

Why is it time to redesign the air conditioner?

Air conditioners have been around for nearly 100 years, but it's still underdeveloped and the technology is basically the same as the day they were invented.

Air conditioners have changed our lives, making people able to grow and survive in places where the heat will make life unbearable. Air conditioning is also essential for businesses and a range of technologies based on temperature and humidity control, such as Internet servers or data centers.

But all this has its price. Air cooling is generally responsible for 10% of the planet's electricity consumption, according to the International Energy Agency. And as the world heats up, the demand for air conditioners will only increase, especially in developing countries. This in turn will increase the effect of cooling devices on the climate, thereby warming the Earth and creating a vicious cycle.

Clearly, the current technology of air conditioners is not sustainable. That's why a new alliance - led by the Indian government and the American Rocky Mountain Institute (RMI), a non-profit environmental research organization - has launched the Global Cooling Awards, a \$ 1 million contest just to design the next generation air cooling system.

"The first home air conditioner was marketed in 1926 by Willis Carrier, who died long ago," Iain Campbell, RMI's chief executive, said in a telephone interview. "If we bring him back to life and show us today's air conditioner products, he not only knows what it is but can also tell you how it works."



Air-conditioners line up outside a building in downtown New Delhi.

There are 1.2 billion air conditioner units installed today, but that number will increase to 4.5 billion by 2050, according to the RMI report. "The impact of that on electricity demand will be huge," said Campbell, co-author of the report. "The dilemma is that it has to pay for the environment, which we can't afford. It's a climate threat that you can't see in the rearview mirror, but when faced directly, it will be huge. "

The award, the Global Cooling Prize, has a specific set of guidelines for participants, with the requirement to design a cooling solution that has an impact on the climate less than five times the current popular method. That is, that technology can help counter environmental impacts according to future growth needs.

And to allow this idea to work, proposed designs are allowed to be more expensive than existing air conditioners, but no more than twice. In theory, higher prices will be offset by cheaper operating costs. "If a technology is twice as expensive and uses a quarter of the electricity, the payback is simply about two and a half years," Campbell explained.

However, participants had to follow 7 additional rules, most of which were designed to prevent what Campbell called "unintended consequences", such as excessive use of water or soil minerals, rare, as well as restrictions on fuel combustion and insulation.

The eight finalists will build prototypes that will work both in the lab and in real-life conditions in an apartment complex in Delhi. "We will take the 60-day test at the peak of summer in Delhi," Campbell said. "India will be the largest cooling market in the next 30 years, from less than 14 million air conditioner units to nearly one billion by 2050. They will need to double the size of their electricity systems. to get there. "

Up to now, the competition has attracted more than 2,100 participants from 95 countries. From a long list of 139 teams, eight finalists were given \$ 200,000 to develop prototypes and send them to India for testing in the summer of 2020.

Three of these people are from India, three are from the US and one is from the UK, one from China.



An air conditioner is assembled at a factory in Jhajjar, India.

The proposed designs use a range of technologies, from vapor compression to evaporative cooling. Barocal, a spin-out start-up (a derivative subsidiary for sale by the parent company) of Cambridge University, uses solid state cooling technologies instead of traditional liquid refrigerants that have may leak over time. Meanwhile, a proposal from Kraton, a Texan chemical engineering company, simply uses water, completely eliminating the main mechanical component of air conditioners and compressors, to Makes design more scalable and affordable.

Other participants focused on the limitations of existing air conditioners, such as the lack of control over both temperature and humidity. The design proposed by American startup M2 Thermal Solutions allows users to set both a specific temperature and humidity level in a room.

It's hard to say what these proposed new machines will look like before actual prototypes are built, but arguably they will also be aesthetically pleasing, since most designs are on the list. The book is based on a technology that is fundamentally different from traditional devices.

The overall winner, announced in November 2020, will be awarded \$ 1 million in prize money. But this is when the real challenge begins: It is convincing the world that traditional air conditioners need replacement.

"The air conditioner industry is currently worth more than \$ 100 billion and has a well-established value chain - from manufacturing and distribution to after-sales support," said Kraton senior vice president Vijay Mhetar. , said. "Any new design needs to have minimum barriers to customer adoption and have a similar supply chain set up."



Workers install an air conditioner unit in a food store in Shanghai.

According to Xavier Moya from Barocal and Cambridge University, the challenge is to convince people to buy an air conditioner based on performance and climate impact, rather than just its price. "The shift in consumer perceptions can also be helped by reducing the sale of environmentally unsustainable designs," he added.

But why has the air conditioner changed so little since it was invented in 1902? According to Ryan Melsert, CEO of M2 Thermal Solutions, the company behind the competition said it could be due to "out of sight" attitude towards the product.

"These systems are all around us, but are hidden in the cabinets and basements of homes, in utility rooms of businesses, or under the hood," he said. "Because they are rarely seen, customers are very tolerant of this lack of innovation."



Air conditioner hanging on the wall of an office building in Fuzhou, Fujian Province, China

Over the past century, most of the investments in the industry have made traditional designs cheaper, according to Vijay Mhetar, although the best model on the market today is only reasonably effective. The theory - the ratio between heat removed and energy used - is 14%. That's low compared to more efficient technologies like lighting and solar cells, 67% and 28%, respectively, according to the RMI report.

"We believe that a step in performance change will probably come from an entirely new design, invented from outside the industry," he said.

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