# COOL-DOWN GÜSSING

Urban Overheating: Innovative Interventions in Güssing

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

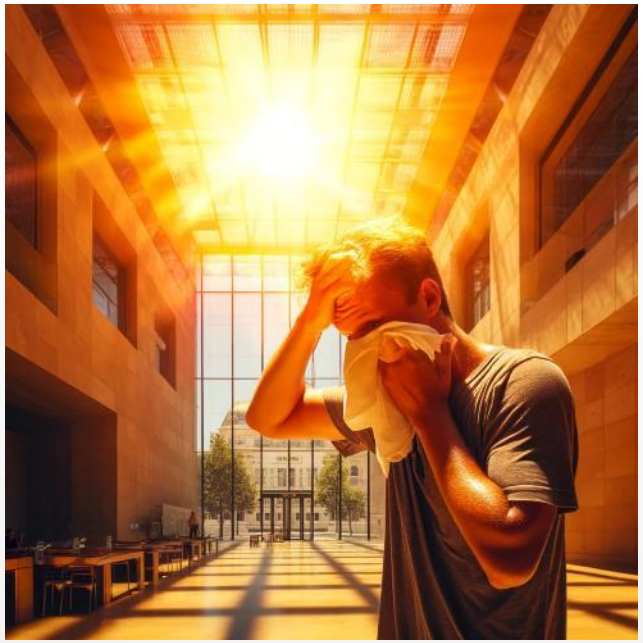
Project duration: 42 months (04/20 – 09/23)

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**



# DEMOSITES

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

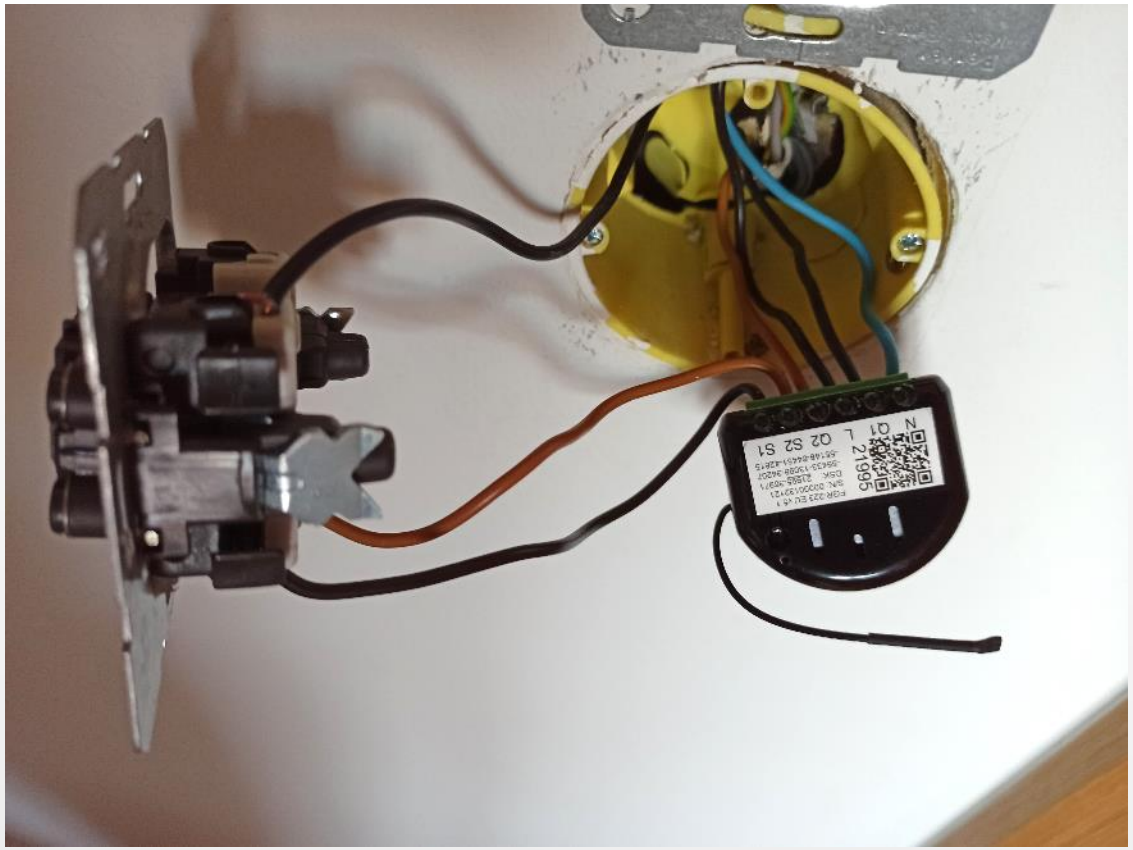
- Kindergarden

- Fire station

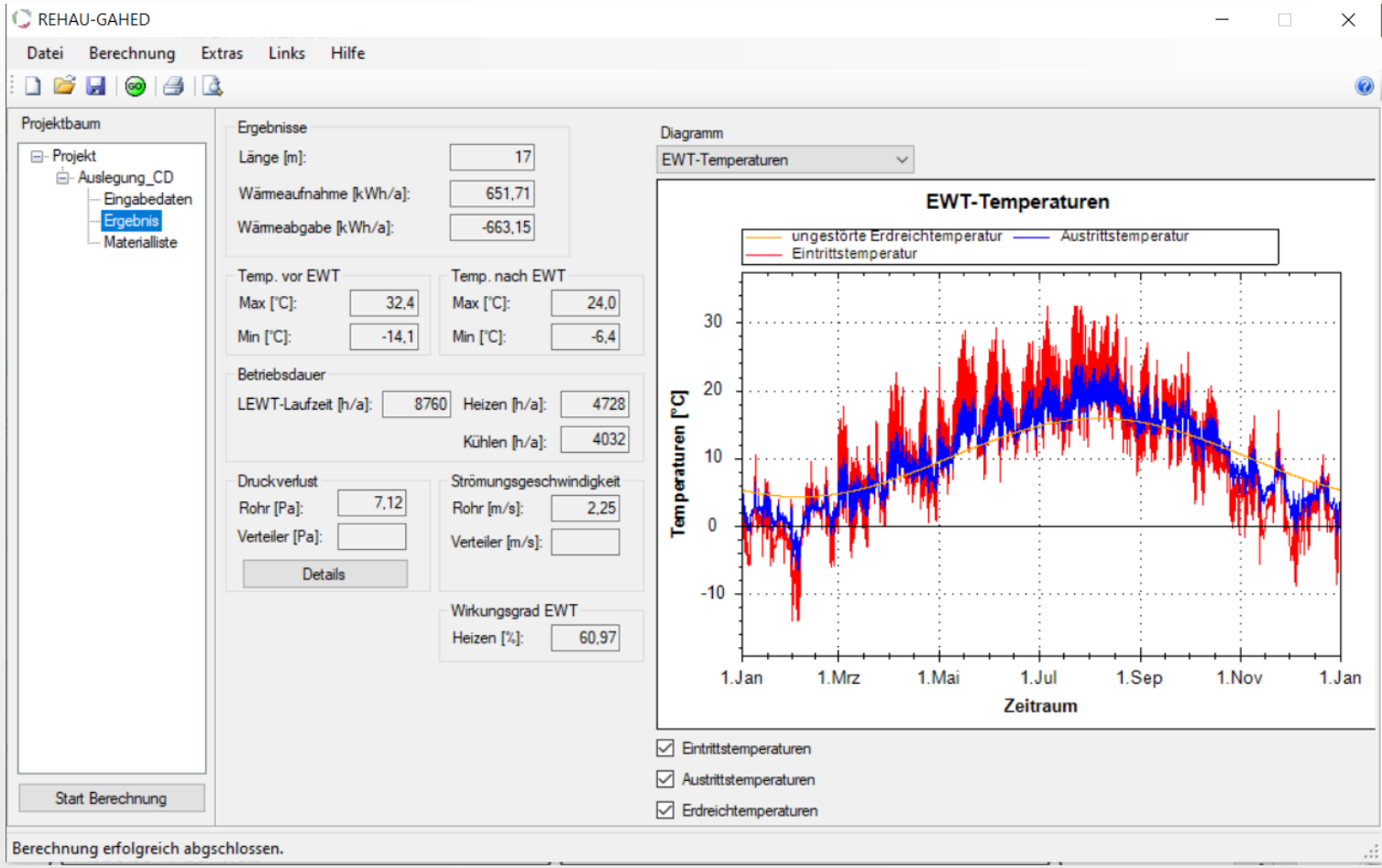
# AVOIDANCE OF HEAT INPUT

- Sun protection
  - unavailable
  - not sufficient
  - used incorrectly

- Shading
  - Smart home systems
  - Easily retrofitted via radio receiver (e.g. z-wave).
  - Blinds or windows with motor drives
    - Fully automated
    - Time dependent
    - Sunset
    - Slat angle

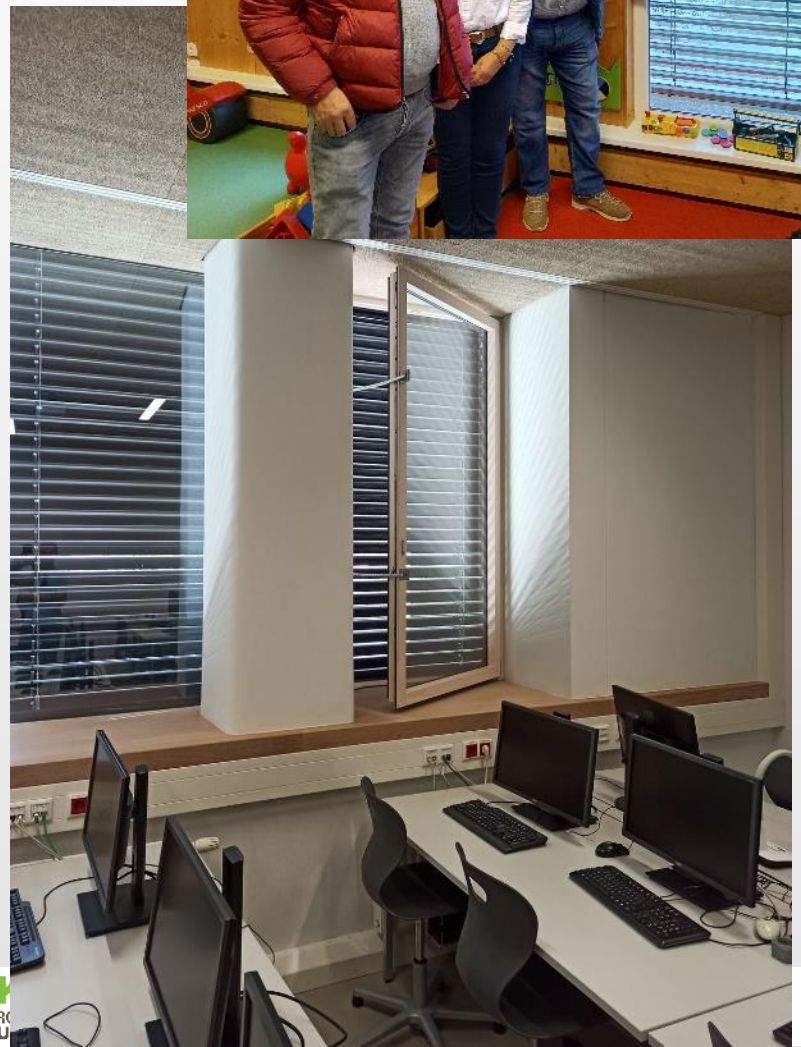



- Air-flowing ground heat exchanger for controlled ventilation
  - + cooler air is brought into the building
  - + approx. 10 to 15% savings in heating and cooling energy
  - - no dehumidification possible
  - - Pay attention to hygiene
  - - Retrofitting is complex
- 17 m ventilation pipe in the ground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

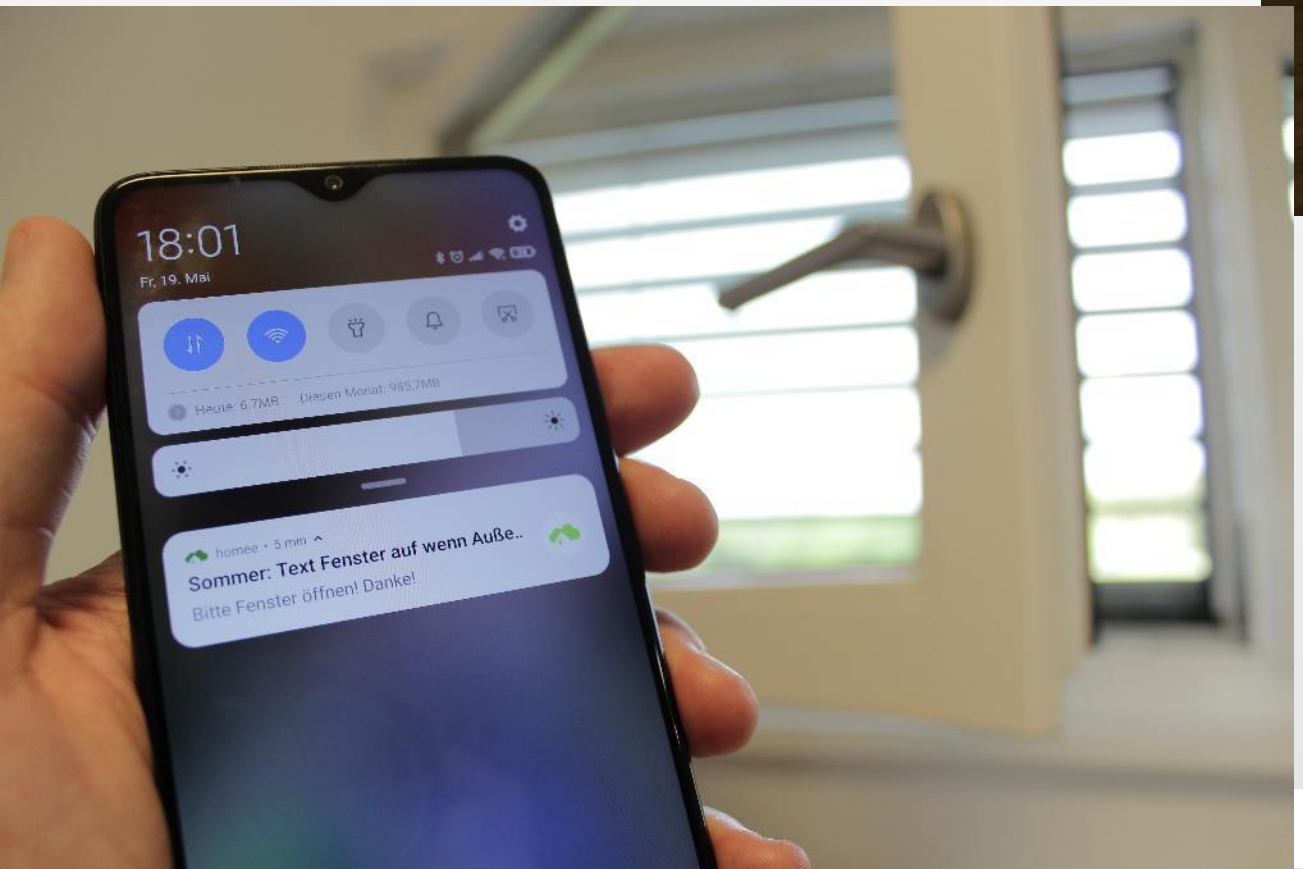


# TECHNOLOGIES AND DEMO SITES

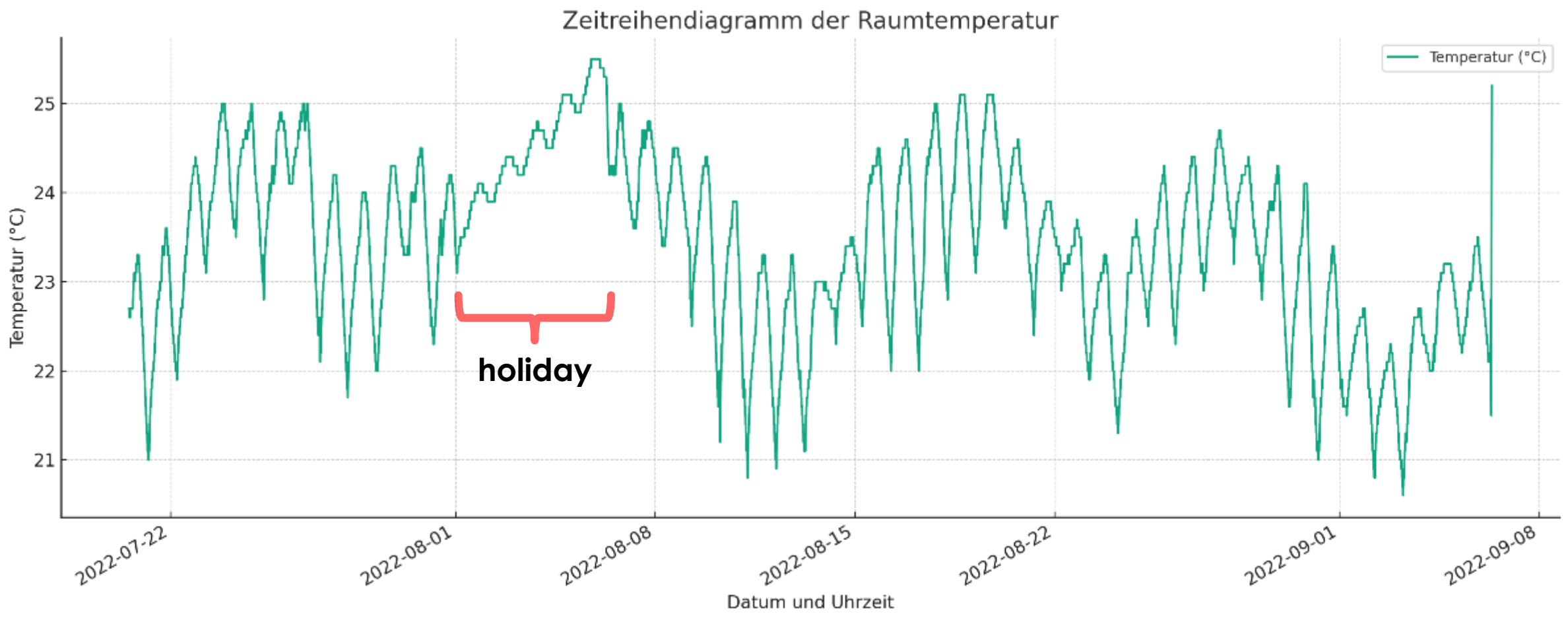
- Night ventilation
  - Taking advantage of the cool outside air at night
  - Opening windows
  - Good air exchange rates can be achieved (approx. 2-6 times)
  - Servomotors and weather station
  - Cooling of the building mass
  - no dehumidification
  - Insurance coverage (Burglary protection)
  - Change in weather
  - Insect repellent



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

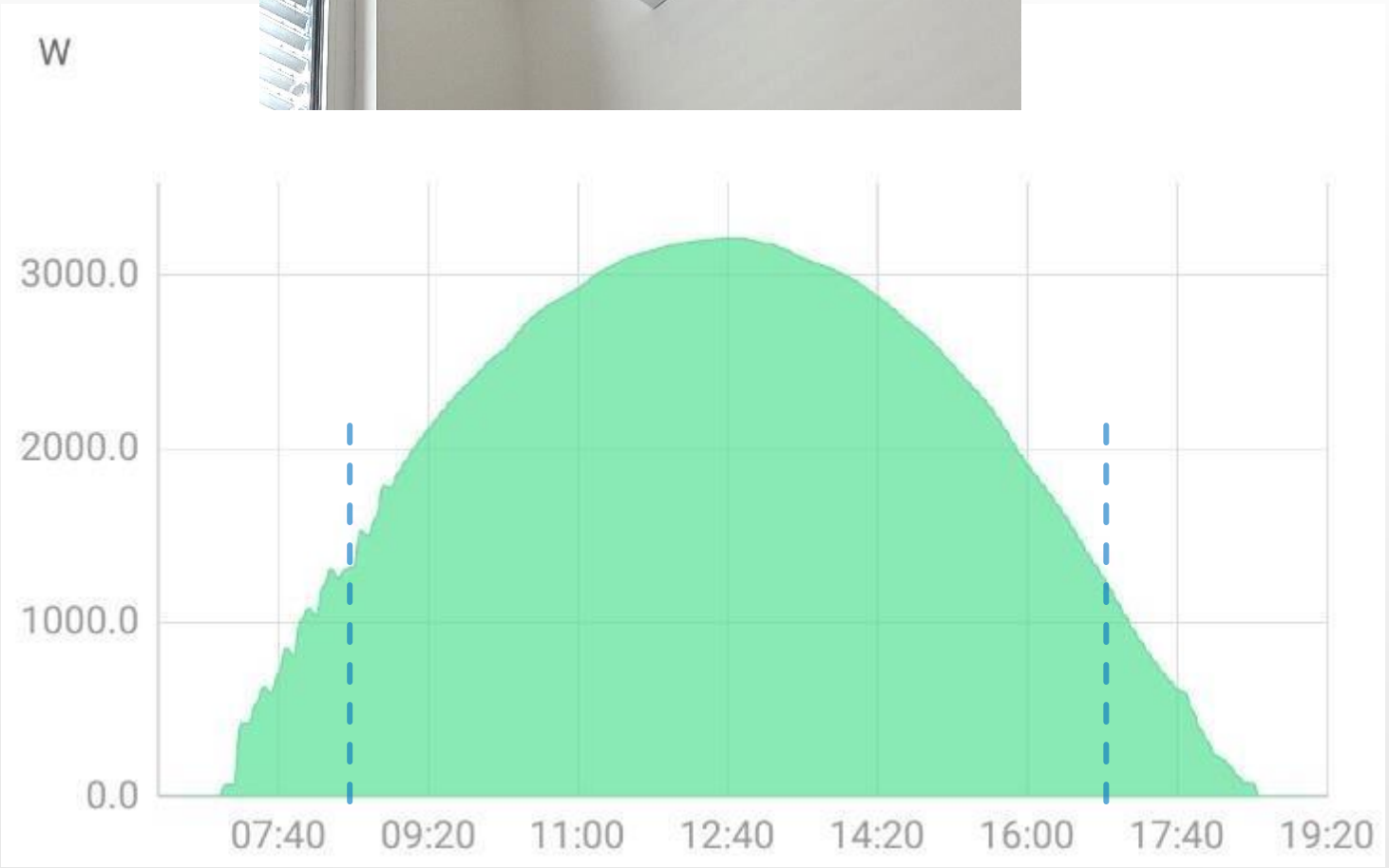



- Partially automated night ventilation for a single family house
  - measurements in summer 2022



# TECHNOLOGIES AND DEMO SITES

- 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
  - or smart home system



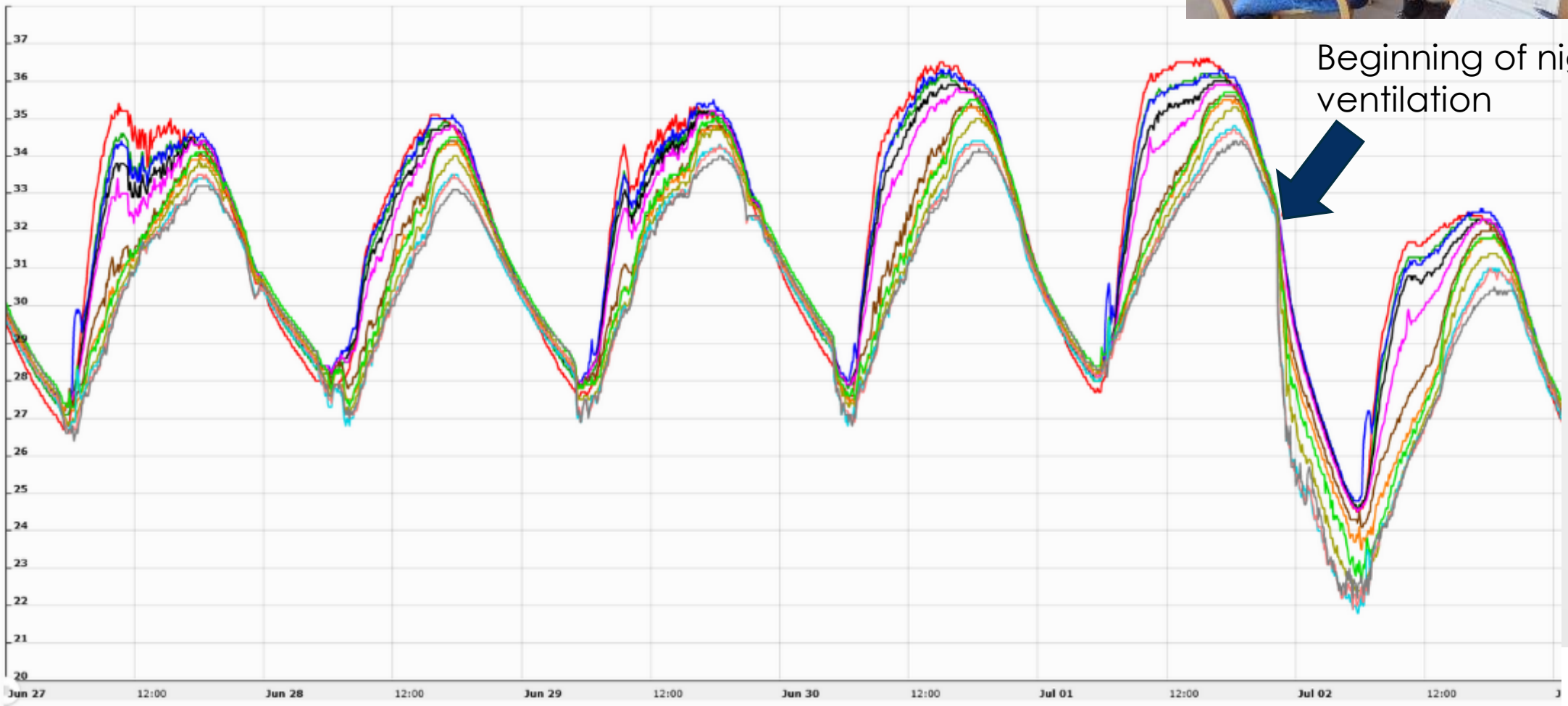
- Evaluation of air conditioning and PV at a single family house

| | 2022 | 2023 |
|---|---|---|
| Coverage via PV | 82 % | 91 % |

# TECHNOLOGIES AND DEMO SITES

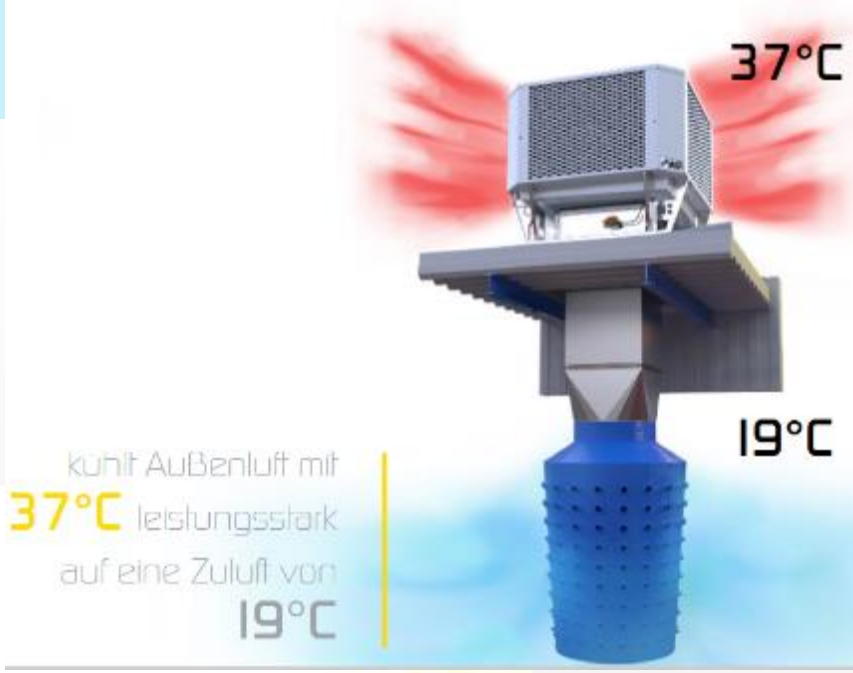
- Company Guttomat
  - Night ventilation via the existing fire smoke ventilation flaps
  - 21 flaps
  - Wind, rain sensor
  - Control with timer and indoor/outdoor temperature sensor
  - - depending on the night temperature outside
  - - no dehumidification, no active cooling during the day
  - + low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

- Guttomat
  - Temperature reduction through night ventilation is clearly visible!
  - Morning: 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% |

- BORG Güssing
  - Split air conditioning units not desired
  - Night ventilation via window not possible
    - Dust entry (neighbor)
    - Birds (otherwise they will trigger the alarm system)
    - Cross ventilation not possible in a meaningful way


## Schule BORG, Assessment using the AHP method

| Bewertungskriterium | Priorität | Fensterantriebe | | Splitanlage 4kW | | Dezentrales Lüftungsgerät (Aero School) | |
|---|---|---|---|---|---|---|---|
| | | Rating | Gewicht | Rating | Gewicht | Rating | Gewicht |
| Ökologische Aspekte | 21.2% | 5 | 1.06 | 1 | 0.21 | 4 | 0.85 |
| Technische Aspekte | 6.3% | 4 | 0.25 | 4 | 0.25 | 4 | 0.25 |
| Herstellungskosten | 3.9% | 4 | 0.16 | 3 | 0.12 | 2 | 0.08 |
| Betriebskosten | 21.2% | 5 | 1.06 | 3 | 0.64 | 4 | 0.85 |
| Kühleffekt | 24.5% | 3 | 0.74 | 5 | 1.23 | 4 | 0.98 |
| Umgebungseinfluss | 4.0% | 3 | 0.12 | 4 | 0.16 | 5 | 0.20 |
| Umsetzungswahrscheinlichkeit | 18.9% | 3 | 0.57 | 3 | 0.57 | 3 | 0.57 |
| Gesamtbewertung | 100.0% | | 3.95 | | 3.17 | | 3.77 |

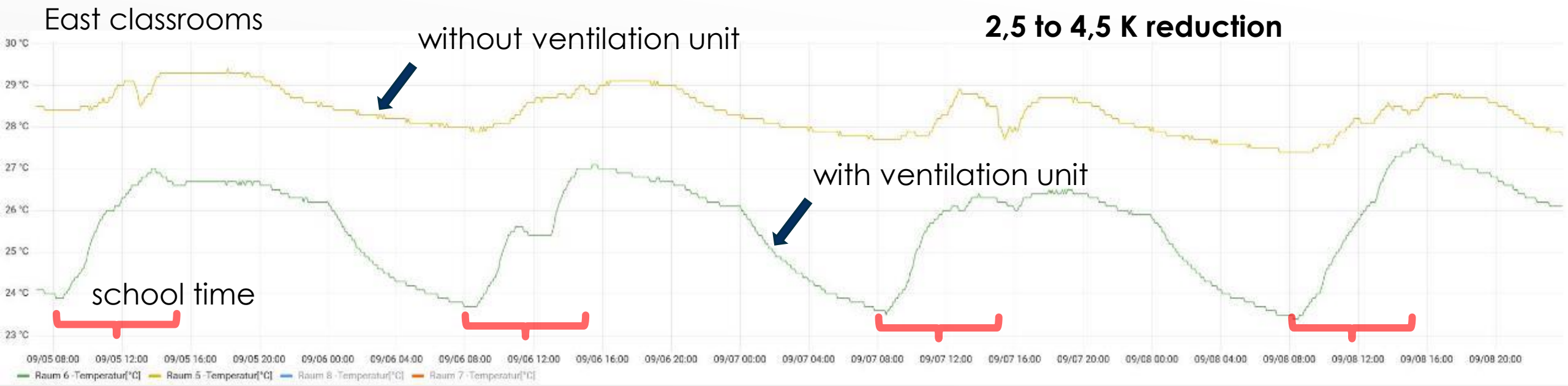
## AHP-Method (Analytic Hierarchy Process)

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

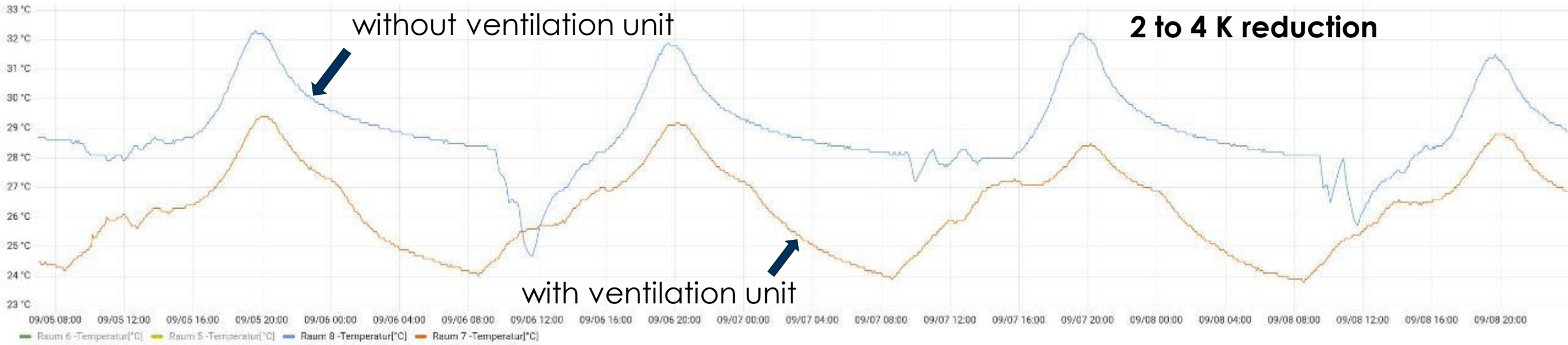
- School
  - decentralized ventilation unit (Wernig)
  - 800 m³/h for night ventilation
  - incl. heat recovery for winter

# TECHNOLOGIES AND DEMO SITES

## East classrooms




## West classrooms



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

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

I'm staying at your disposal:

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