COOL-DOWN GÜSSING

Sustainable cooling concepts for existing buildings using the example of the municipality of Güssing

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GET

4ward Energy Research GmbH

FORSCHUNG Burgenland
RESEARCH & INNOVATION

JOKE SYSTEMS

O.K. ENERGIE HAUS

Reiterer & Scherling
Ingenieurbüro | Unternehmensberatung
Sicherheitsfachkraft

powered by klima+ energie fonds

FFG
Forschung wirkt.

Call for proposals: Smart Cities Demo - Living Urban Innovation 2019

Project duration: 42 months (04/20 – 09/23)

Project partners:

- Güssing Energy Technologies GmbH
- 4ward Energy Research GmbH
- Forschung Burgenland GmbH
- Joke-Systems GmbH
- O.K. Energie Haus GmbH
- Reiterer & Scherling GmbH

DEFINITION OF THE PROBLEM

- The municipality of Güssing (like many other cities) is **strongly affected** by summer overheating
- Increased number of hot days → When temperatures are too high, the **quality of living** and working drops significantly
- Sharp increase in **energy requirements** for room cooling and air conditioning
- Later cooling measures are **difficult to implement**

Three commercial buildings, three residential buildings and three public buildings were inspected in detail as part of the project

- Guttomat (garage door manufacturer)

- Vulcolor Naturfarben (produces natural colors for the food industry)
- Autohaus Doczekal

- Detached house Doczekal

- Detached house Scher-Deutsch

- Residential buildings Krottendorf

- BORG Güssing

- Kindergarden

- Fire station

AVOIDANCE OF HEAT INPUT

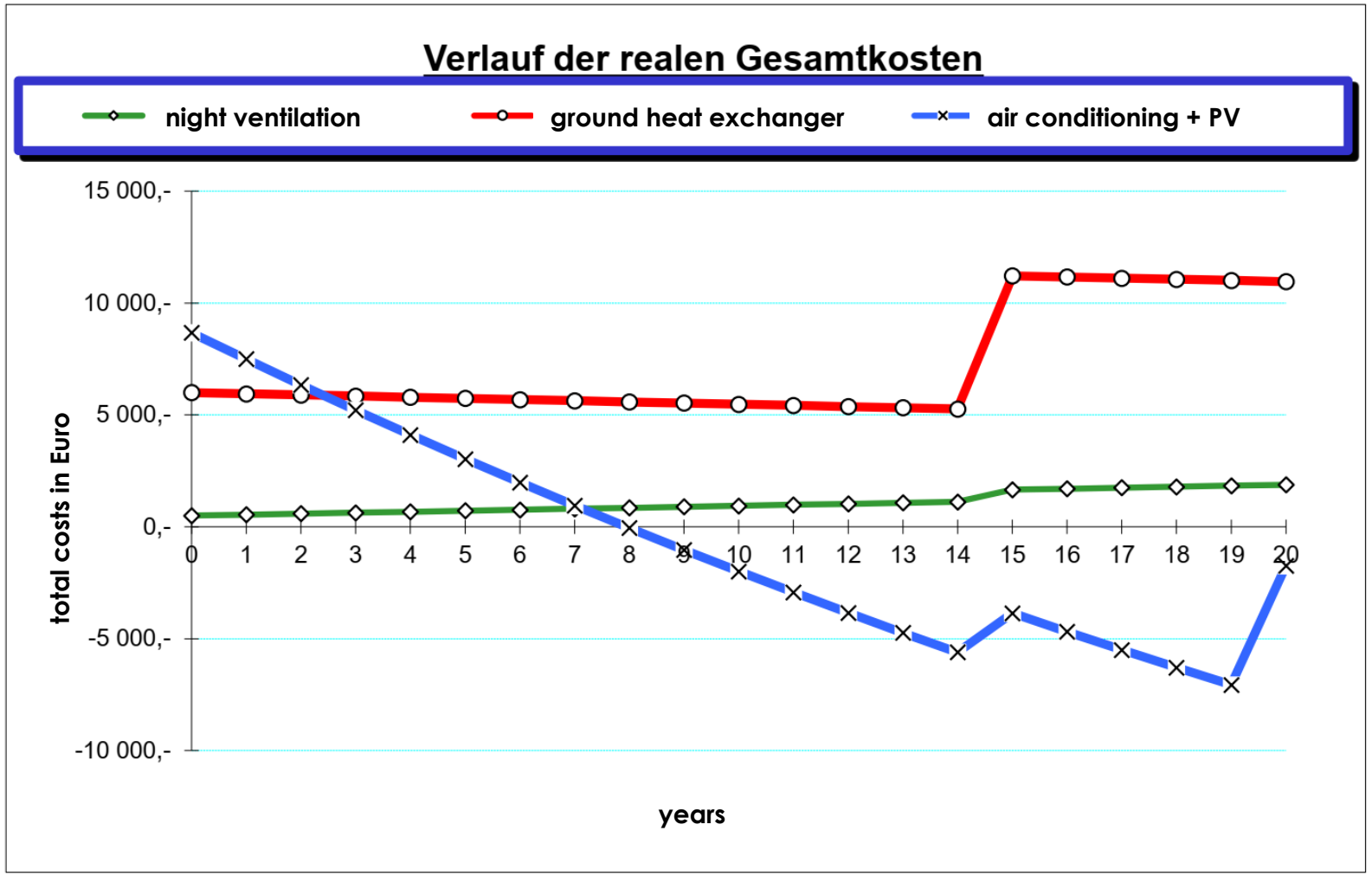
- Sun protection
  - unavailable
  - not sufficient
  - used incorrectly

- Detached house
  - Wooden frame construction
  - Year of construction 2019
  - External blinds with servomotors
  - Controlled ventilation device

Detached house

- Variant 1: Partially automated night ventilation
- Variant 2: Supplementing the controlled ventilation device with a ground heat exchanger
- Variant 3: Split air conditioning unit 3 kW and PV system 5 kWp

Detached house



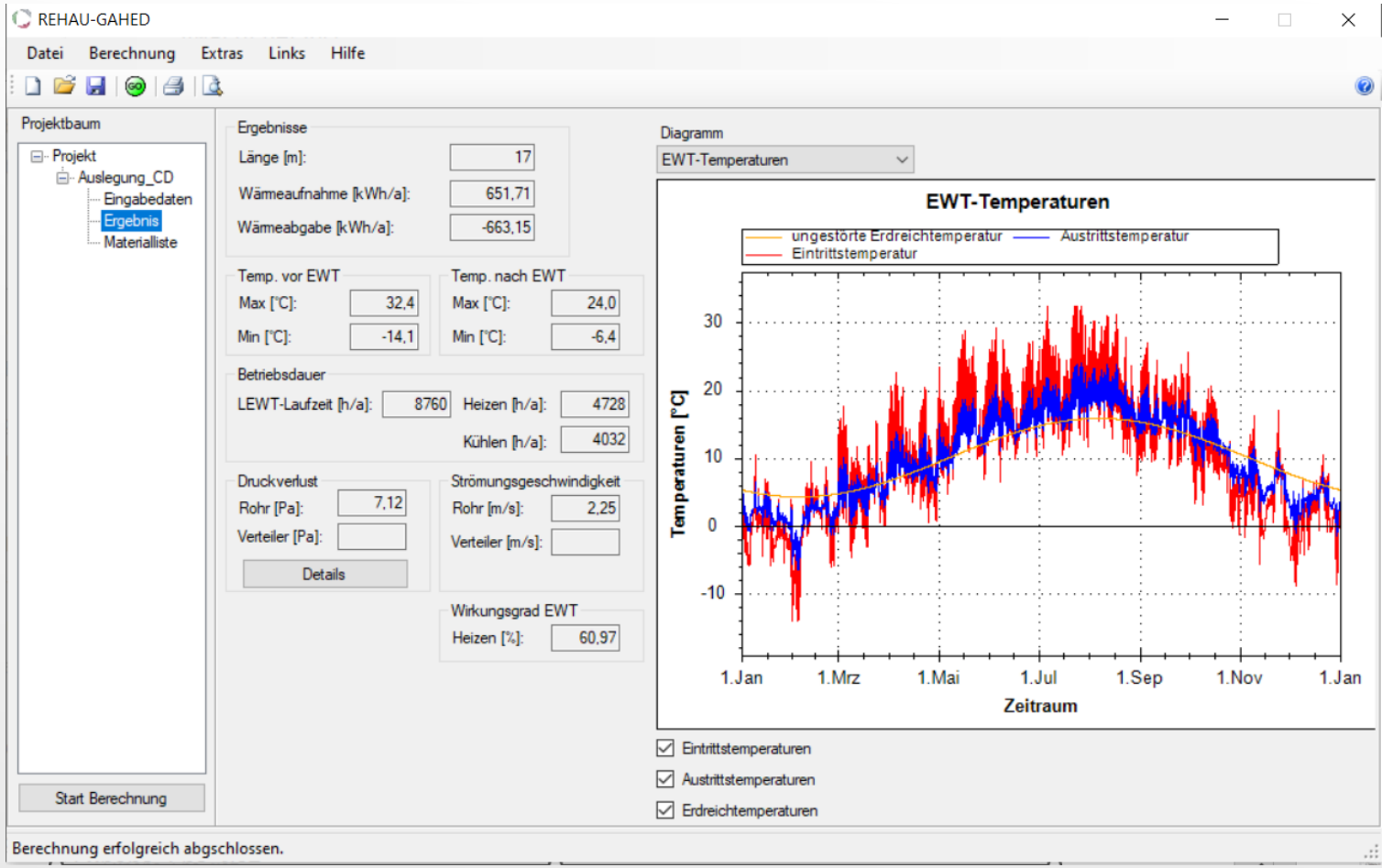
Detached house, assessment according to the AHP method

Bewertungskriterium	Priorität	Klimasplitgerät 3 kW + PV 5 kWp		Teilautomatisierte Nachtlüfung		Erdwärmetauscher zur Vorkühlung	
		Rating	Gewicht	Rating	Gewicht	Rating	Gewicht
Ökologische Aspekte	4.3%	3	0.13	5	0.22	3	0.13
Technische Aspekte	5.2%	4	0.21	4	0.21	2	0.10
Herstellungskosten	11.6%	2	0.23	4	0.46	2	0.23
Betriebskosten	17.5%	4	0.70	5	0.88	4	0.70
Kühleffekt	24.1%	5	1.21	3	0.72	3	0.72
Umgebungseinfluss	3.3%	4	0.13	4	0.13	4	0.13
Umsetzungswahr-scheinlichkeit	34.0%	4	1.36	5	1.70	3	1.02
Gesamtbewertung	100.0%		3.97		4.32		3.04

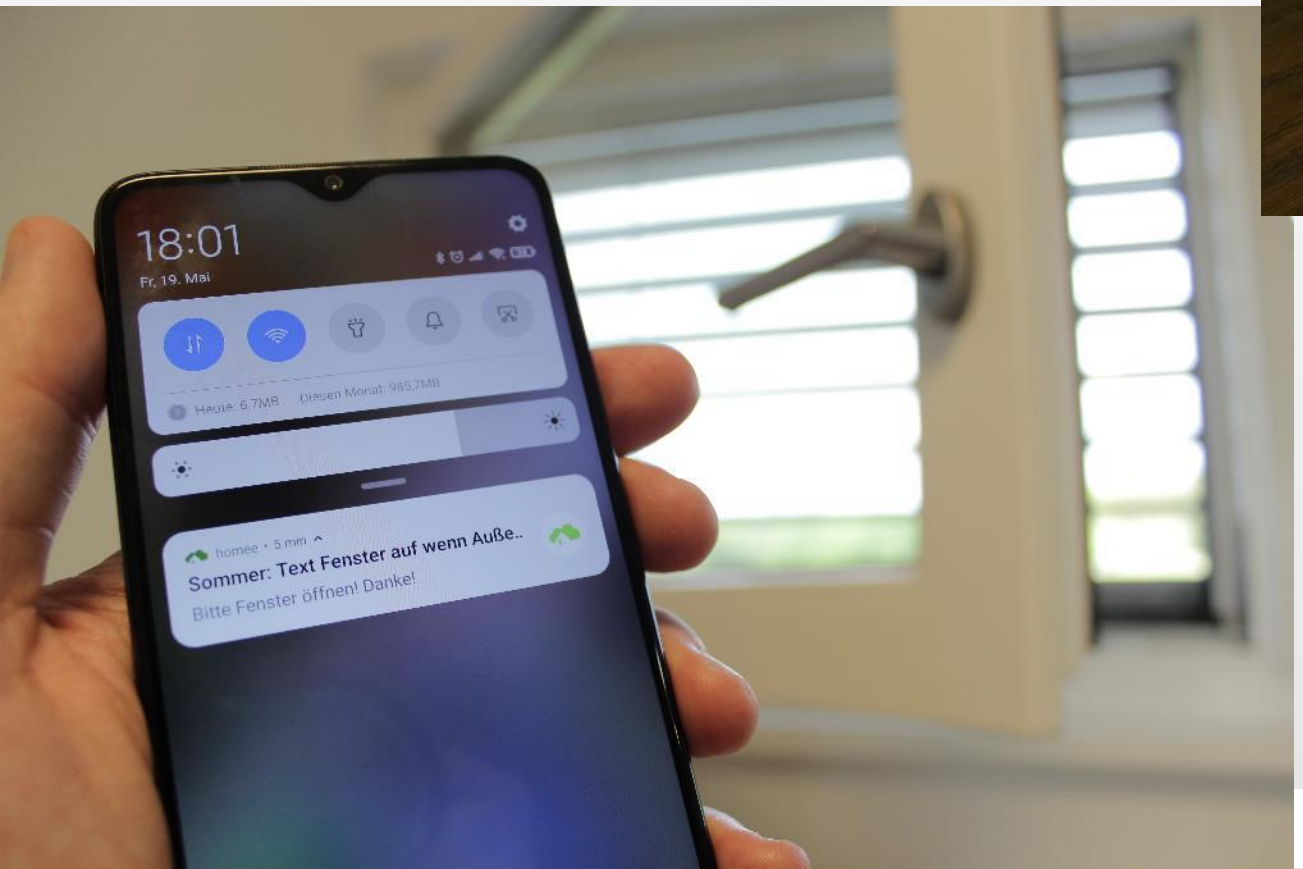
AHP-Method (Analytic Hierarchy Process)

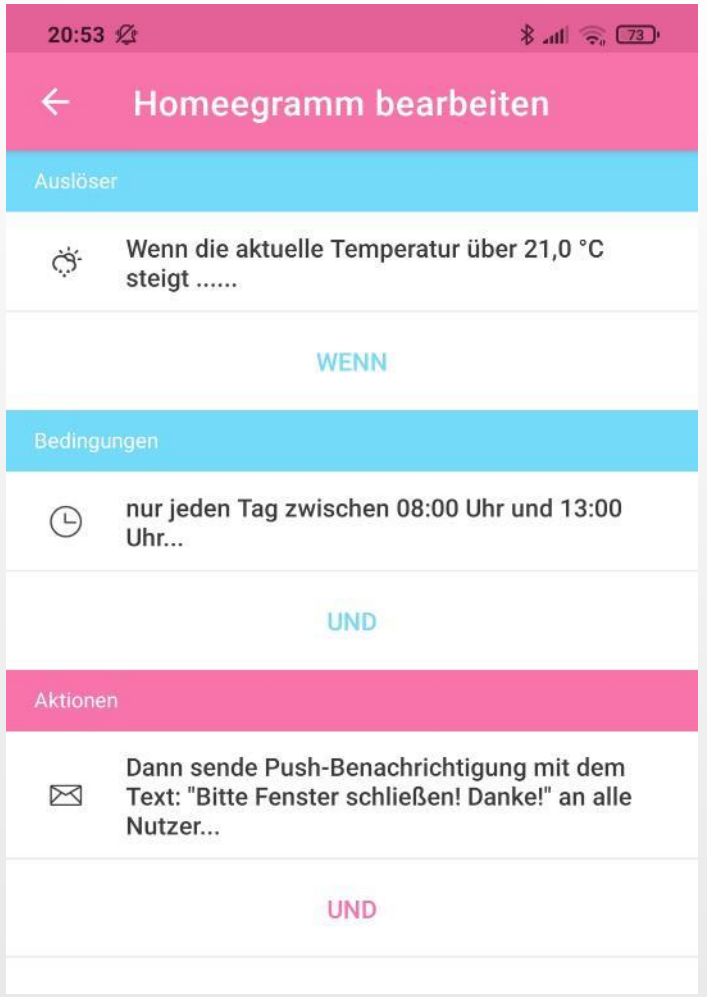
- Multi-criteria decision making method
- Economic, ecological, technical aspects; cooling effect; environmental influence; probability of implementation

- Air-flowing ground heat exchanger for controlled ventilation
  - + cooler air is brought into the building
  - + approx. 10 to 15% savings in heating and cooling energy
  - - no dehumidification possible
  - - Pay attention to hygiene
  - - Retrofitting is complex
- 17 m ventilation pipe in the ground
- Air inlet 32.4 °C → outlet 24 °C

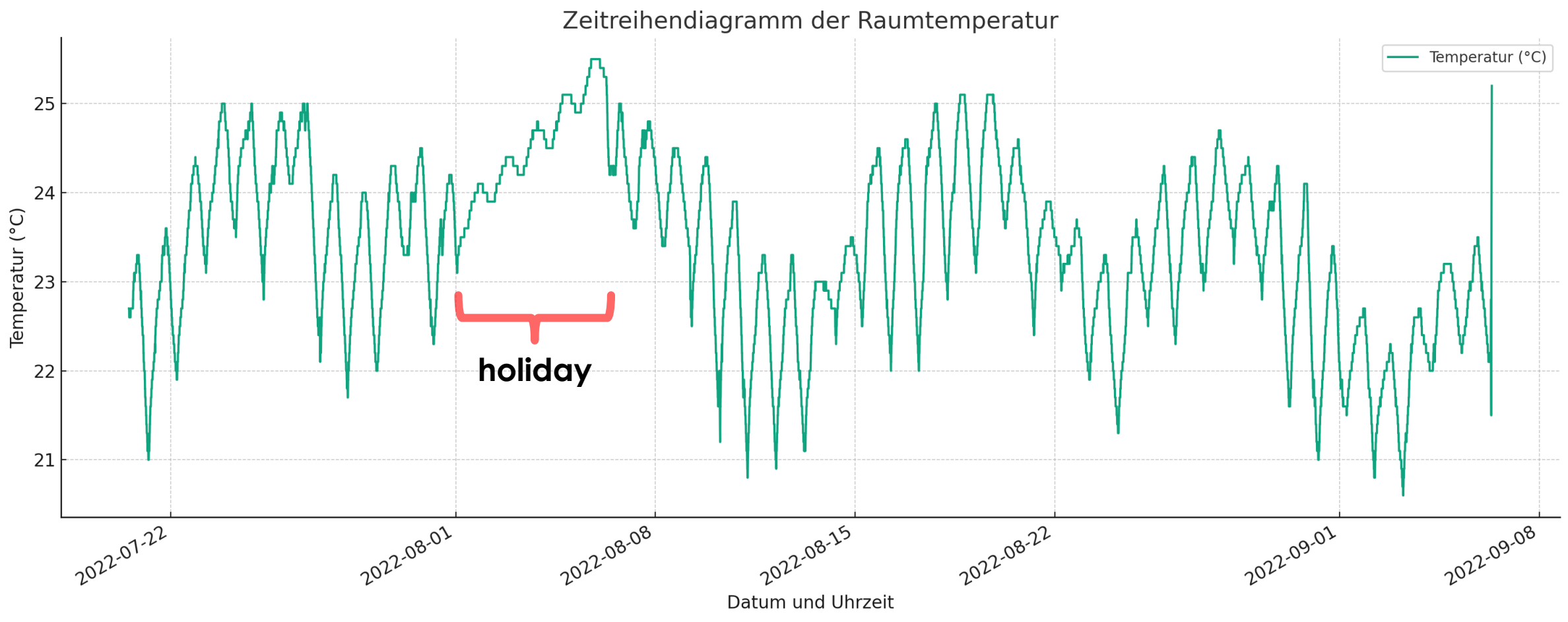


- Partially automated night ventilation
  - Push notification to your smart phone
  - manual opening/closing of windows,…

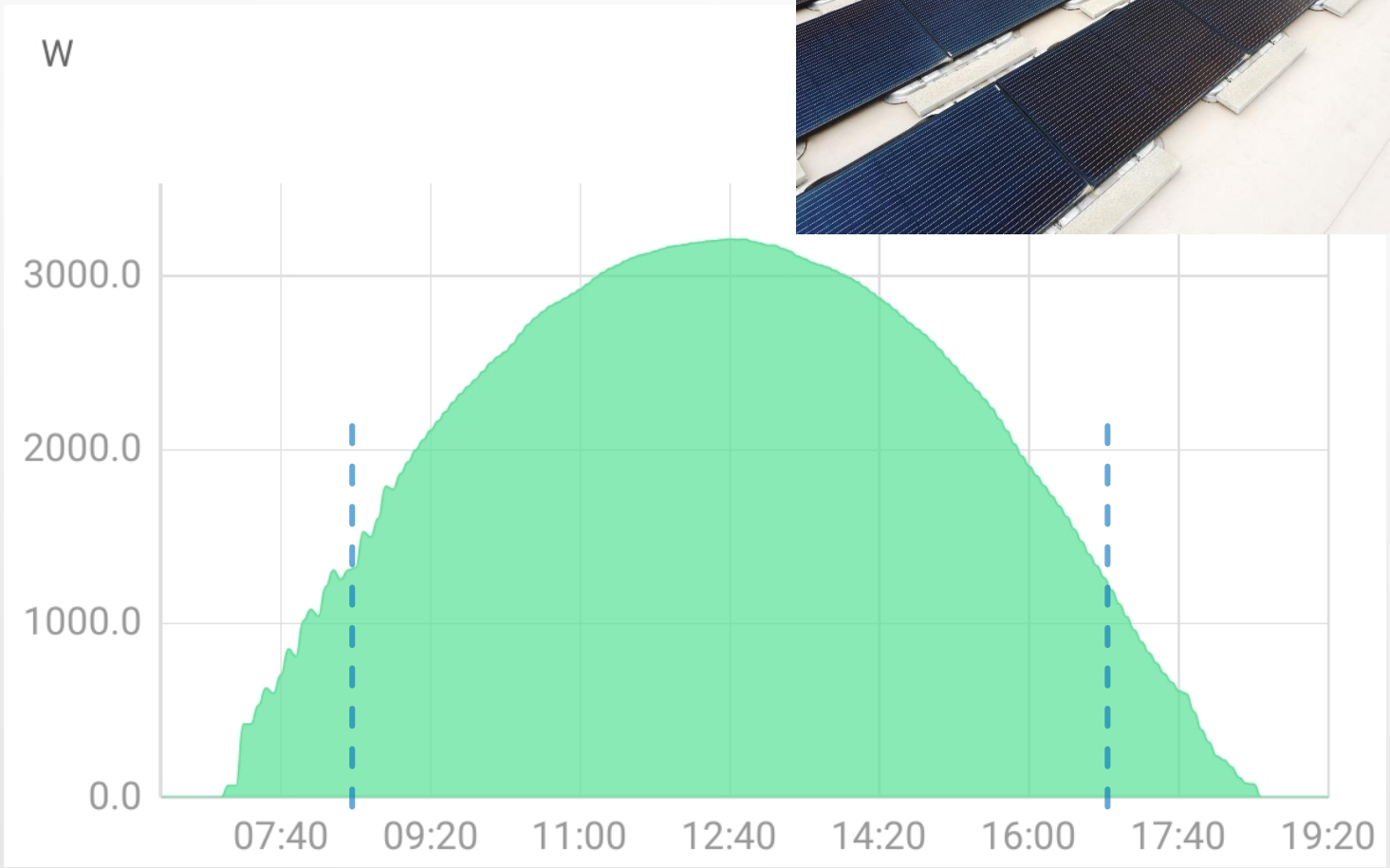




- Partially automated night ventilation
  - measurements in summer 2022



- Why in combination with PV?
  - Use PV electricity yourself
- Air conditioning split unit operating times?
  - 9 a.m. to max. 5 p.m. with your own PV electricity is usually possible
  - What after?
  - Timer, or remote operation via APP
  - or energy manager with “Smart Grid” interface

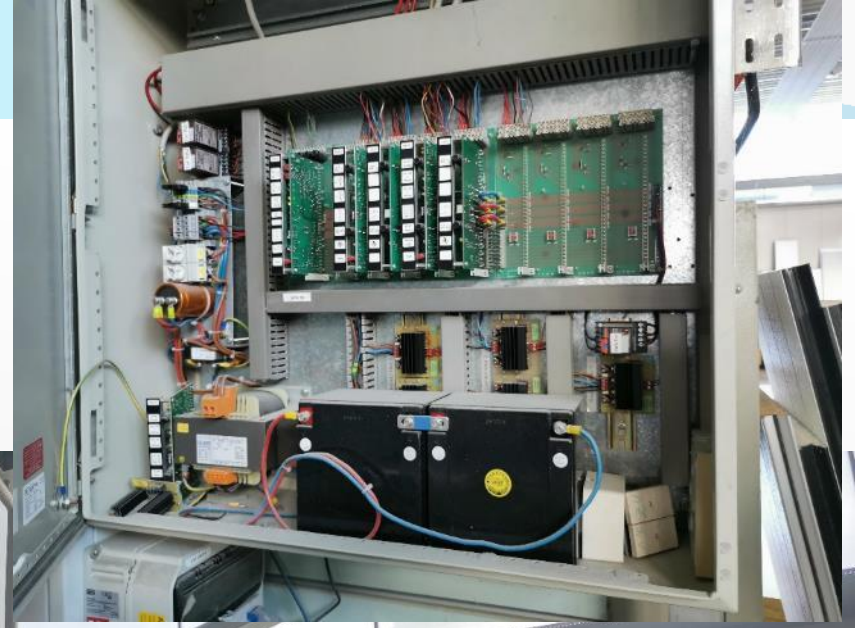


- Evaluation of air conditioning and PV

	2022	2023
Numbers of days	7	9
Operating hours	17,5 h	16,5 h
Air conditioning power needs	11 kWh	13 kWh
Coverage via PV	82 %	91 %

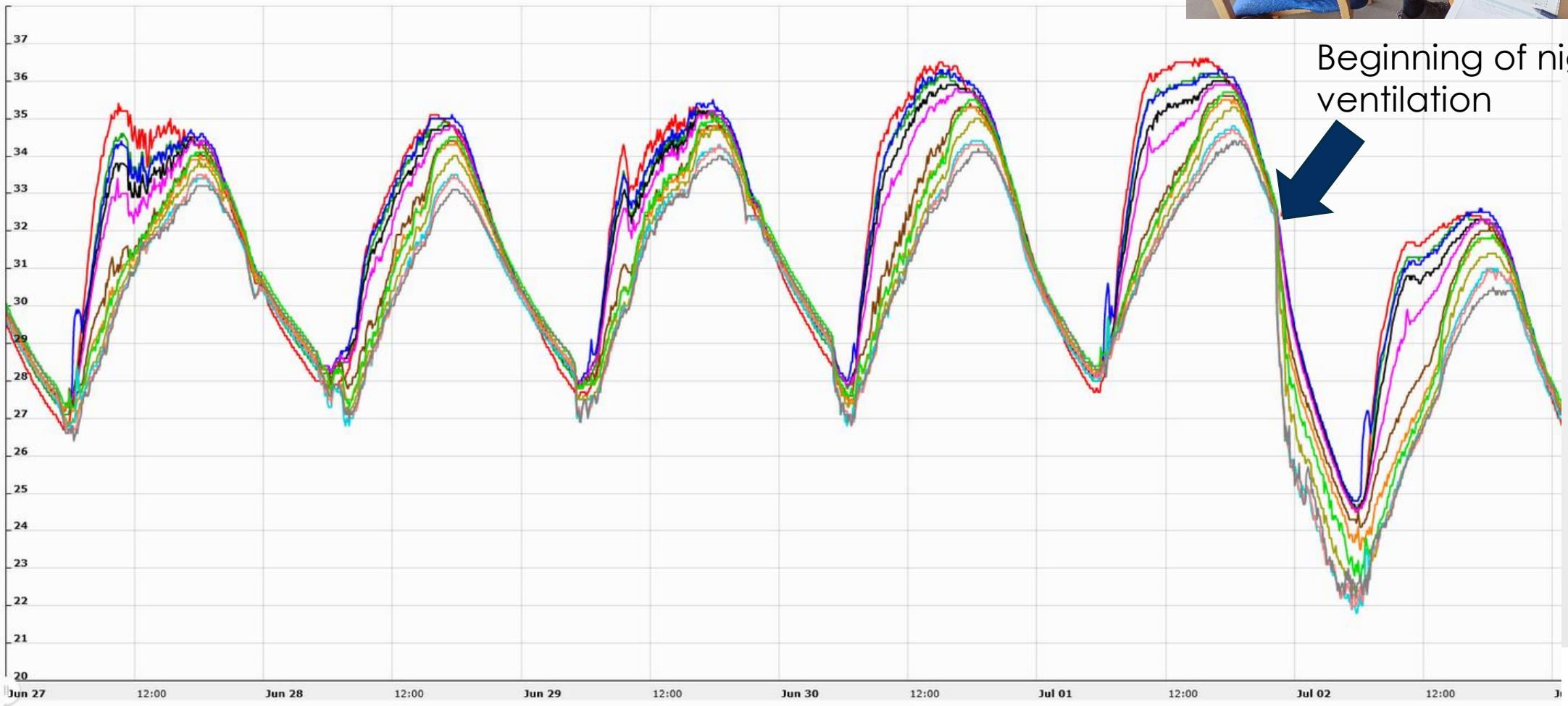
TECHNOLOGIES AND DEMO SITES

- Company Guttomat
  - Night ventilation via the existing fire smoke ventilation flaps
  - 21 flaps
  - Wind, rain sensor
  - Control with timer and indoor/outdoor temperature sensor
  - - depending on the night temperature outside
  - - no dehumidification, no active cooling during the day
  - + low operating costs, ecological
  - + no unpleasant drafts during the day
  - + increased employee productivity, reduced risk of accidents



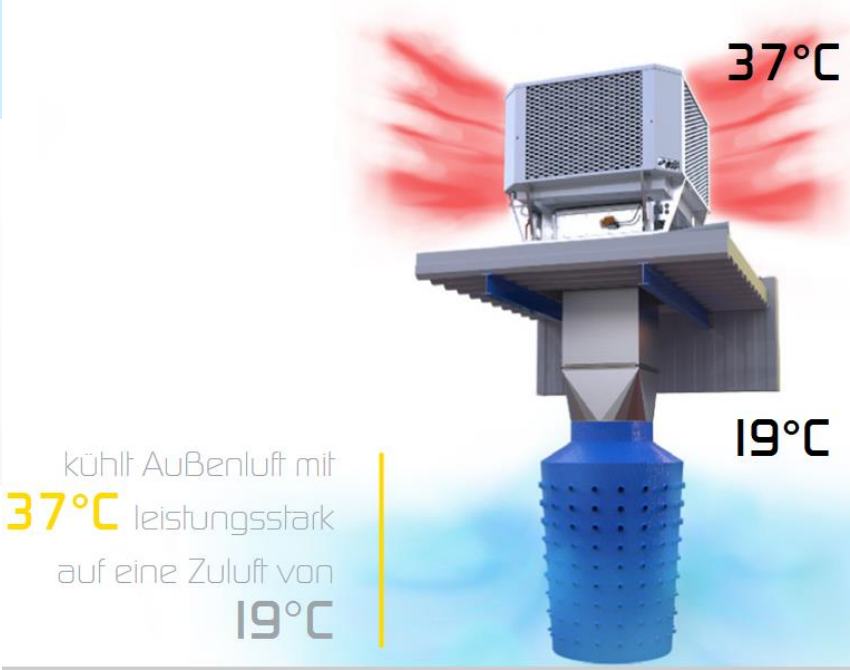
TECHNOLOGIES AND DEMO SITES

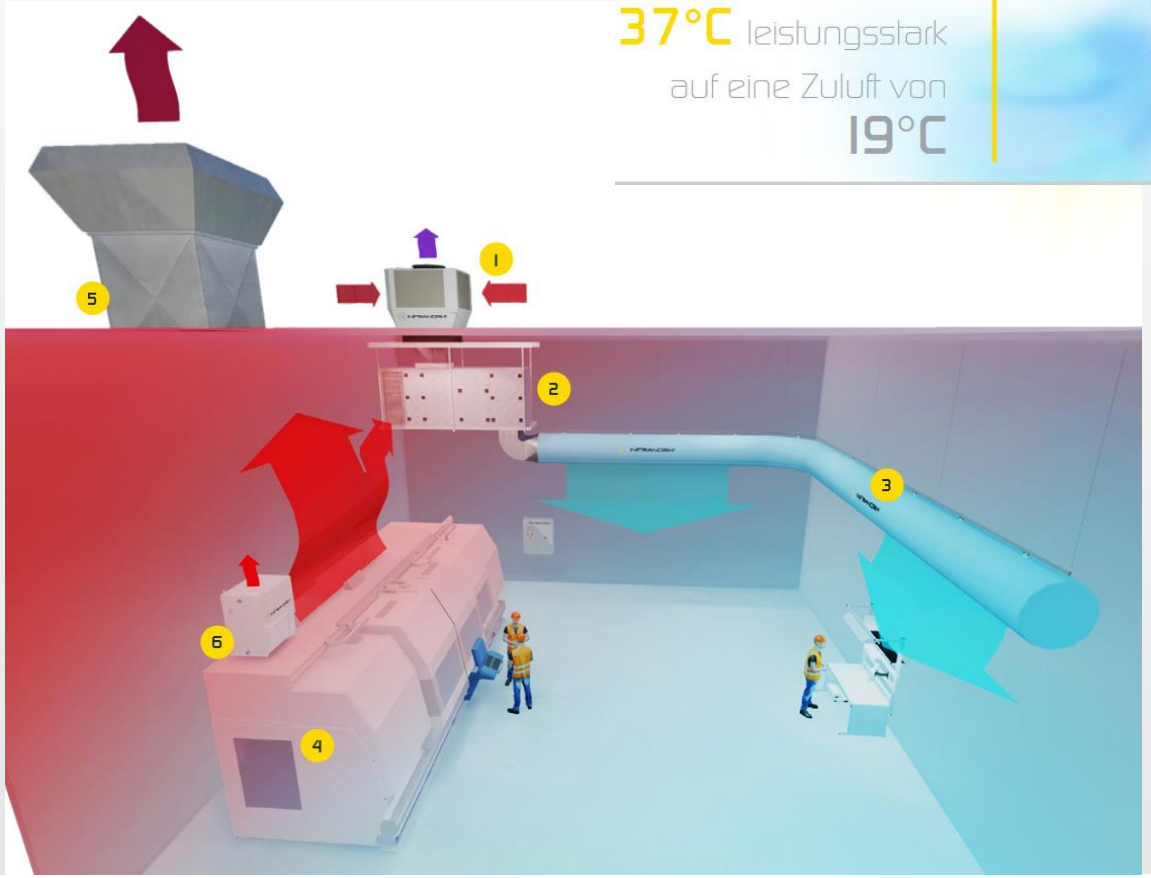
- Guttomat
  - Temperature reduction through night ventilation is clearly visible!
  - Early: 22 °C instead of 27 °C
  - Midday: 27 °C instead of 31 °C



TECHNOLOGIES AND DEMO SITES

- Adiabatic cooling
  - cools efficiently with water
  - saves 90% CO2 and 80% operating costs
  - Textile air hoses



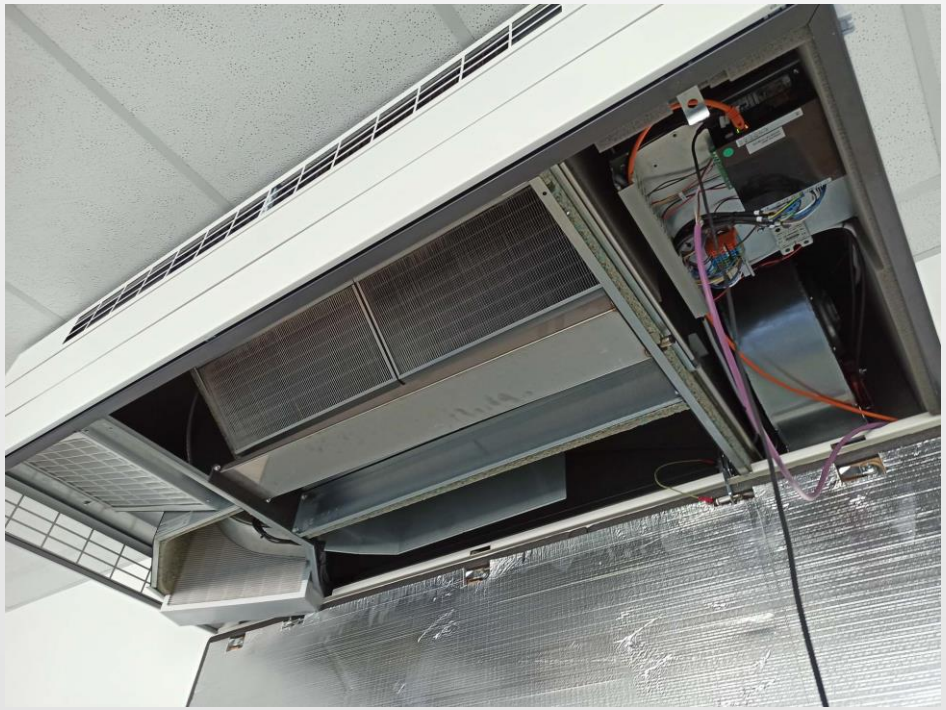


- Adiabatic cooling
  - Simple calculation/simulation of company buildings/halls
  - Statements about comfort
  - e.g. www.infranorm.com
  - https://www.youtube.com/watch?v=p_y4MsHQol4

Rahmen-/ Simulationsparameter	
Interne Wärmelast:	150 kW
Wärmelast solar max.:	17,6 kW bei 36 °C
Wärmelast solar min.:	14,4 kW bei 18 °C
Berechnungsjahr:	2015
Wetterdatenstandort:	Linz
max. Raumluftfeuchte:	65 %
min. Hallentemperatur:	25,0 °C
min. Zulufttemperatur:	18,0 °C
Anzahl Einheiten:	3 Stk.
CO_2-Faktor Strom:	0,258 kg/kWh
CO_2-Faktor Wasser:	0 kg/m³
Strompreis:	0,15 €/kWh
Wasserpreis:	2,00 €/m³
Leitwert Wasser:	500 µS/cm

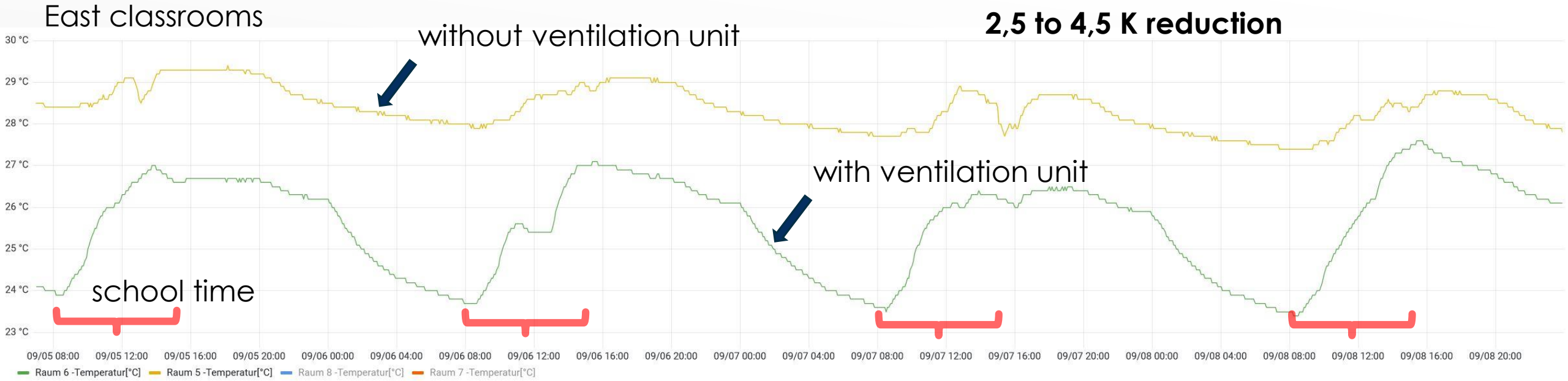
Berechnete Werte für die adiabate Kühlperiode		
Betrieb (adiabat):	1 939 h/a	
Wasserverbrauch:	567 m³/a	1135 €/a
Betriebskosten:	-80 %	-12743 €/a
CO_2:	-87 %	-24 to/a
max. Frischluftmenge:	42 000 m³/h	
max. rel. Hallenluftfeuchte:	61 %	
Behaglichkeit		
unbehaglich kühl	0 h	0,0%
etwas zu kühl	4 h	0,2%
komfortabel	1 922 h	99,1%
etwas zu warm	10 h	0,5%
unbehaglich warm	0 h	0,0%

- School
  - decentralized ventilation unit
  - 800 m³/h for night ventilation
  - incl. heat recovery for winter

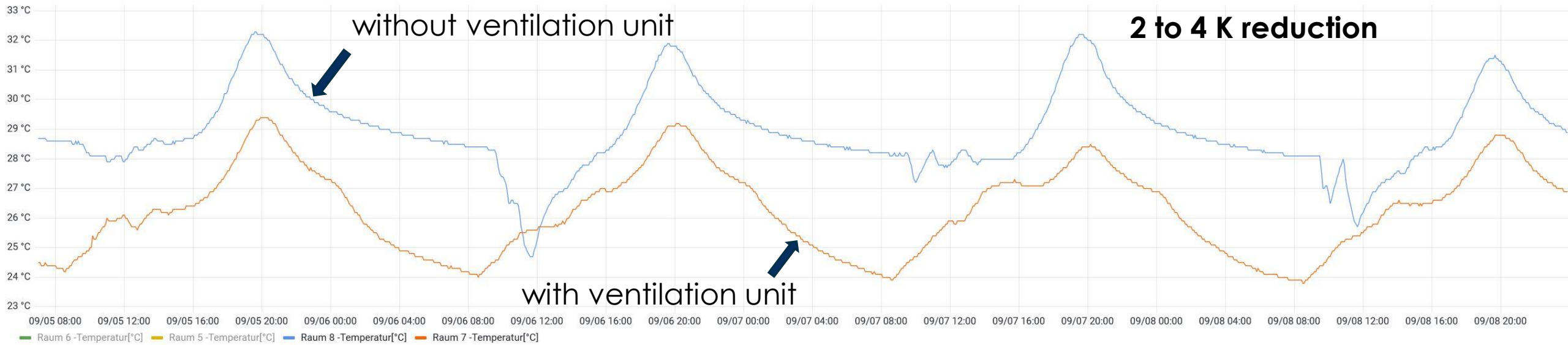


TECHNOLOGIES AND DEMO SITES

East classrooms

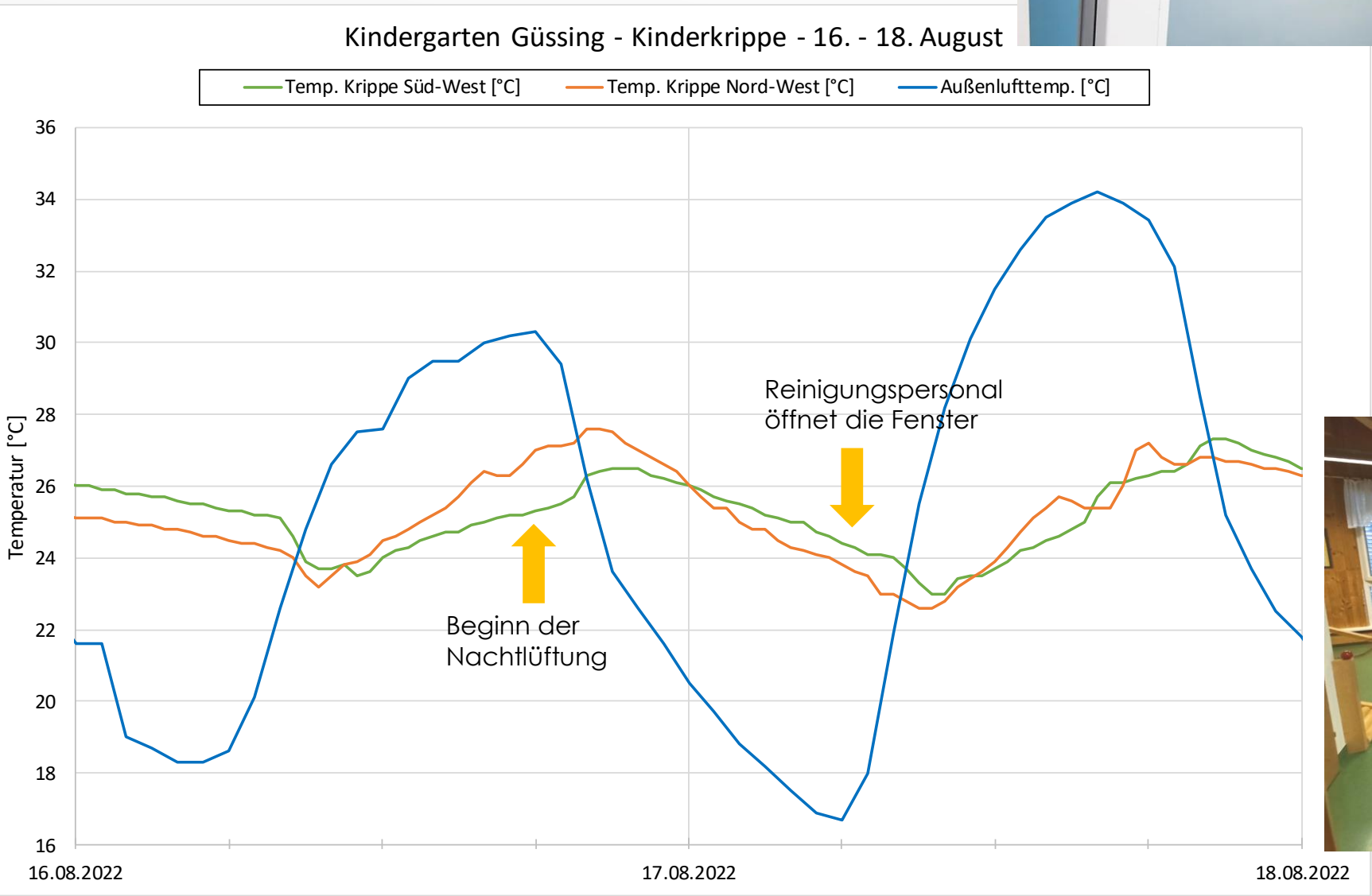


West classrooms



TECHNOLOGIES AND DEMO SITES

- Night ventilation via windows
- tested manually
- at the moment installation to get motorized



CONTACT

Project website https://smartcities.at/projects/cool-down-guessing/

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