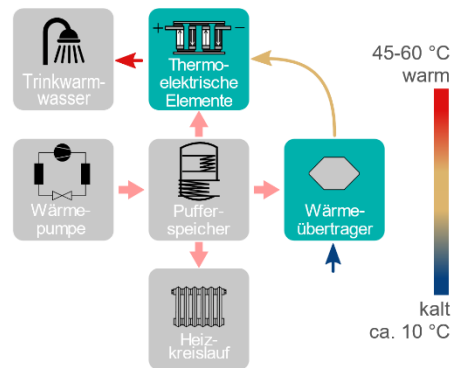


Thermoelectric water heat pump

Energy-saving potable water heating system based on hot water with low flow temperature

Invention

More and more houses are covering their energy requirements with renewable energies such as solar thermal energy and heat pumps. These processes involve water from a buffer tank heated to a fairly low temperature. To raise the temperature for showering, for example, the conventional method is an electrical heating rod or a second fossil-fueled heat generating system.



The water heat pump uses existing (renewable) energy from the buffer tank to provide potable water at higher temperatures. Cold potable water is first preheated with heat exchangers to almost the buffer tank temperature. Then thermoelectric elements use the buffer tank heat to bring the water to the desired higher temperature. For existing energy to be used as efficiently as possible, the thermoelectric element arrangement is similar to that of countercurrent heat exchangers. The water to be heated flows along a series of thermoelectric elements while the water from the buffer tank flows in the opposite direction. The buffer tank water cools down more and more while the potable water is warmed more and more by the thermoelectric elements.

Fig.: Sketch of the concept; arrow color shows temperature (from blue=cold to orange to red=hot); broad arrows: heat flow; narrow arrows: potable water flow; invention=mint

Commercial Opportunities

The technology is suitable for heating water with low flow temperature to a higher desired temperature such as for showering. This is useful when the water is heated with solar thermal energy, heat pumps, low-temperature networks, or geothermal heat. In such cases, the heating rod normally used for reheating water is replaced by the thermoelectric heat pump described here.

Current Status

A German patent application has been submitted to the German Patent and Trade Mark Office. On behalf of the Aachen University of Applied Sciences, we are offering interested companies the opportunity to license this technology and cooperate with the inventors at the Aachen University of Applied Sciences in its refinement.

Relevant Publications

Hagenkamp, M., Blanke, T. & Döring, B. Thermoelectric building temperature control: a potential assessment. *Int J Energy Environ Eng* 13, 241–254 (2022). <https://doi.org/10.1007/s40095-021-00424-x>

Hagenkamp, M., Blanke, T., & Döring, B. (2022,.). Thermoelektrische Lüftungswärmepumpe – theoretisches und praktisches Potenzial. *e-nova International Conference* (pp. 173-178). Pöfnitz: Verlag Holzhausen. ISBN: 978-3-903207-64-6

An invention of the Aachen University of Applied Sciences.

Competitive Advantages

- Reheating largely uses renewable energy
- Requires about 25% less electrical energy than a conventional heating rod
- Little space required (similar to an under-counter device)
- No noise emissions
- Simple electrical installation

Technology Readiness Level

1 2 3 4 5 6 7 8 9

Technology concept formulated

Industries

- Heat pump technology
- Warm water treatment, flow heater and water boiler manufacturers
- Thermoelectric element manufacturers

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