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Halving the electricity consumption by adding a heat pump system in a household dishwasher

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Heat pump systems have been used for a long time in refrigerators and freezers, and the industry has driven the development of small, high quality, low price heat pump components. The low price of good quality heat pump components, along with an increased willingness to pay extra for lower electricity consumption and environmental impact, make it possible to introduce heat pump systems in household products as tumble dryer and dishwasher. The first heat pump tumble dryer was introduced on the market in 2000 and is currently one of the state-of-the-art variants. A modern heat pump tumble dryer consumes 65% less electricity comparing a traditional variant.

The first heat pump dishwasher was introduced on the market 2014. It uses only the heat pump system for heating in the washing and rinsing steps. In the drying step, was a traditional open drying method used where the humid air vents into the kitchen.

The heat pump system, evaluated in our research, operates in all steps; washing, rinsing and drying. In the washing and rinsing steps the condenser heats the dishwasher cabinet, dishware and washing water. The evaporator obtains the heat from a water tank where the majority of the heat transfer occurs when water turns into ice in the water tank.

In the drying step, a new drying method was introduced where warm humid air inside the cabinet circulates towards the cold surface of the frozen water tank in a closed system. The drying results were compared to those obtained with a traditional open drying method in which the humid air vents to the kitchen. Results showed that this new drying method was more effective than the traditional drying method.

The heat pump dishwasher, handled in our research, consumes 50% less electricity compared to a traditional dishwasher. It has also a drying method with no diversion of humid air into the kitchen. These two competitive advantages increase the conditions for a heat pump dishwasher to succeed. The trend ought to be the same for the dishwasher as for the tumble dryer where the heat pump variant is dominating the market today.

Keywords: heat pump, electricity consumption, household appliances, dishwasher