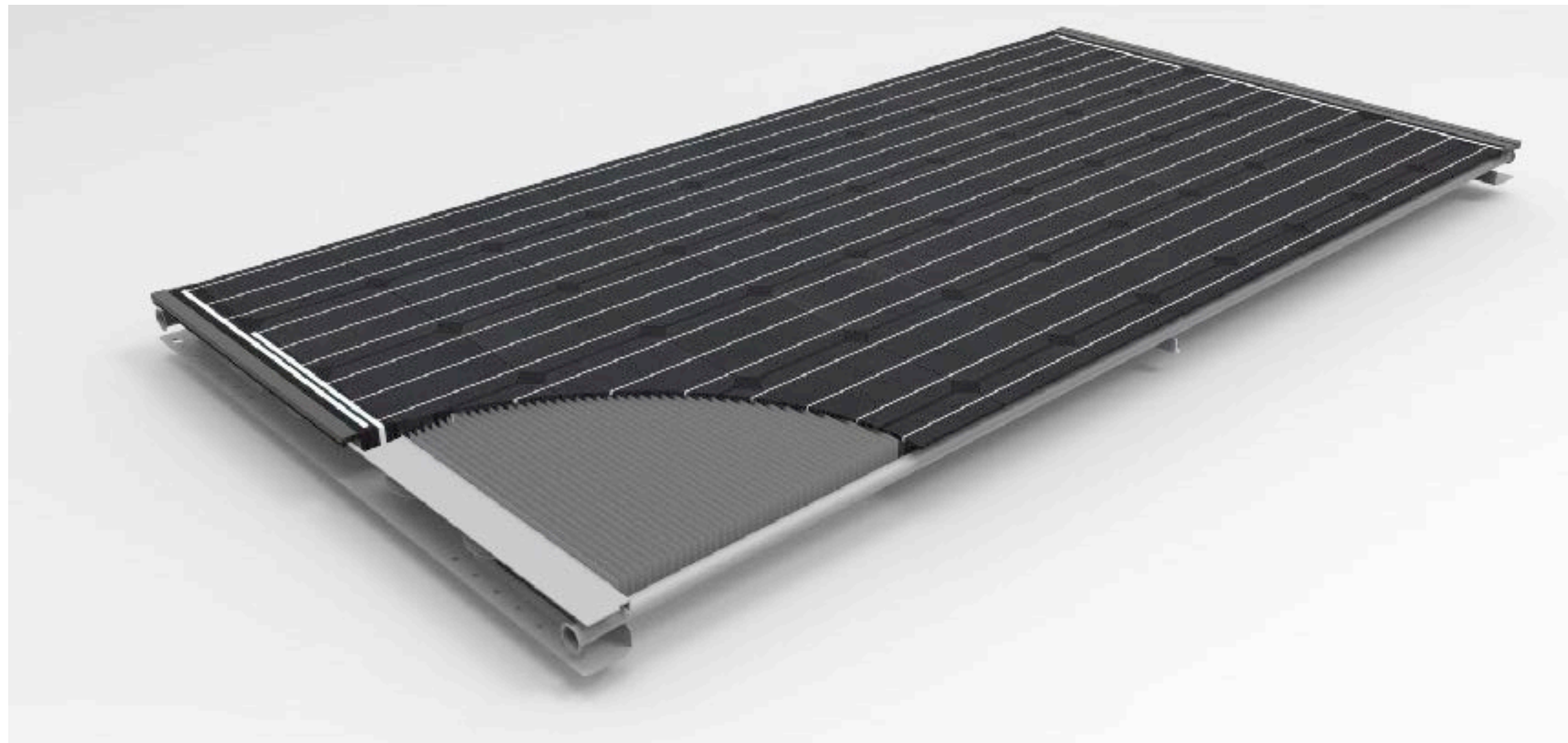


SUN. DAY AND NIGHT.

PVT heat pump collector as innovative energy supply solution

Andreas Siegemund, Managing Partner

Consolar Solare Energiesysteme, Germany

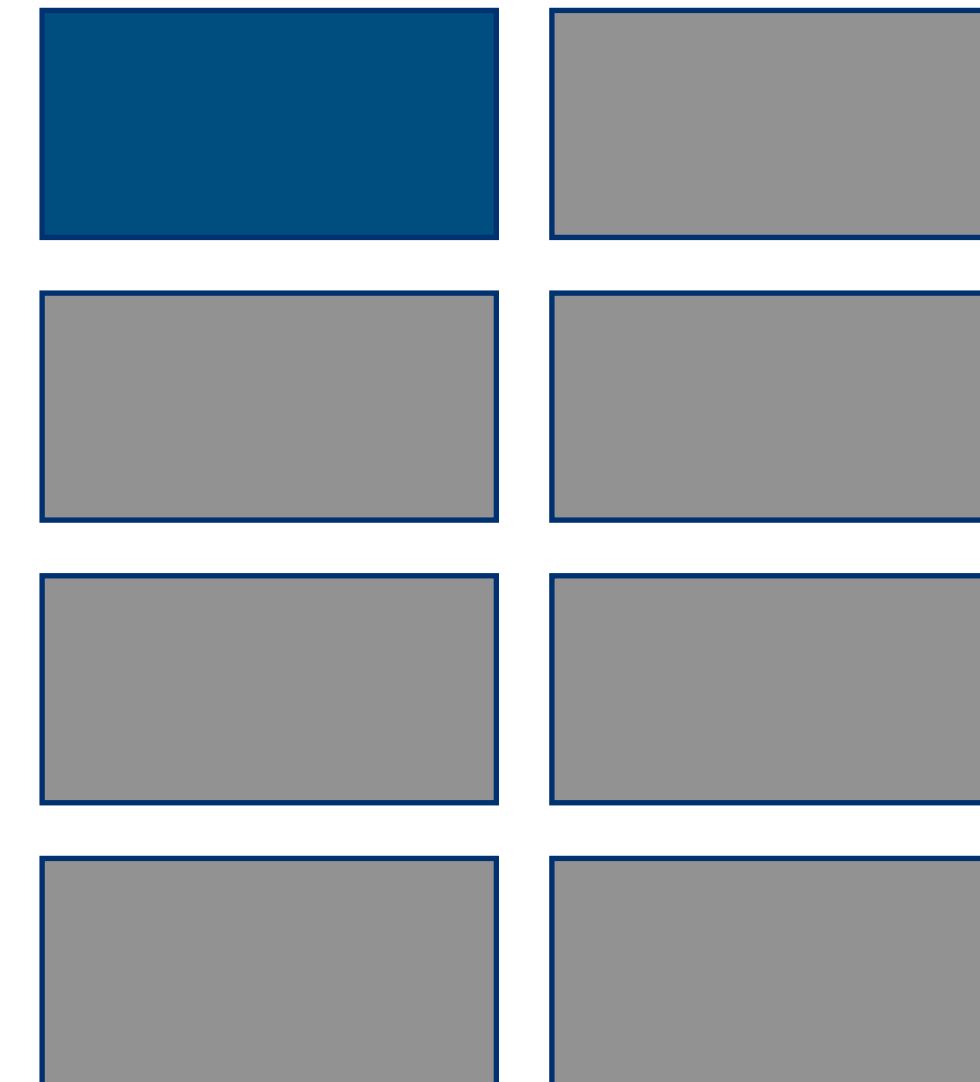
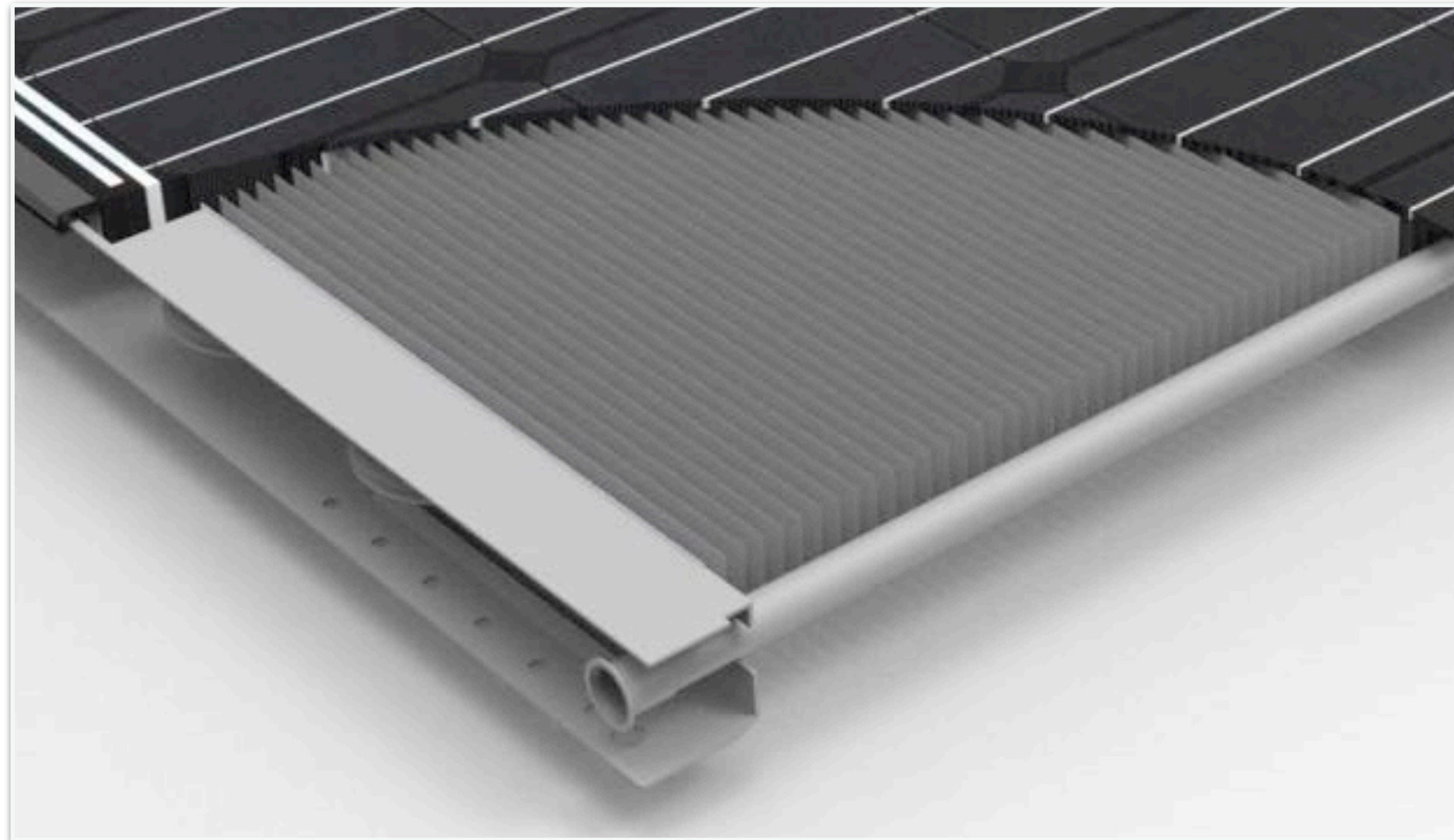


SOLINK: PVT Heat Pump Collector

- ▶ **New energy source for heat pumps**
- ▶ **Heat, cooling and electricity**
- ▶ **Opens up the urban market**
- ▶ **Renovate existing buildings in one or two stages**

SOLINK

What makes SOLINK powerful?



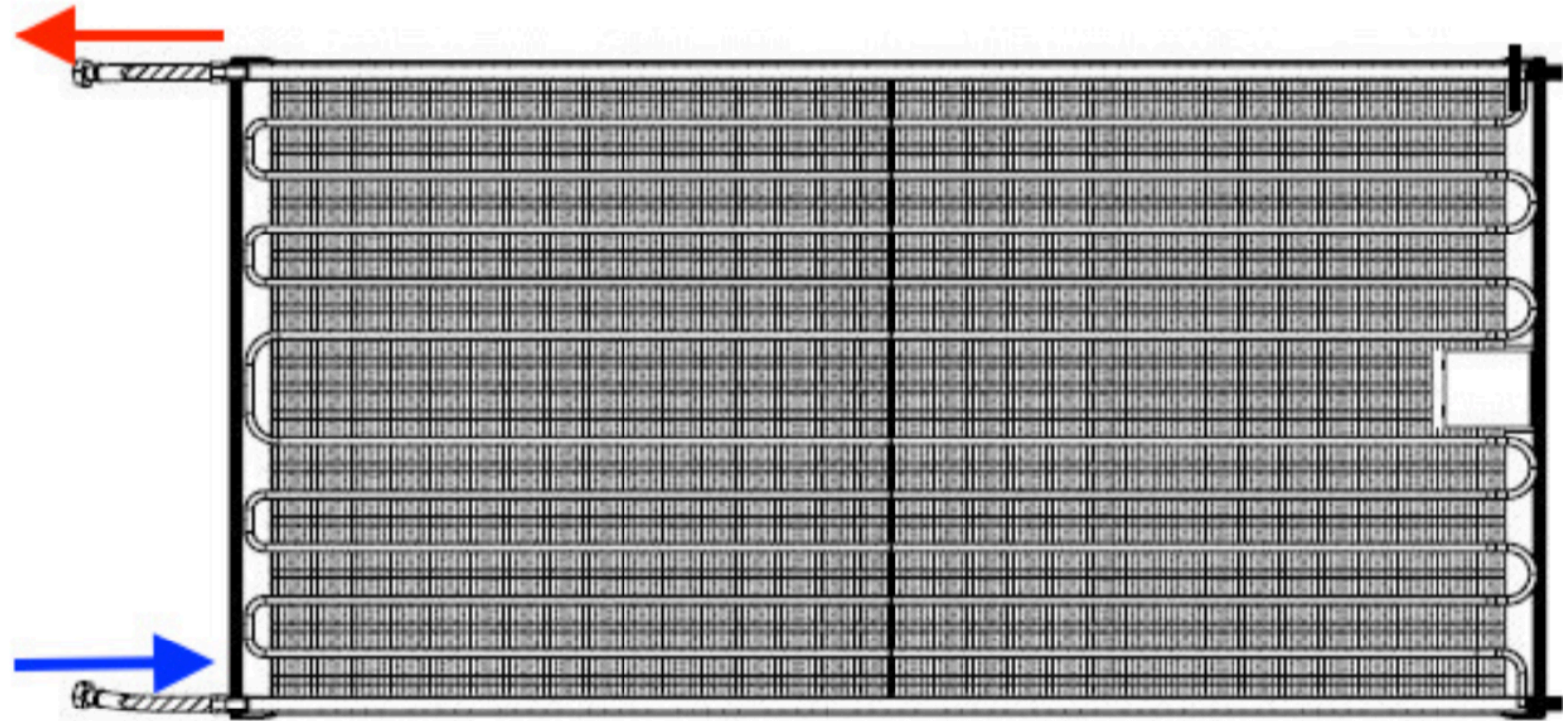
Top side: 2,25 m² PV panel

Underside: 18 m² air heat exchanger

Uses solar heat from the rear side of the panel

Collector design and data

- ▶ Integrated copper manifolds
- ▶ Meander piping with heat exchange fins
- ▶ Weight: 38 kg
- ▶ XL PV panel 450 Wp



Comparison with air-source heat pump systems

- ▶ More efficient on cold, clear days
- ▶ Resistant to icing up
- ▶ No immersion heater electricity for de-icing
- ▶ Attractive roof mounting options
- ▶ Silent operation



Baden Württemberg, 24 collectors

Comparison with ground-source heat pump systems

- ▶ Installers can also supply the heat pump source
- ▶ No permits or approval processes
- ▶ New markets and applications
 - urban areas
 - regions where ground collectors are not permitted



Luxembourg, 20 collectors

Technical advantages:

- ▶ Like a turbo for the PV module:
6-10% more yield due to cooling effect
- ▶ Max. stagnation temperature 70°C
- ▶ Supplies at least as much electricity as the heat pump consumes in a year



Consolar building, Lörrach

Comparison with market companions

Leading PVT heat pump collector technology

- ▶ 15 years' experience with heat pump collectors as a sole heat source
- ▶ More than 1200 systems successfully in operation
- ▶ Extensive testing and monitoring of projects with:
IGTE at the University of Stuttgart
ISFH in Hameln
KIT Karlsruhe Institute of Technology



Monitoring equipment, IGTE

PVT collector as sole heat source for brine heat pumps

- ▶ Most typical PVT collectors must be combined with an additional heat source
- ▶ Systems with SOLINK need only one heat source
- ▶ Reduced roof space requirement:

Systems from known market companions require at least 33% more roof area

Due to ice buildup lowering yield, standard PVT solutions need to be oversized further

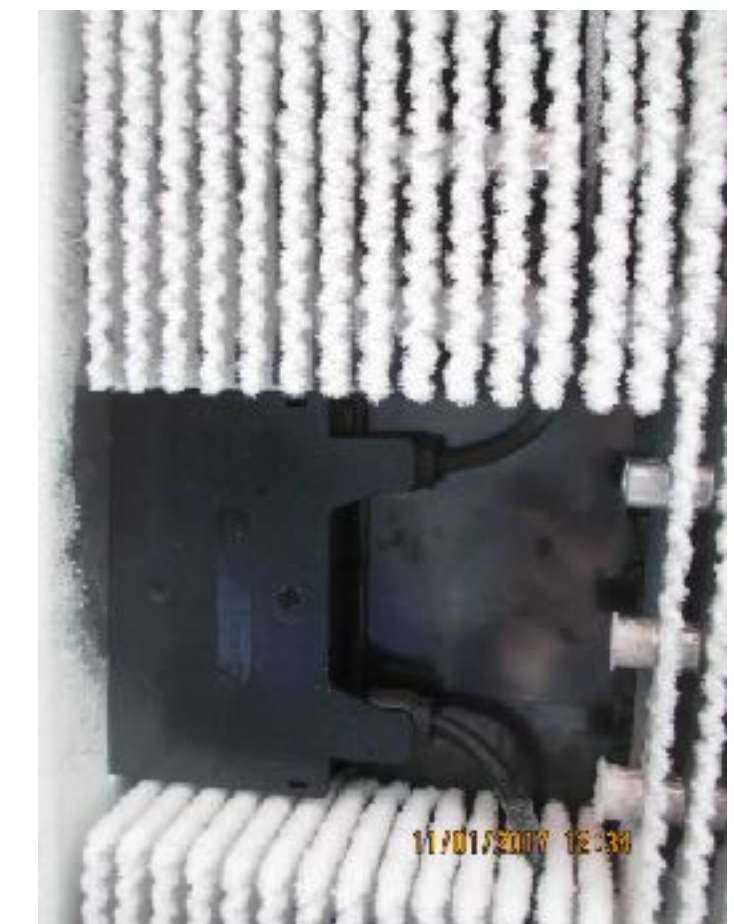
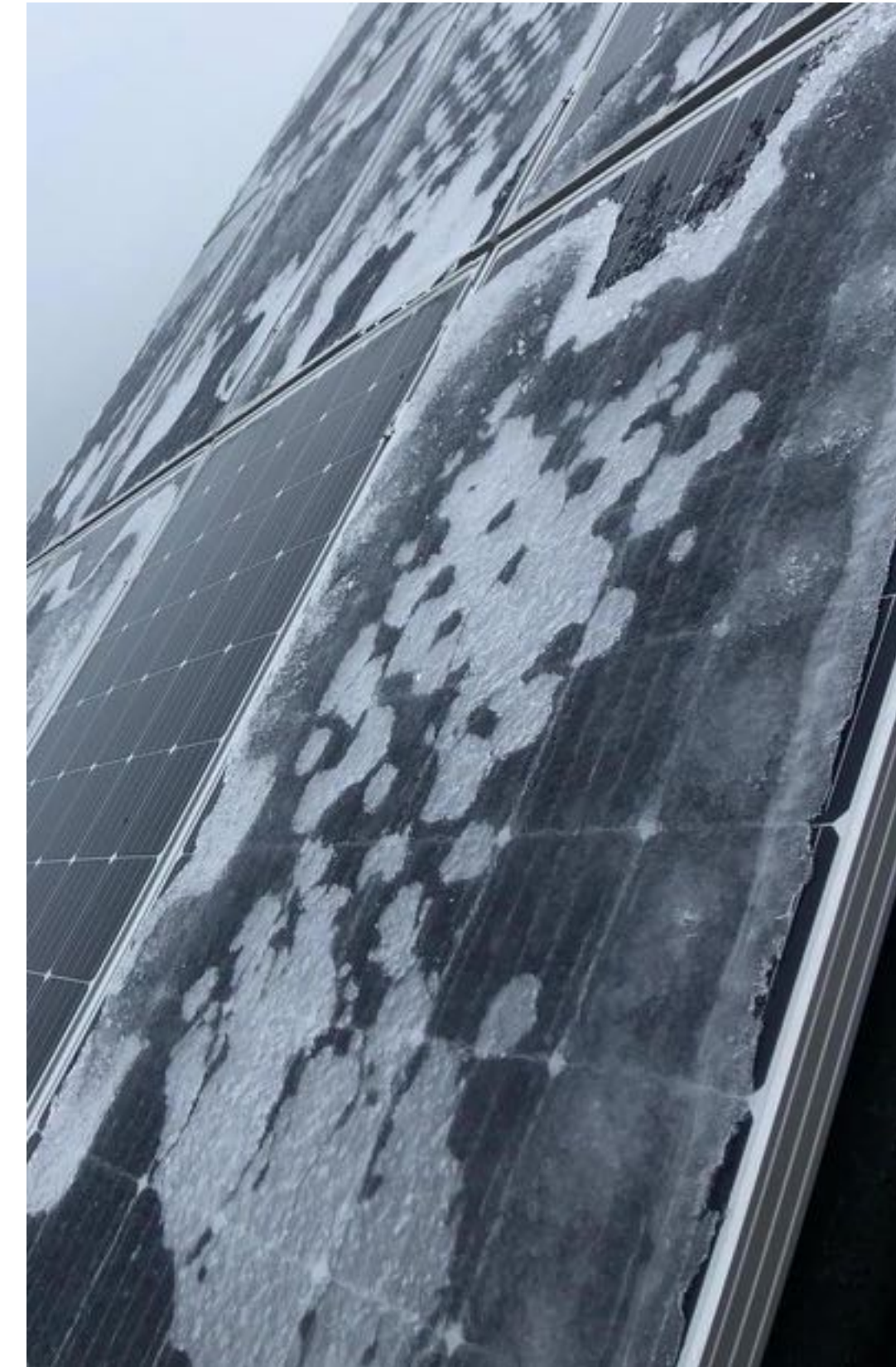


Icing-resistant design

- ▶ The lowest temperatures do not reach the PV module due to physical contact only by the fins
 - Solar yield not critically affected by ice buildup
 - No danger of falling sheet ice
- ▶ Fins are spaced to avoid the rear side completely icing over → reliable operation

Left: Competing PVT with sheet ice & shards

Right: SOLINK in continuous operation $< 0^{\circ}\text{C}$

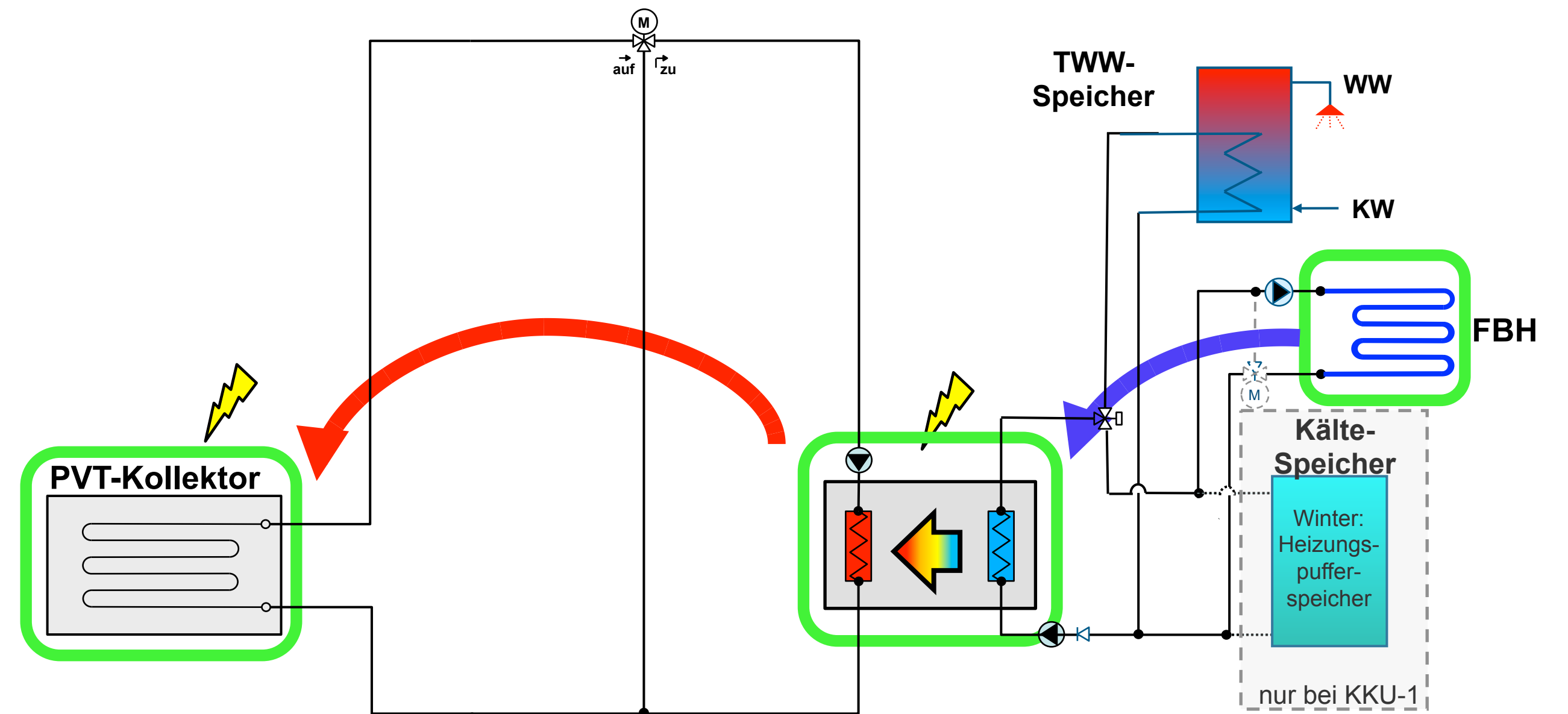


Cooling with SOLINK

- ▶ Efficient recooling (collector as radiator) possible day and night

Cooled PV modules

- ▶ Large cooling surface (fins)
- ▶ Higher PV yield due to cooling fins, even when the heat pump isn't running

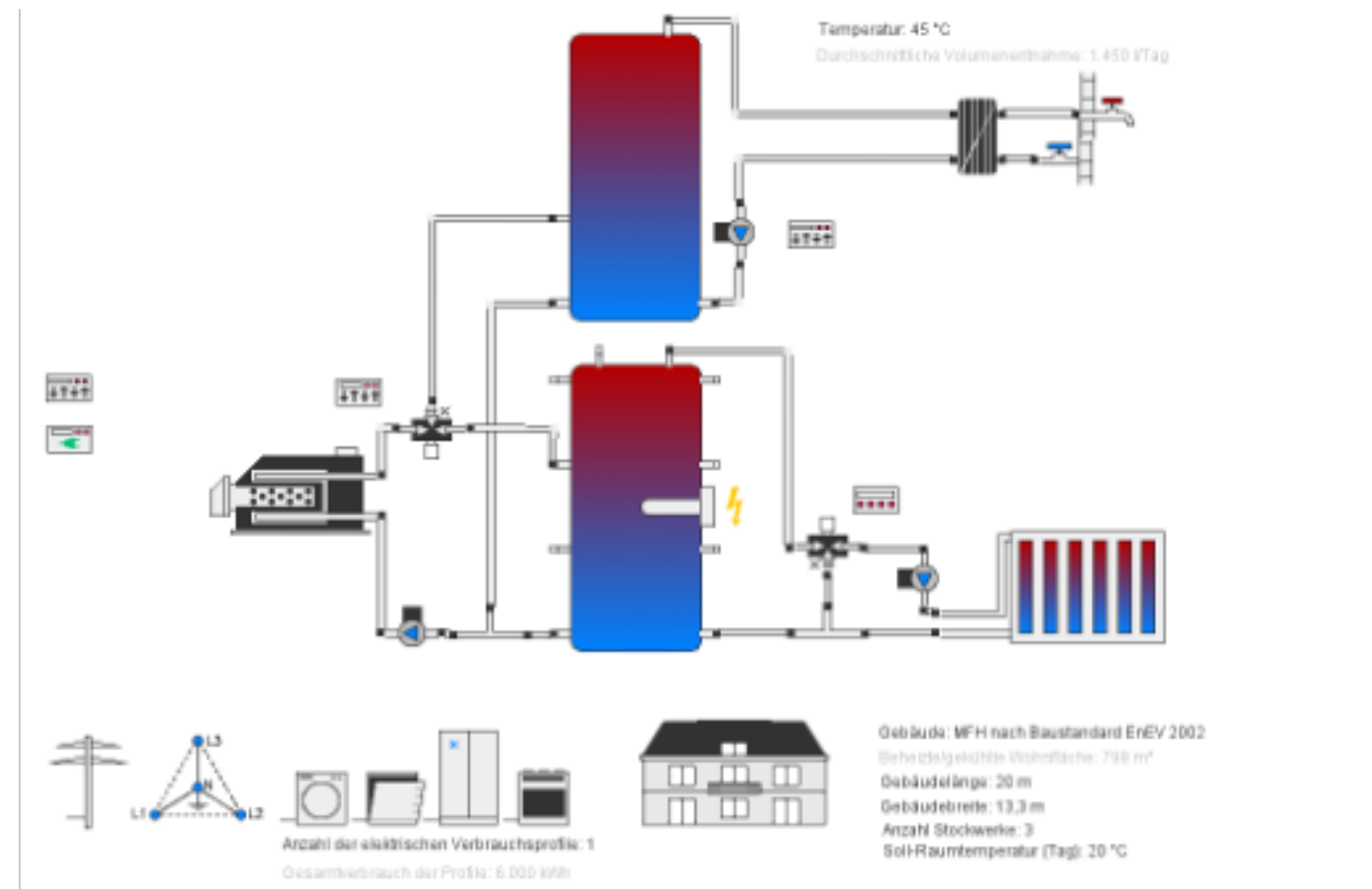


Choosing the right heat pump and collector field size

- ▶ Deduct 3-6 K from the air design temperature (e.g. -10°C) \Rightarrow heat pump power at B-15/W35
- ▶ Size the system to provide 80% of the maximum required heating power
- ▶ Collector area (m^2) = $F \times$ heat pump power:

	Freestanding	Pitched roof parallel
Multi-stage or inverter HP	$F = 3.3 \text{ m}^2/\text{kW}$	$F = 3.6 \text{ m}^2/\text{kW}$
Single-stage HP	$F = 4 \text{ m}^2/\text{kW}$	$F = 4.3 \text{ m}^2/\text{kW}$

Simulation: step-by-step renovation



Apartment building 800 m²

Heating demand: 77,400 kWh/a

Hot water 22,080 kWh/a

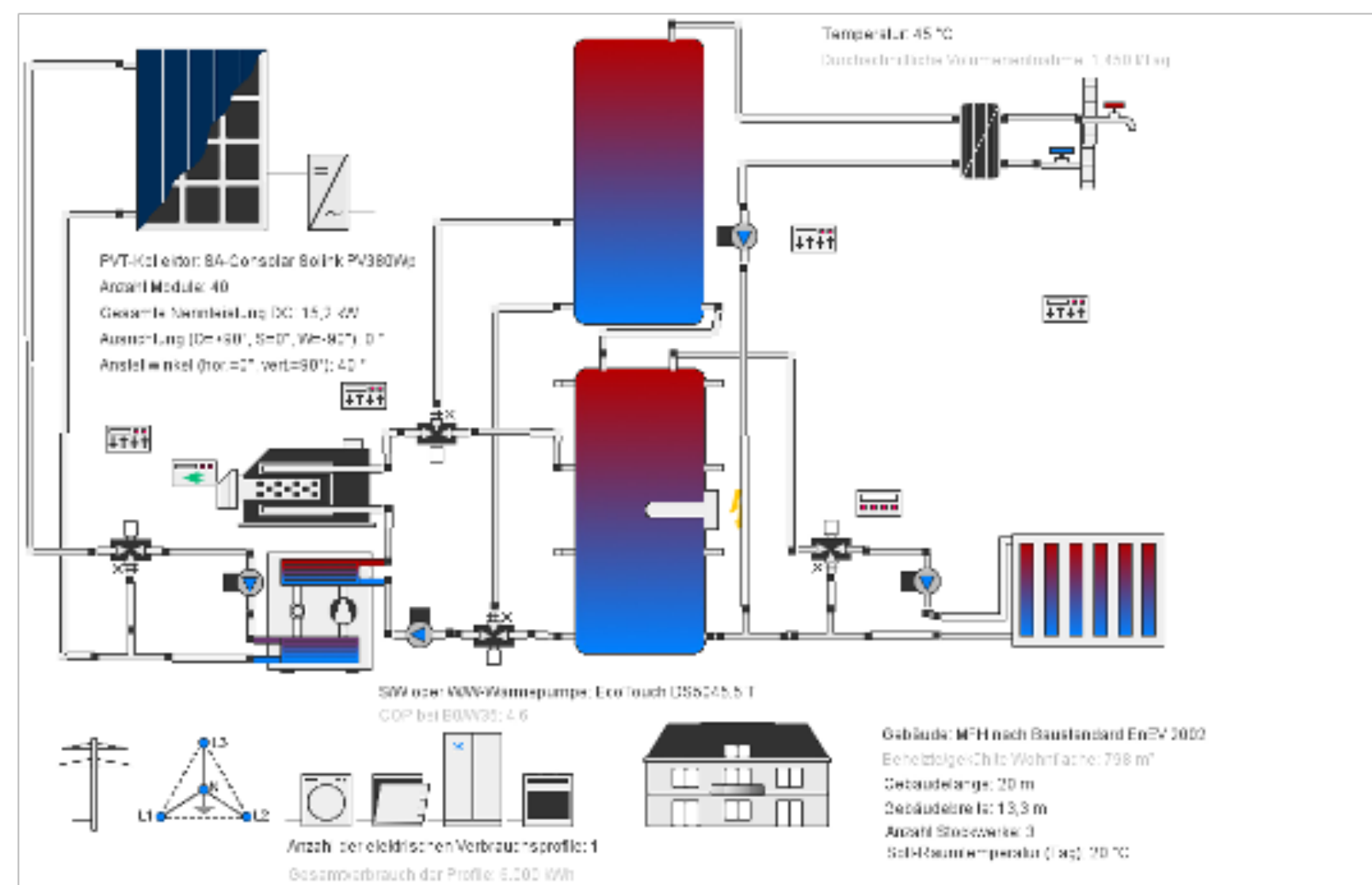
Gas boiler 40 kW

▶ **1st stage: SOLINK heat pump + peak-load boiler**

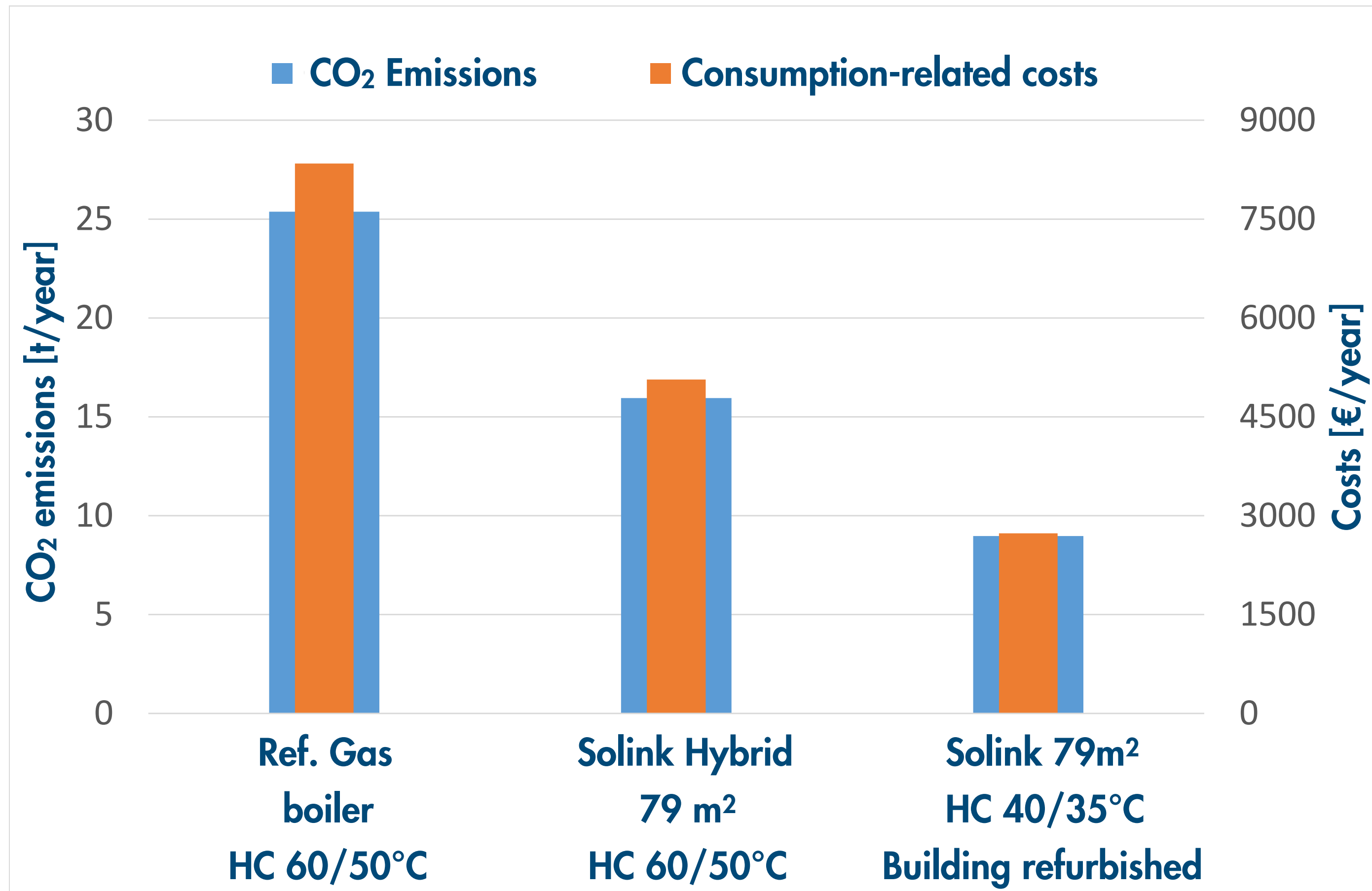
Addition SOLINK, 79 m², heat pump 34 kW (B0/W35)

▶ **2nd stage: Building refurbishment**

Heating demand after renovation: 43,400 kWh



Simulation: step-by-step renovation



Assumptions

- ▶ Energy price gas: 6 cents/kWh
- ▶ Energy price for electricity from heat pumps: 22 cents/kWh
- ▶ Energy price for electricity in general: 29 cents/kWh
- ▶ Feed-in tariff: 9.03 cents/kWh
- ▶ CO₂ factor gas: 202 g CO₂eq/kWh
- ▶ CO₂ factor electricity: 537 g CO₂eq/kWh

Result

- ▶ Energy SOLINK-HP: 78 % // 100 %
- ▶ Emissions: - 37 % // - 65 %
- ▶ Costs: - 39 % // - 67 %

Reference Systems

SOLINK



Location:
Heitersheim,
Freiburg (Germany)

6 units

56 m²,
28 collectors

17 kW Waterkotte
heat pump
(B-15/W35)

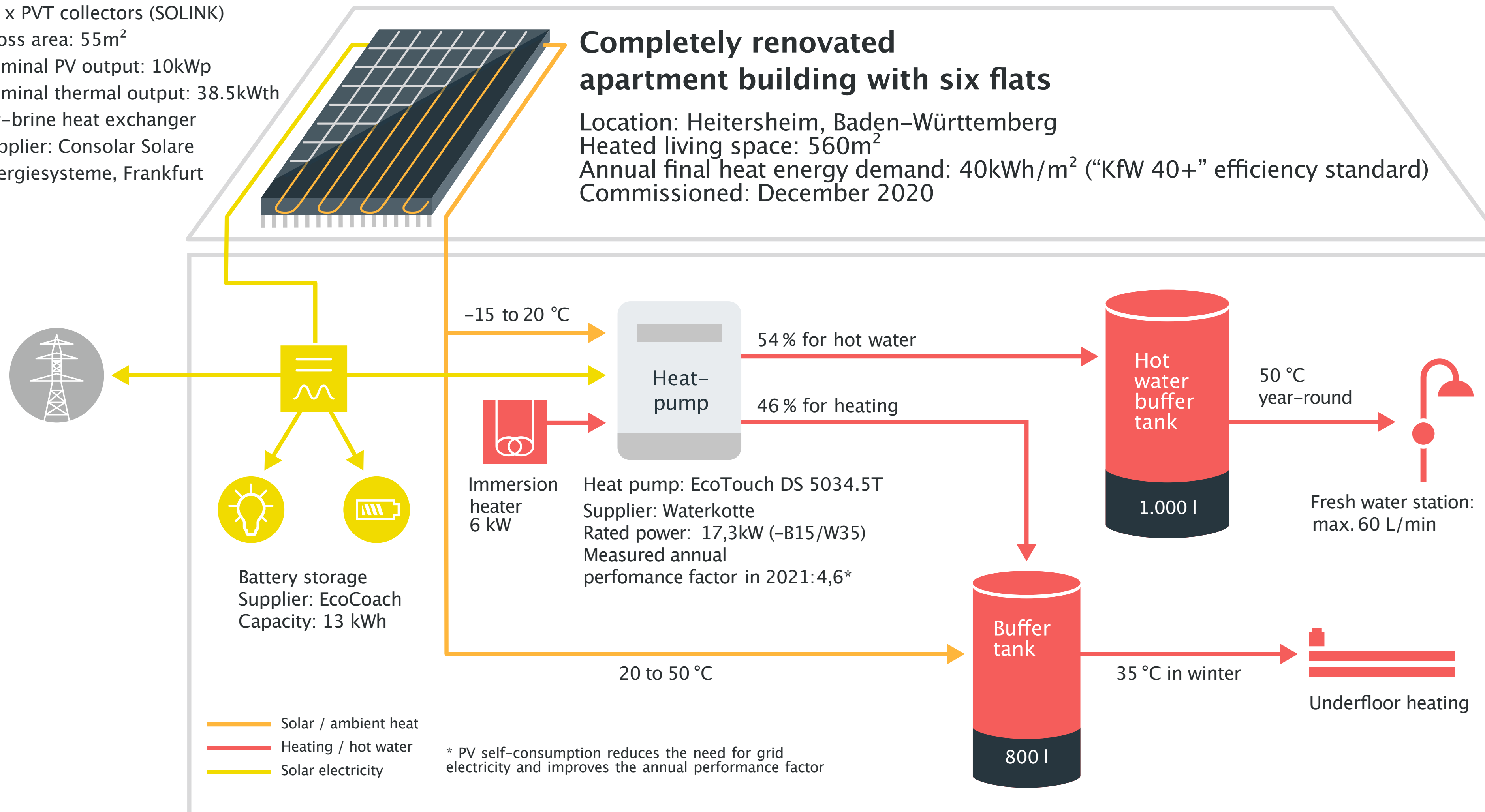
Project type:
Multi-residential
dwelling

SOLINK

28 x PVT collectors (SOLINK)
 Gross area: 55m²
 Nominal PV output: 10kWp
 Nominal thermal output: 38.5kWth
 Air-brine heat exchanger
 Supplier: Consolar Solare
 Energiesysteme, Frankfurt

Completely renovated apartment building with six flats

Location: Heitersheim, Baden-Württemberg
 Heated living space: 560m²
 Annual final heat energy demand: 40kWh/m² ("KfW 40+" efficiency standard)
 Commissioned: December 2020



Location:
 Heitersheim,
 Freiburg (Germany)

6 units

**56 m²,
 28 collectors**

**17 kW Waterkotte
 heat pump
 (B-15/W35)**

**Project type:
 Multi-residential
 dwelling**

SOLINK

Energie Südwest ESW - New Town Hall



Location:
Offenbach an der Quaich
(Germany)

PVT field:
200 m², 100 SOLINK collectors

Heat pump:
51.2 kW monovalent

**Heating, cooling,
cool district heat network**

Project type:
Town hall

SOLINK

Energie Südwest



Location:
Offenbach an der Quaich
(Germany)

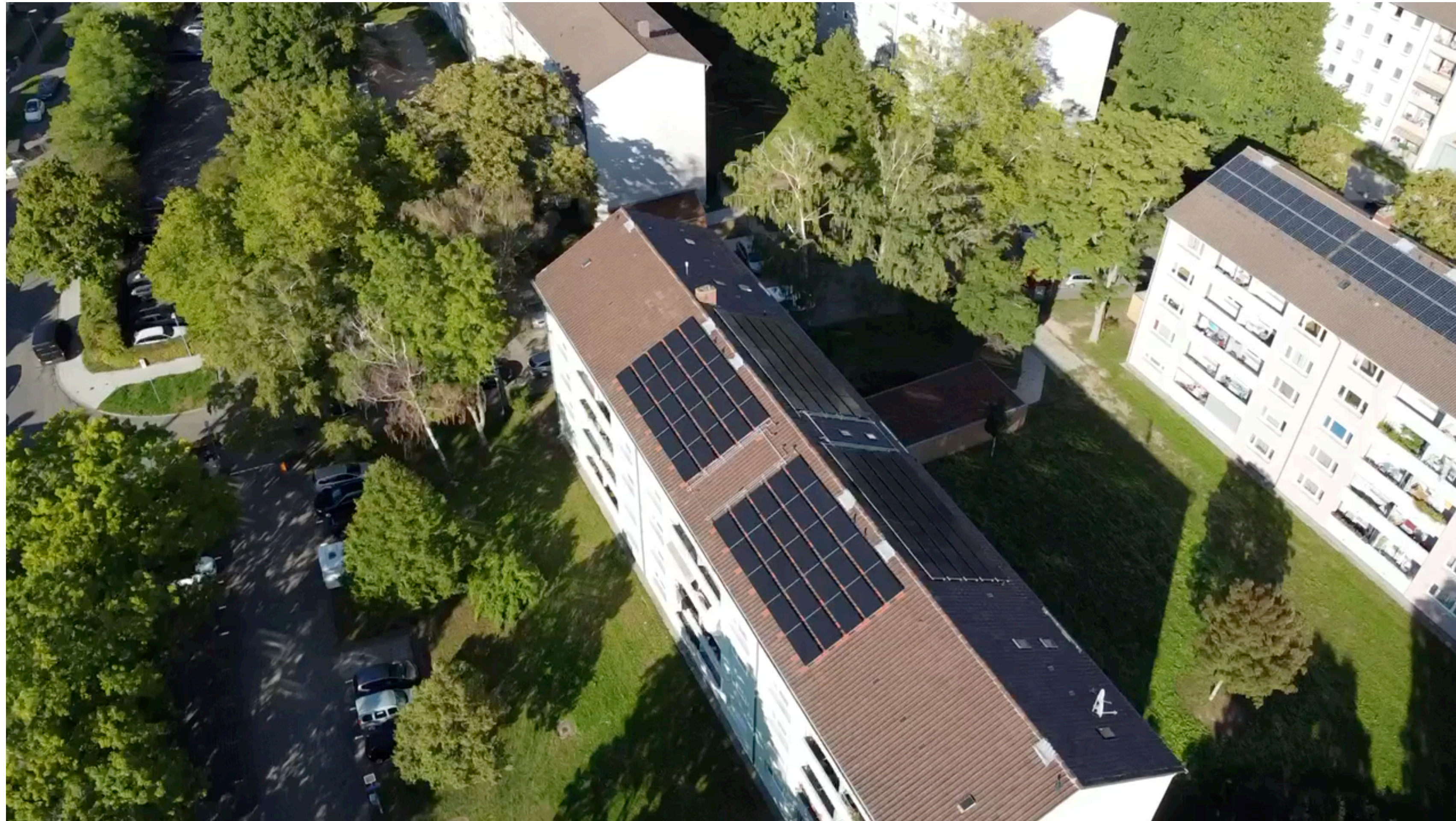
PVT field:
200 m², 100 SOLINK collectors

Heat pump:
51.2 kW (B0/W35)
monovalent

**Heating, cooling, district heat
network**

Project type:
New office/council building

SOLINK



Location:
Karlsruhe-Durlach (Germany)

**PVT field: 200 m²,
100 SOLINK collectors**

**Heat pump: 55.4 kW
bivalent with 90 kW gas boiler**

Project type:
Multi-residential dwelling
Built 1963,
Renovation 1995: 65 kWh/m²a
Living space: 2300 m²
35 residential units

VOLKSWOHNUNG Karlsruhe GmbH

Contractor: KES Karlsruher Energieservice GmbH

Träger: Stadtwerke Karlsruhe, VOLKSWOHNUNG

SOLINK

Freiburg - Hornbühl-Ost, Badenova



Gisinger GmbH, non-binding visualisation

Location: Freiburg (Germany)

PVT field:

4 x 88 m², 44 SOLINK collectors

1 x 70 m², 35 SOLINK collectors

Heat pumps:

4 x Waterkotte 22.8 kW

1 x Waterkotte 17.3 kW

1000 l heating + 1000 l DHW buffers

Project type:

Multi-residential development

Office building in Lörrach, Weiler Straße



Location:
Lörrach (Germany)

PVT field:
309 m², 156 SOLINK collectors
Facade installation 75°

Heat pump:
Waterkotte 55,3 kW
(B-15/W35)

2000 l heating buffer
2000 l cooling buffer

Project type:
Office building

SOLINK

Office building in Lörrach, Weiler Straße





Sun. Day and Night.

SOLINK-Angebot

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