How should governments subsidize clean-energy heating?

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Transitioning to low-carbon energy production is a big climate challenge to overcome. Many countries are already looking to adopt clean heating solutions more widely, with the International Energy Agency projecting

that by 2045 nearly half of global heating will be done with heat pumps. To ensure speedy uptake, governments are likely to offer subsidies to ensure these energy-efficient options actually make their way into homes and offices.

A new study from Aalto University assesses the impact of heat pumps on energy consumption as well as how heat pumps should be subsidized. These devices run on electricity to warm spaces by efficiently transferring heat from one area to another, cutting buildings' carbon footprints significantly.

"My research shows that a heat pump can reduce carbon dioxide emissions from heating by more than 80 percent. Electrifying heating means we can warm our homes and buildings cleanly. Heat pumps are also truly energy-efficient: they can can produce up to four units of heat for every unit of electricity," says Jussi Vimpari, a post-doctoral researcher at Aalto University.

In the study, Vimpari compares the prices, rents, heating systems, and emissions from heating, and the percentage of residents' income spent on heating in all residential buildings in eight large Finnish cities, including those in the capital region of Helsinki. In Finland, city buildings are typically heated with oil, district heating, or electricity. Only 15% of heating in the country is currently done with heat pumps.

An average of about 9 percent of household income was spent on heating and installing a heat pump reduced this to roughly 4 percent. The investment required for the pump was an average of €3,800 per resident, unsubsidised, with the cost recouped through lower heating in just over ten years. In Finland, the cost of the unit and its installation is subsidized up to 25-50 percent.

The findings also show that neighborhoods with lower housing prices are

less motivated—and likely less able—to invest in heat pumps.

"In areas with high prices, the cost of the heat pump is just a small fraction of the overall cost of the home, around one percent. But in areas where homes are valued at lower prices, the relative cost of the device seems to be too large to invest," Vimpari explains.

This division in purchase habits means subsidies are going to areas where homeowners are likely to buy the device—even without the monetary incentive. Vimpari says potential subsidies should be allocated to those who would benefit the most.

"When the cost of the heat pump amounts to a larger percent of the cost of the home, the owner has less motivation and capability to make the investment. This may be especially true because income correlates with housing prices: owners may want to heat their homes more efficiently, but just cannot afford the upfront cost. If governments want to help citizens transition to clean energy, they need to think about those who need the benefits most," says Vimpari.

Some countries like the United States or Germany still rely mainly on gas boilers for heating, as fuel still costs less than electricity in these markets. The European Union, however, has discussed banning gas boilers in new buildings in efforts to move away from fossil fuels; member nations like Finland promote heat pumps for their energy-efficiency, while neighboring Sweden spurred sales of the device when they introduced tax on heating oil in the 1990s.

"Eventually all heating has to become non-fussil fuel based. Currently, the electrification of heating with heat pumps looks like the most efficient way to do this, as we have the means to produce emission-free electricity and heat pumps can convert that electricity to heat with very high efficiencies," Vimpari notes.

More information: Jussi Vimpari, Should energy efficiency subsidies be tied into housing prices?, *Environmental Research Letters* (2021). DOI: 10.1088/1748-9326/abfeee

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