Study finds heat pumps more efficient than gas or oil

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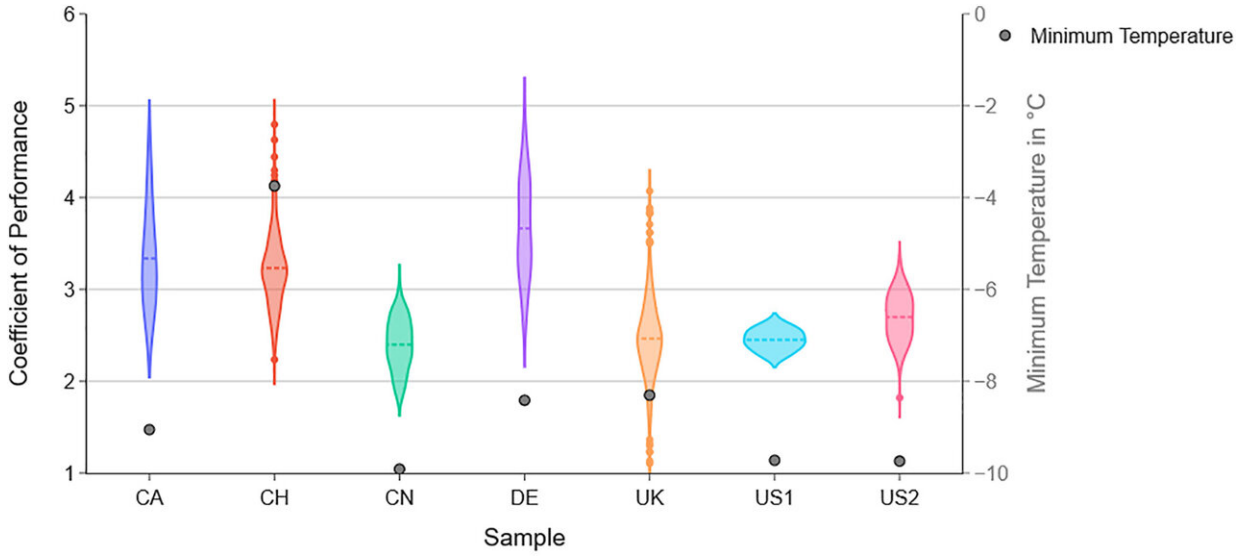

Range of coefficient of performance when outside temperature is between −10 and 5°C. Credit: *Joule* (2023). DOI: 10.1016/j.joule.2023.08.005

As the year 2030 approaches, governments and industry leaders are actively studying ways to meet a European climate law aiming to reduce greenhouse gas emissions by at least 55%. The European Green Deal initiative has set a goal of zero greenhouse gas emissions by 2050.

One way to achieve these goals is to improve home heating efficiency.

Currently, the majority of European homes are heated by oil- and gas-based systems. These approaches are costly, especially as gas prices have soared in the wake of the invasion of Ukraine.

Such fuel energy usage is a key contributor to the pollution the European Union seeks to combat.

A study by Oxford University researchers has found that despite widespread questions about its efficiency, an alternative—heat pumps—in fact operate more efficiently and with lower pollution than gas and fuel systems.

In a paper published in *Joule*, researchers say studies conducted in several countries confirm heat pump efficiency "is significantly higher than fossil fuel and electric resistive heating systems."

After studies in North America, Asia and Europe, researchers found that heat pumps were two to three times more efficient than oil and gas heating homes and offices in temperatures below zero degrees.

At temperature approaching minus 30 degrees, heat pumps still showed an impressive advantage, up to double the efficiency of oil and gas.

Some countries are increasingly turning to heat pumps, though not all embrace the approach. In the United Kingdom, where heat pump adoption is one-tenth that of France, there has been widespread belief—spread in part by gas and oil advertising campaigns—that heat pumps don't work well in low temperatures.

The Oxford study debunks that belief.

"Heat pumps can provide the most efficient heating in many cold climates around the world," said Duncan Gibb, a senior advisor at the

Regulatory Assistance Project who contributed to the report. The Project focuses on heat decarbonization policies.

"As most European countries experience milder winters with minimum temperatures above minus 10°C," he said, "our analysis suggests that heat pumps can be successfully installed in these conditions without concerns over performance or the need for back-up heating capacity."

Heat pumps work by transferring heat from one location to another. Generally, heat is removed from cooler areas to a warmer one.

There are three key types of heat pumps: air-source, used for both heating and cooling, in which heat is removed from outside air and transferred indoors; water-source, where heat from a well, pond or lake are brought inside; and ground-source, in which the relatively stable temperatures of the ground provide a flow of heat indoors.

The Oxford researchers used air-source pumps in their study.

"Our view is that the widespread rollout of air-source heat pumps around the world as part of decarbonization efforts can be successful with existing technology in most areas that have space heating demand," Gibb said.

Heat pumps are seen as more energy efficient because they transfer heat rather than generating it. They can be utilized for both heating in winter and air conditioning in summer. They are also quieter than oil and gas based systems.

European officials are exploring tax breaks and other incentives to encourage broader use of heat pumps, which have installation costs up to three times greater than gas tanks.

"This research reveals that there is no technical reason why heat pumps cannot be widely used in every European country," said Gibb.

More information: Duncan Gibb et al, Coming in from the cold: Heat pump efficiency at low temperatures, *Joule* (2023). DOI: 10.1016/j.joule.2023.08.005

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