PV-supported Heat Pump System

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**PV or Thermal Collectors?**

- The most interesting question today is: PV or Solar Collector?
- They compete on the same roof area?
- IEA cannot handle this question!
PV or Thermal Collectors?

• In Sweden electric energy is often used for delivering domestic hot water

• This is an advantage for PV

• *The Swedish answer to the question is PV!*
**PV or Thermal Collectors?**

- Solar thermal system can not compete in combination with heat pumps or district heating in Sweden

- PV and heat pumps or PV and district heating are good combinations
Bed rock Heat Pump
Heat pump and solar collectors?
PV+Heat Pump or Solar Collector

![Graph showing comparison between Solvärme and PV+VP over a 12-hour period.](image-url)
Energy demand of building

Total building energy demand including household electricity

- Blue line: Without any technical installations
- Red line: With ventilation heat recovery
- Green line: With ventilation heat recovery and ground source heat pump

Energy (kWh)

Month:
- January
- February
- March
- April
- May
- June
- July
- August
- September
- October
- November
- December
Monthly Net Meetering

Building electricity demand and PV generation with monthly net metering

- Building electricity demand with GSHP-system and ventilation heat recovery
- PV generation, 5.19 kWp
Purchased Electricity

Total building electricity demand (purchased)

1. Total building electricity demand with and without PV-system with instantaneous metering, daily net metering and monthly net metering.
Use or export PV-power?
Saved fraction with net meetering

Saved electricity in energy system in relations to installed PV-system peak power with different measuring schemes

- Instantaneous metering
- Monthly net metering
- Daily net metering
Increasing self consumption

・ Net meetering
・ Storage in water volume
・ Storage in Batteries
Administrativt (nettodebitering)
"Vanligt hus " + VP och PV

\[ f=0,42, \ X=0 \]

Elbehov=17280 kWh/år, 3,2 kWp PV, 21m²
"Vanligt hus" + VP+PV

Elbehov=17280 kWh/år, 8 kWp PV, 55m²
”Välisolerat hus” + VP+PV

Elbehov=9964 kWh/år, 2,9 kWp PV, 20m²
"Välisolerat hus" + VP
Vertikala PV

\[ f=0.68, \ X=0 \]

Elbehov=9964 kWh/år, 4,7 kWp PV, 31m²
"Välisolerat hus" + VP
Vertikala PV

Elbehov=9964 kWh/år, 7 kWp PV, 46m²
Total building electricity demand (purchased)

![Graph showing total building electricity demand over a year, with peaks in summer and lower demand in winter. Two lines represent different systems: one with a flat plate collector system and another with a more complex system.](image-url)
Sammanfattning

<table>
<thead>
<tr>
<th>Hus</th>
<th>PV (kWp)</th>
<th>f-Andel Sol</th>
<th>X-Nätutbyte</th>
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Large Collectors with Reflectors
Utbyte i kWh/månad i olika lutning

![Diagram showing energy output in kWh per month at different inclinations]

- 30°-2,4kWp
- 70°-3,3kWp
- 90°-4,8kWp