Heat Pump Technology in Combination with Renewable Energies (RE)

Factsheet 13

Facts and Figures

Reaching Sustainability Goals through the Use of heat pumps and Renewable Energies

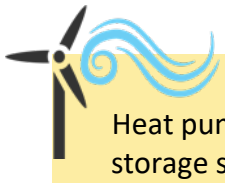
The use of heat pump technology in combination with renewable energies promises three sustainability goals at once:

more energy efficiency, more renewable energy and fewer CO_2 emissions.

Heat pumps can be used in combination with various renewable energy sources to provide an efficient and sustainable heating and cooling solution.
Here are some examples:

Biomass

Heat pumps can be used in combination with biomass boilers to provide heat for buildings. Biomass boilers burn wood pellets, chips or logs to produce heat, which can then be distributed via a heat pump to provide space heating and hot water.



Wind Energy

Heat pumps can be connected to heat storage systems that are charged with excess electricity from wind turbines. When the electricity demand is low, the heat pump can extract heat from the heat storage system to provide heating and cooling for buildings.

Solar Energy

Heat pumps can be combined with solar thermal panels to provide hot water for domestic use. The solar panels heat up the water, which is then stored in a tank. The heat pump can then extract additional heat from the tank to increase the water temperature

Example of how Heat Pump in Combination with Photovoltaics Works

1. The PV panels generate electricity from the sun's rays.
2. This electricity is then used to power the heat pump, which extracts heat from the surrounding air or ground.
3. The heat pump then increases the temperature of this heat and distributes it throughout the building via a heating system, such as underfloor heating or radiators.
4. In summer, the heat pump can also be used to provide cooling by extracting heat from the building and releasing it into the outside air.

The savings potential of combining a heat pump with PV panels can be significant.
By generating electricity from the sun, the building's energy consumption is reduced, which in turn reduces the running costs of the heat pump.
Additionally, excess electricity generated by the PV panels can be sold back to the grid, generating additional income.

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Schematic of the solar PV/LHP heat pump

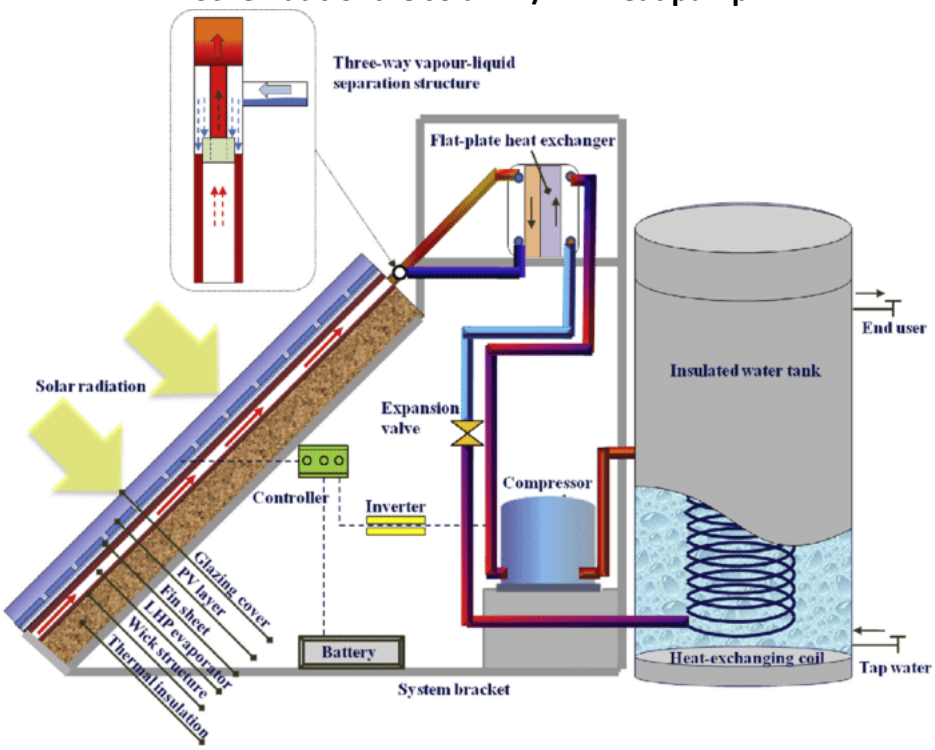

Figure 1: Source: Zhang, Xingxing & Shen, Jingchun & Xu, Peng & Xu, Ying. (2014). Socio-economic performance of a novel solar photovoltaic/loop-heat-pipe heat pump water heating system in three different climatic regions. Applied Energy. 135. 20-34. 10.1016/j.ap

„Fig. 1 illustrates the target PV/LHP heat pump water heating system, which comprises a PV/LHP module, the vapour/liquid transportation lines, a flat-plate heat exchanger (LHP condenser and heat pump evaporator), an electric compressor, a coil con- denser immersed into a water tank, an expansion valve and an electric control & storage unit (controller, inverter and battery). The PV/LHP module is the key component of the system that con- sists of a single tempered glazing, a PV lamination layer, the LHP evaporator, a fin sheet and a polystyrene board for thermal insula- tion. These layers are positioned into an aluminium-alloy casing using the clamping and argon-arc welding methods. The LHP evap- orator plays an essential role in transferring the heat from the PV layers to the flat-plate heat exchanger. It is placed into an alumin- ium X-shape fin sheet and then attached to the rear surface of PV layer using thermal-conductive silicon sealants.“

Source: Zhang, Xingxing & Shen, Jingchun & Xu, Peng & Xu, Ying. (2014). Socio-economic performance of a novel solar photovoltaic/loop-heat-pipe heat pump water heating system in three different climatic regions. Applied Energy. 135. 20-34. 10.1016/j.ap

Sources:
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