PVT heat pump collector as innovative energy supply solution

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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
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
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
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°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
Planning and System Design

Choosing the right heat pump and collector field size

► Deduct 3-6 K from the air design temperature (e.g. -10°C) => heat pump power at B-15/W35
► Size the system to provide 80% of the maximum required heating power
► Collector area (m²) = F x heat pump power:

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<th>Freestanding</th>
<th>Pitched roof parallel</th>
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<td>Multi-stage or inverter HP</td>
<td>F = 3.3 m²/kW</td>
<td>F = 3.6 m²/kW</td>
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<tr>
<td>Single-stage HP</td>
<td>F = 4 m²/kW</td>
<td>F = 4.3 m²/kW</td>
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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
Location: Heitersheim, Freiburg (Germany)

6 units

56 m², 28 collectors

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

Project type: Multi-residential dwelling
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/m²² ("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
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
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
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
Freiburg - Hornbühl-Ost, Badenova

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
Office building in Lörrach, Weiler Straße
Sun. Day and Night.
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