

### Duke File (IDF) Number

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### Meet the Inventors

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### Department

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Mechanical Engineering and Materials Science  
(MEMS)

### Publication(s)

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### External Link(s)

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• [From the lab of Po-Chun Hsu](#)

## A dual-mode device for energy saving of building

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### Unmet Need

Buildings account for over 30% of energy consumption and about 10% of global greenhouse gas emissions. 48% of a building's energy consumption can be accounted to heating and cooling needs, and this is expected to increase over 75% over the years 30 years. Statistics show the annual building energy cost is over \$430 billion in the U.S. This causes serious problems to both our environment and economy. While there are several highly performing heating and cooling solutions with low carbon footprint, most of them focus on providing either heating solutions or cooling solutions. However, when one spans the climatic zones across the United States, one can see that more than 50% of places might requiring heating as well as cooling, albeit at different times of the year. Thus, this creates an unmet need for a high performance, energy-saving, flexible heating and cooling solution which can be manufactured at a low cost and can be integrated in the pre-existing systems.

### Technology

Duke inventors have reported a device that allows flexible switching between heating and cooling mode without affecting performance. The developed invention uses solar heating and radiative cooling. The device performance is predicted to be excellent across all the climate zones in the United States. This is attributed to the device's high energy saving performance in heating-only, cooling-only as well as dual-mode operation. It is expected that this technology could increase monthly energy consumption savings up to 45.8%. This would not only reduce the cost of energy to the consumer, but also reduce carbon footprint for residences as well as commercial buildings. A lab-scale prototype has been tested.

### Advantages

- Incorporates heating and cooling, flexible, high efficiency, energy-saving solution in the same device
- Device predicts outperforming the conventional systems in only-heating, only-cooling as well as heating and cooling mode, thus having universal applicability
- Device manufacturing has the prospect of being low-cost and scalable

