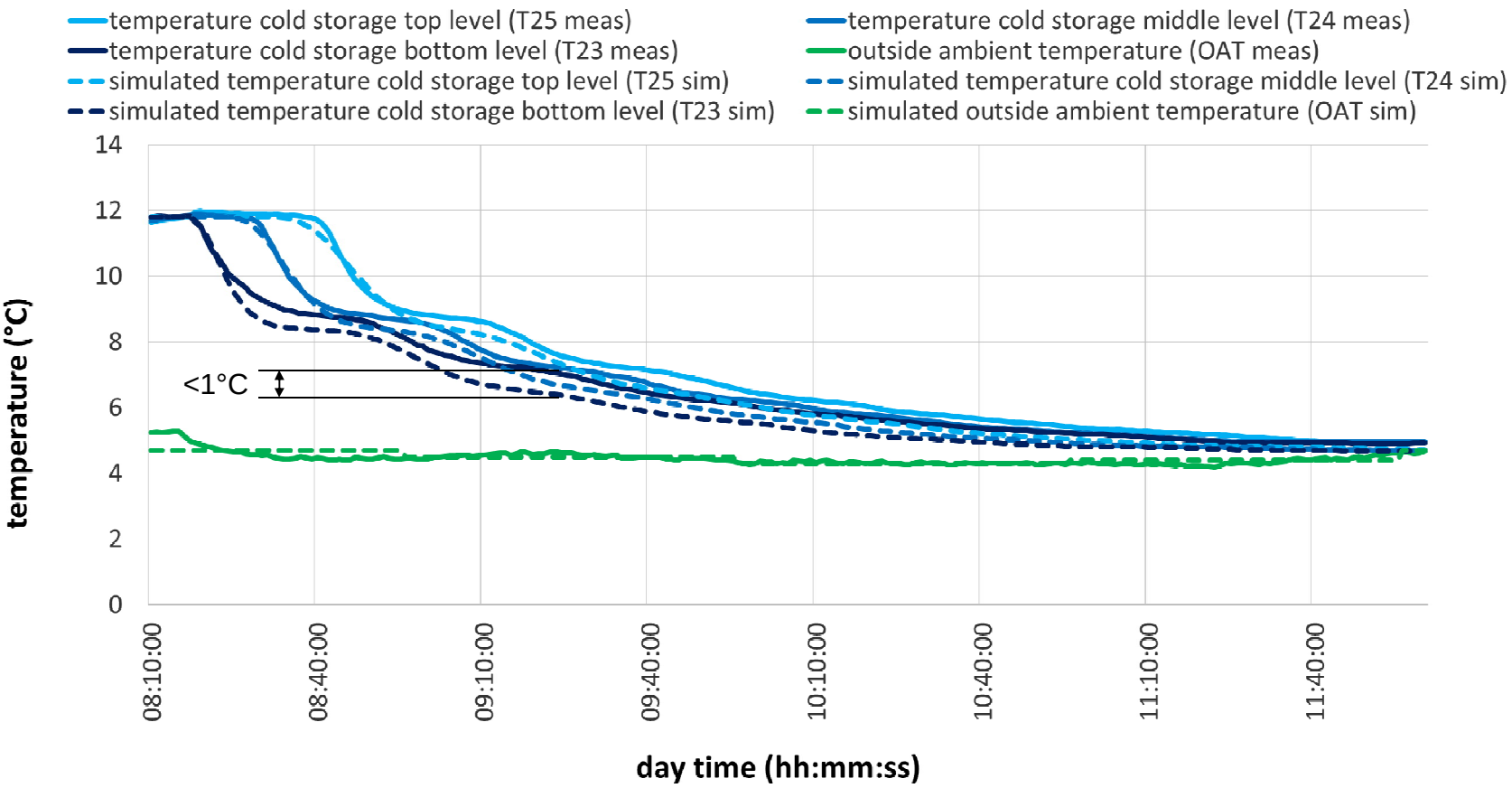
«free-cooling» results

- **Cold storage charging by “free-cooling”**



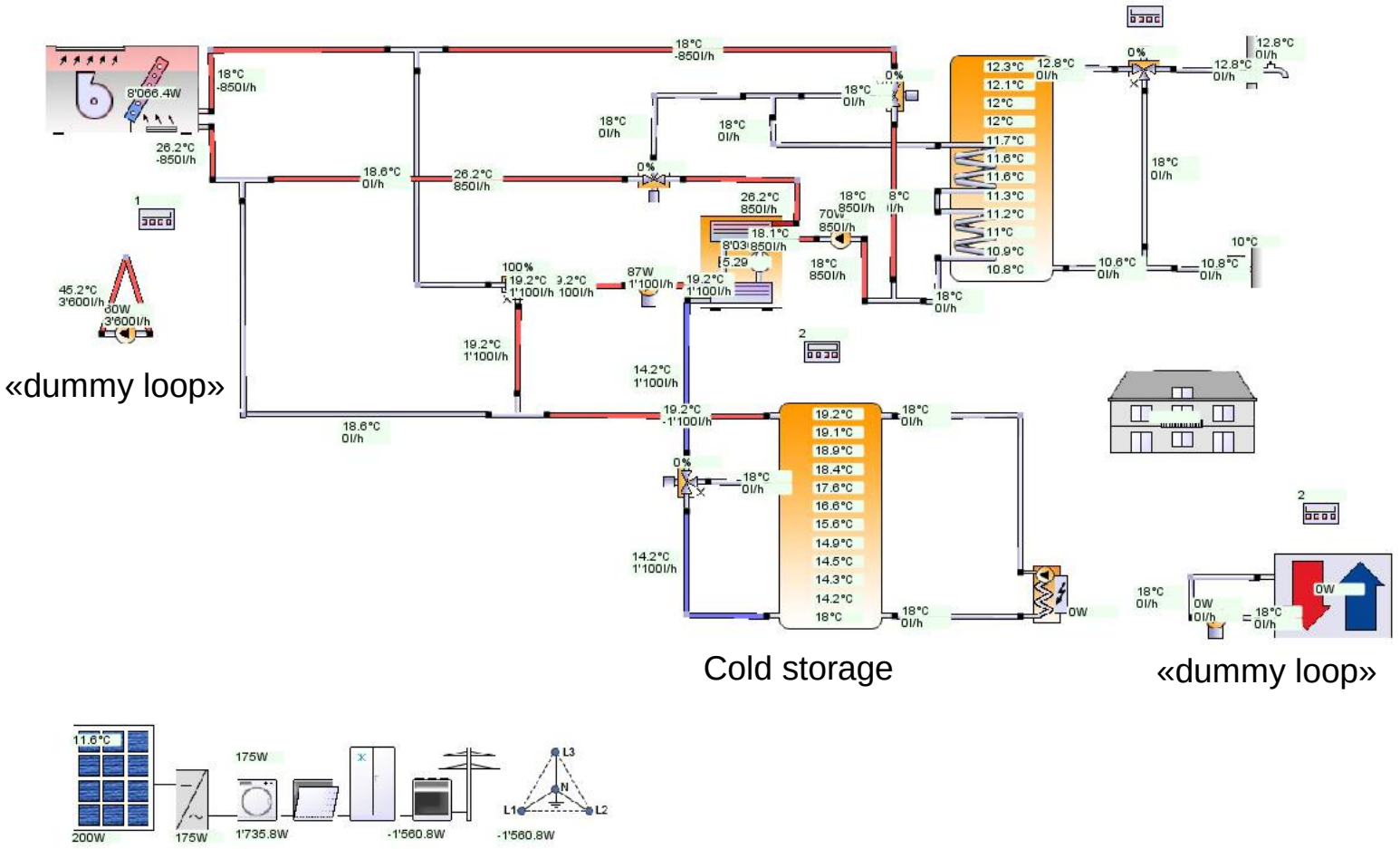
«free-cooling» results

Cold storage charging by “free-cooling”



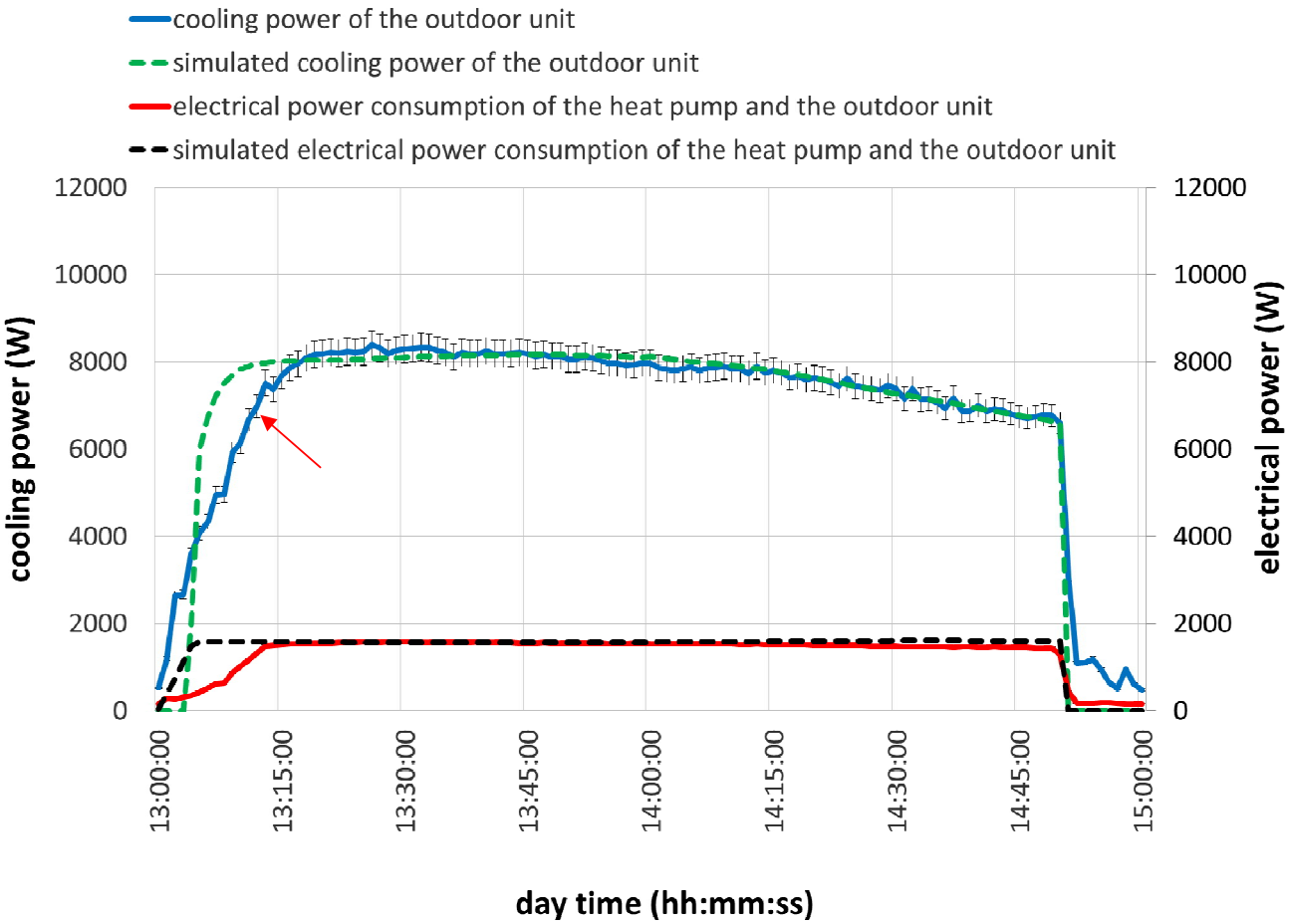
Polysun simulation «active cooling»

- **Cold storage charging with the cooling machine**



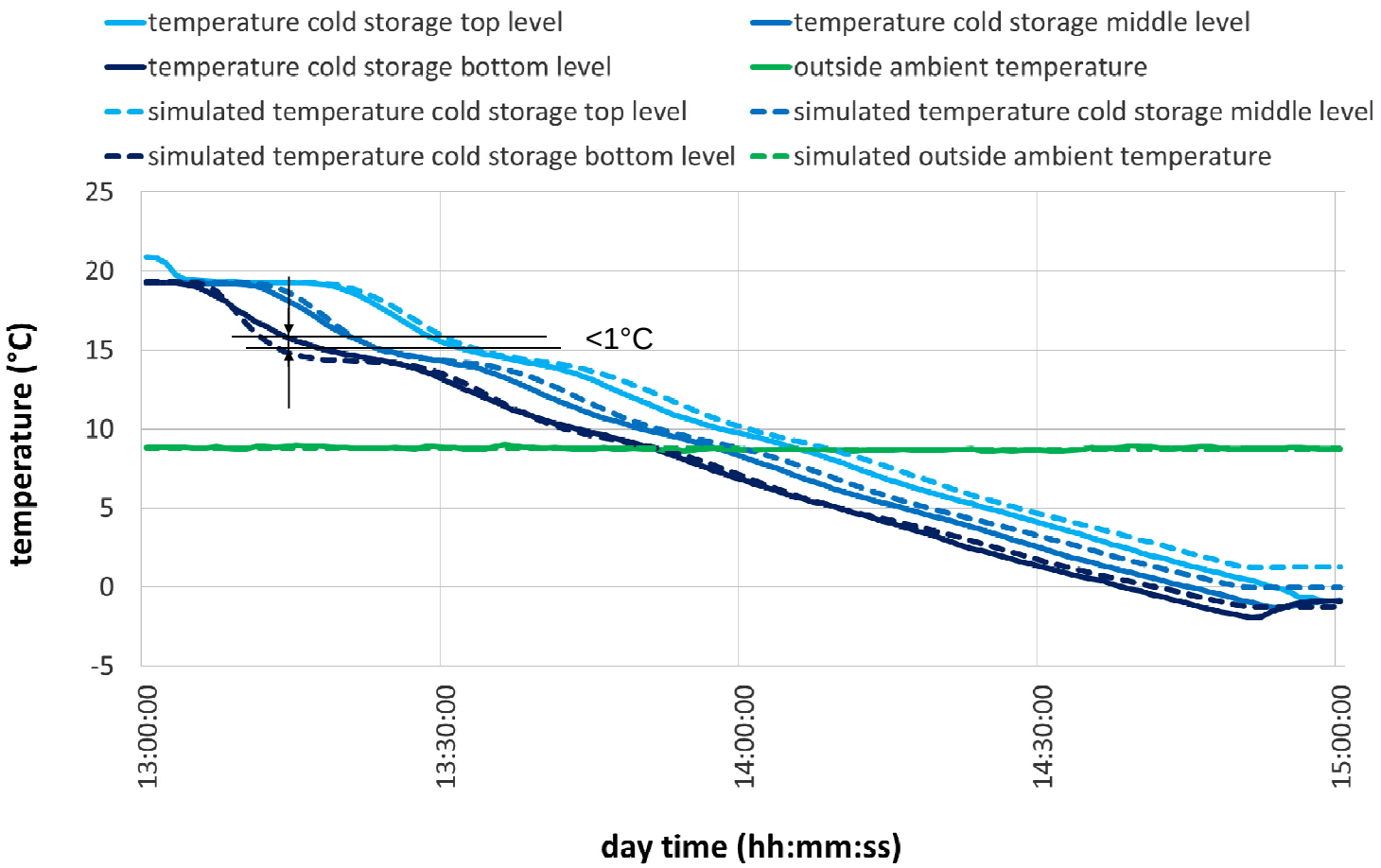
«active cooling» results

Cold storage charging with the cooling machine

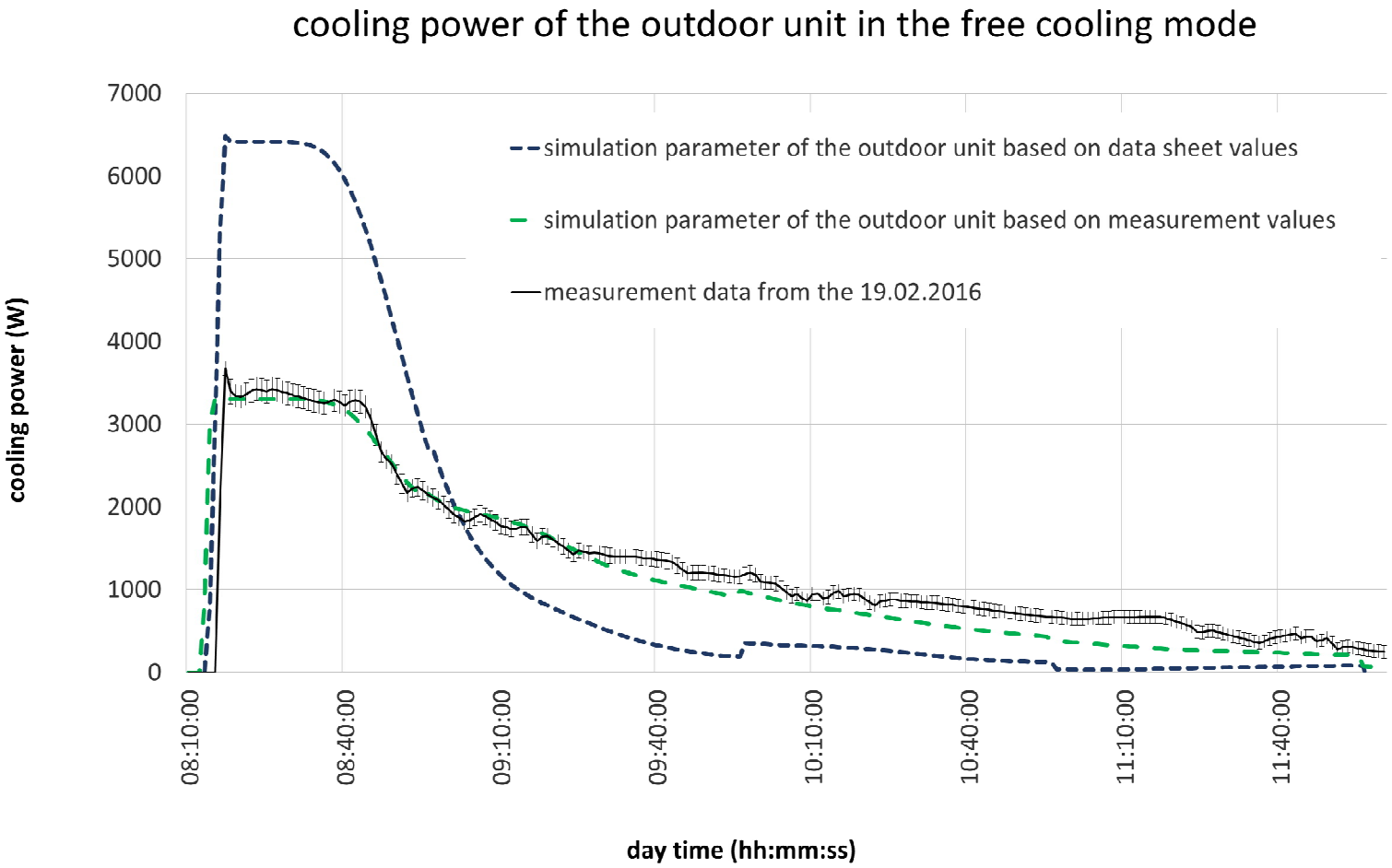


«active cooling» results

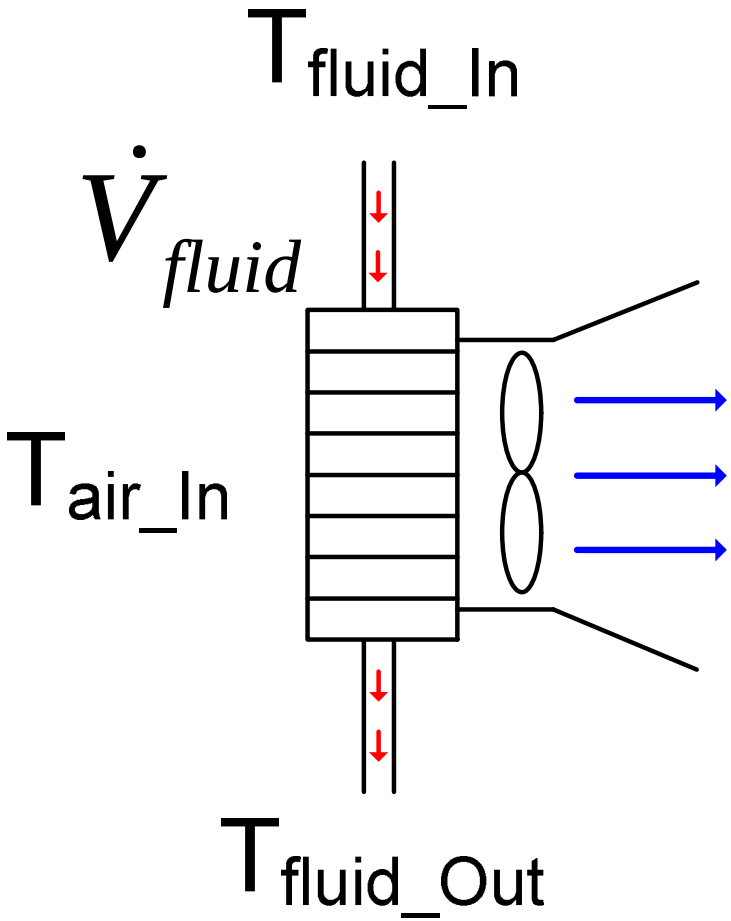
Cold storage charging with the cooling machine



Parametrisation of the outdoor unit



Parametrisation of the outdoor unit



Additional measurement

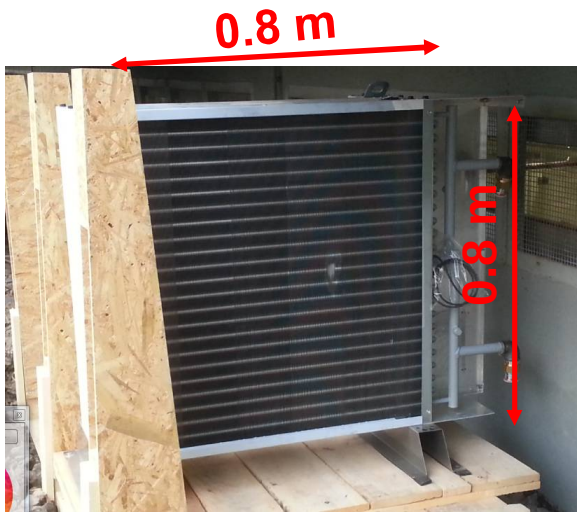
$\dot{V}_{air}$

T air_Out

calculation

Parametrisation of the outdoor unit

- **Measurement the air volume flow**



2.5	2.8	3.1	2.7	2.6
2.3	2.4	2.5	2.4	2.3
2.3	2.3	2.5	2.4	2.3
2.2	2.3	2.4	2.4	2.4

flow velocity (m/s)

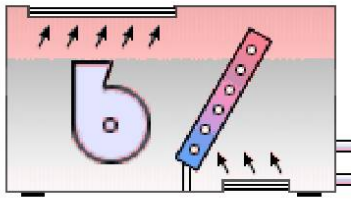
→ **1.57m³/s**

- **Calculation of T_{air_out}**

$$\dot{Q}_{fluid} = \dot{V}_{fluid} \cdot \rho_{fluid} \cdot c_{p\,fluid} \cdot (T_{fluid\_In} - T_{fluid\_Out})$$

$$\dot{Q}_{air} = \dot{Q}_{fluid}$$

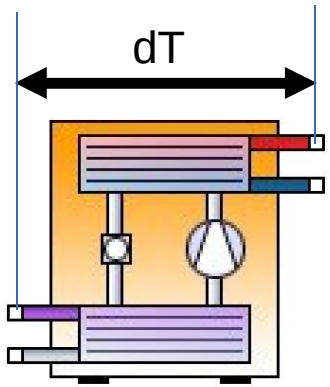
$$T_{air\_Out} = \frac{\dot{Q}_{air}}{\dot{V}_{air} \cdot \rho_{air} \cdot c_{p\,air}} + T_{air\_In})$$

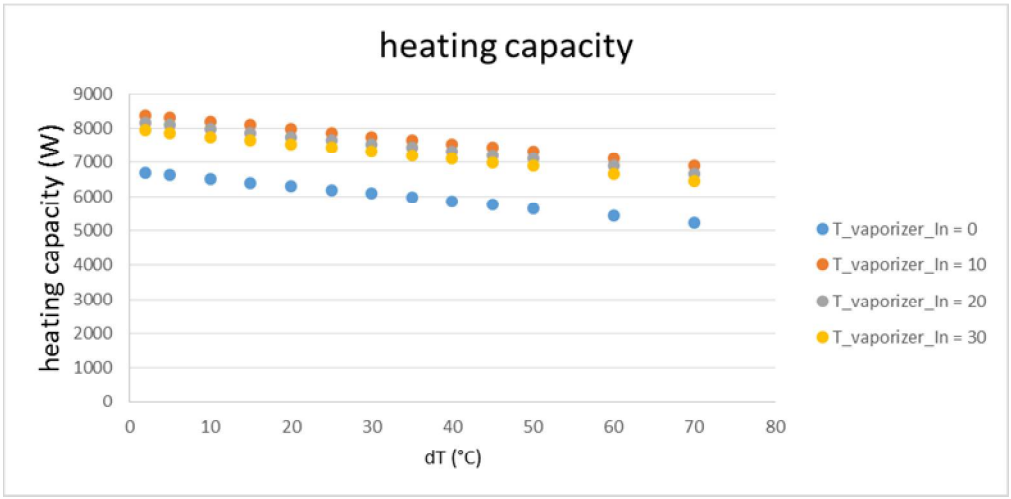


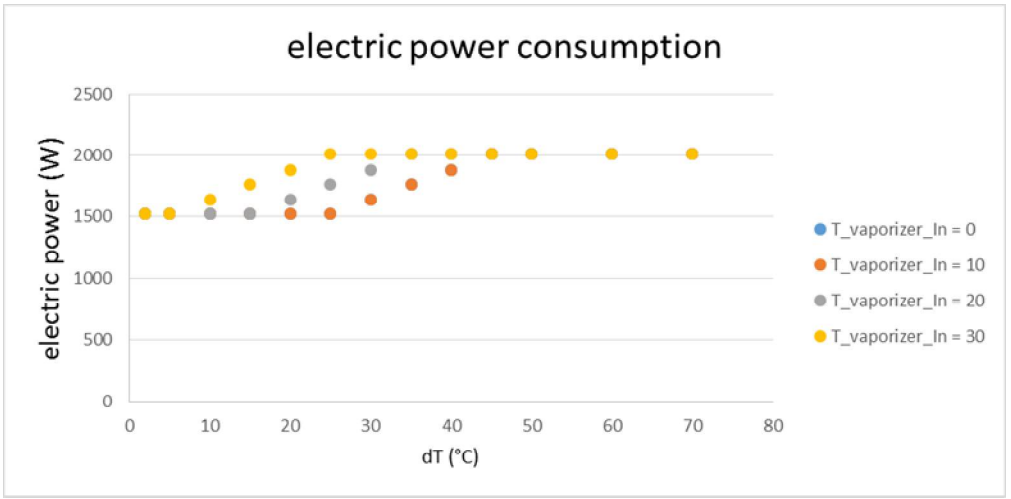
Parametrisation of the heat pump

- **Input file in csv format**

The raw data are from data sheet, and some linear interpolated values



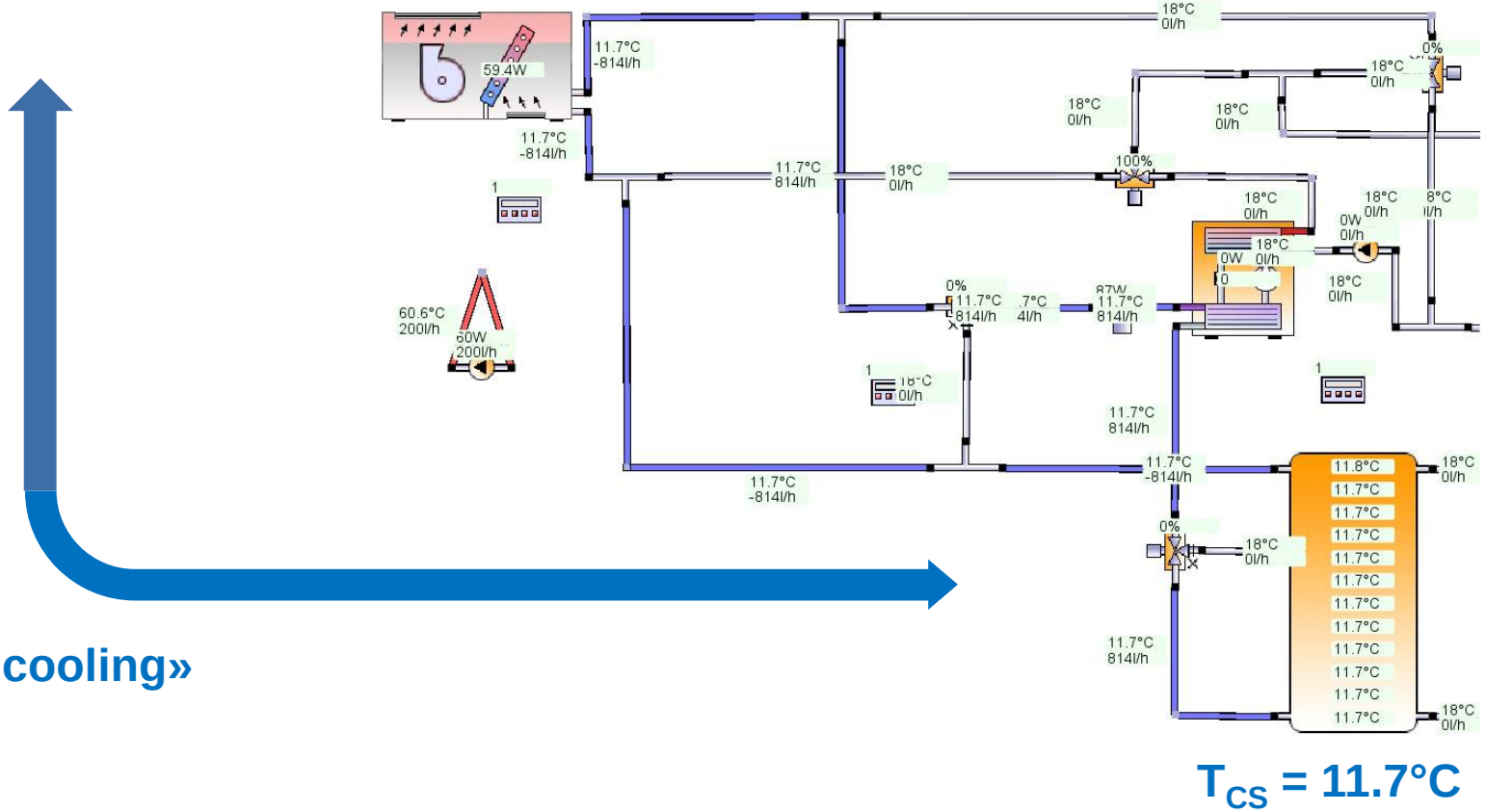




«Workaround» - preconditioning of the cold storage

- **Using the free-cooling mode for preconditioning the cold storage.**

Outside ambient temperature (OAT)
T_{amb} = 11.6°C



«free cooling»

T_{CS} = 11.7°C

Conclusion and Outlook

- **Summary and Outlook**

1. **Further test and measurements**
2. **Annual simulation with Polysun for different system configurations**
3. **Scaling up to systems of higher power - find the relevant parameters**

- **Partners**

Schweizerische Eidgenossenschaft
Confédération suisse
Confederazione Svizzera
Confederaziun svizra

NIBE

vela solaris

MEYER BURGER

zehnder

HARAPOL
SWISS MADE
FINEST SWISS OIL PRODUCTS