

Energy inefficiency can short circuit cooling India

As Indian homes will be a key site where future cooling demand will play out, awareness of energy efficiency is crucial



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More frequent and intense heat waves are expected with a rise in global temperatures due to climate change. In the last three decades, there have been 660 heat waves across India causing 12,273 deaths (<https://bit.ly/3pXxtNj>). India, with currently low penetration levels of air conditioners (ACs), will likely require substantial cooling services to keep citizens healthy and productive. The India Cooling Action Plan (<https://bit.ly/3pZNm5B>) projects the number of room air conditioners to become about four times in the next 10 years, and about 10 times in the next 20 years, making India the world's largest energy user for cooling.

Scant data

Here lies a conundrum. Cooling will likely be at the forefront of India's adaptation to climate change, but if cooling needs are met with inefficient ACs, it could be the bane of India's mitigation efforts. Indian homes will be an important

site where this conundrum between cooling needs and potential emissions will play out. Despite its clear importance, the implications of an increase in residential cooling demand have not been carefully examined. Estimates of AC ownership and usage, the two factors which will determine the extent of future cooling demand, have little empirical backing. We know little about what cooling appliances people seek, and how and why people make their purchase decisions. The pursuit of energy efficiency, too – for instance, who buys efficient technologies and why – remains underexplored.

Delhi survey results

In a recently published paper (<https://bit.ly/3vBtTtu>) in the *Environmental Research Letters*, my colleagues and I look at household cooling patterns, and unpack household characteristics that are leading to increased use of air conditioners and adoption of energy efficient choices. The findings are based on a door-to-door household survey in areas of Delhi, with above average levels of AC penetration.

We find that the desired levels of cooling vary greatly even among relatively homogenous communities. In Delhi's wealthy neighbourhoods, 43% of the households own an AC, 39% own coolers and 18%



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only have a fan. Further, the way households use ACs also differs quite a bit. While most households use an AC for three to four hours a day during peak summer months, about 15% use ACs for over eight hours a day. It is interesting to note that the India Cooling Action Plan in its estimation of residential cooling demand, assumes that an average household uses an AC for eight hours a day, which as per our study seems to be an upper bound. People prefer different AC set-point temperatures, again indicative of varying perceptions of thermal comfort. Half of the households set their ACs between 24°C-26°C, and 27% prefer their AC temperature to be between 21°C-23°C. This wide range of preferred AC temperatures have important implications on energy demand requirements, as every 1°C increase in AC set-point temperature can lead to additional 6%

energy savings (<https://bit.ly/2TDcd3j>).

Unfortunately, energy efficiency does not feature as a priority in the purchase of cooling appliances. Only 7% of the households have an energy efficient (star-rated) fan, and 88% of the coolers are locally assembled. Most people prefer to buy a three-star AC, and less than 20% of AC-owning households bought the highest rated five-star AC.

An obstacle

Large-scale adoption of efficient cooling appliances will be essential to providing the required thermal comfort in a low carbon manner. We find that low levels of energy efficiency awareness are a major bottleneck that hinders the purchase of more efficient appliances. A third of the households did not know of the Star Labelling programme, which is a government programme mandatory for refrigerators and air conditioners. Of the households that had heard of the programme, only half of them understood what it meant. We find that it is this set of informed households that are more likely to own a higher efficiency AC, and also likely to use the appliance efficiently. Higher upfront cost and low market availability of more efficient air conditioners (four-star and five-star) are other

reasons for buying a less efficient AC. We find that many households also use alternative cooling strategies to keep cool, with the use of a fan being the favourite non-AC cooling option, and use of non-energy cooling methods such as natural ventilation being a common practice. Households using such non-AC cooling methods were found to use their AC for fewer hours.

Other solutions

The impending cooling demand transition in India offers a potential advantage. Because a majority of investments in cooling technologies, infrastructure, and behaviours are yet to be made, there is a unique opportunity to lock-in energy efficient consumption patterns. Awareness campaigns on the benefits of energy efficiency along with subsidies and financial incentives that help with the higher upfront costs can help drive up the adoption of more efficient technologies. Encouraging the use of passive cooling alternatives including energy efficient building designs can help provide the desired thermal comfort with reduced dependence on energy intensive cooling technologies.

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