

2017 ENERGY STAR® EMERGING TECHNOLOGY AWARD: Solid-State Refrigeration

What is the ENERGY STAR Emerging Technology Award?

Launched in 2011, the ENERGY STAR Emerging Technology Award raises the profile of innovative technologies that have the potential to significantly reduce greenhouse gas emissions once they are more widely adopted. For 2017, EPA is pleased to recognize **Solid-State Refrigeration** products with the ENERGY STAR Emerging Technology Award.

Key Criteria

In refrigeration products, the use of solid-state cooling modules as an alternative to compressors can offer customers **energy savings** along with **superior product performance**. Winning technologies must demonstrate the following:

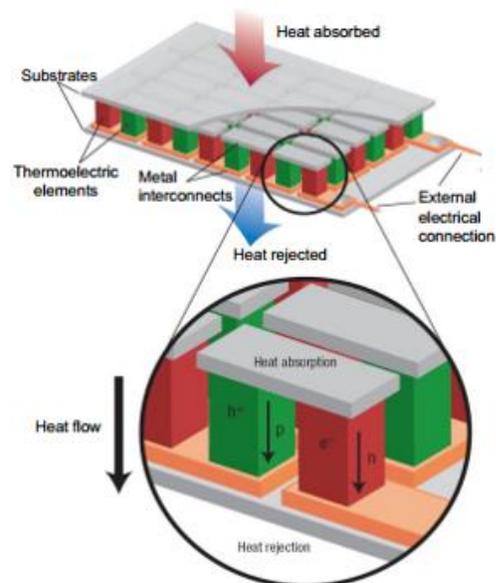
1. Use solid-state cooling as an alternative to a compressor
2. Outperform ENERGY STAR Laboratory Grade Refrigerators or California Energy Commission (CEC) Cooler efficiency requirements by 15% and 5% respectively
3. Noise level during use below 45 decibels (dBA)
4. Approved for use and available for sale in the U.S. market

Technology Description and Benefits of Solid State Cooling

Solid-state refrigeration products operate without a compressor. This greatly reduces the need for refrigerants, eliminating them altogether in some products. When solid-state products do require a refrigerant, they use carbon dioxide. The global warming potential (GWP) of traditional refrigerants such as difluoromethane (HFC-32) is 650, while the GWP of carbon dioxide as a refrigerant is 1¹.

The elimination of compressors also drastically reduces sound and vibration. For products used in residences this feature can improve the consumer experience. In laboratory and medical applications, the reduction of vibration is also a significant benefit, as vibration can disturb sensitive contents of the refrigerator and surrounding equipment.

These products can operate without compressors because of a material phenomenon known as the Peltier effect. The Peltier effect (or thermoelectric cooling) occurs as a current is passed through the junction of two different semiconductor elements (n-type and p-type). There is a decrease in temperature at the junction, as thermal energy is carried along the semiconductor elements via electron transport. Heat is thereby removed from the system (refrigeration product interior) and transferred to the outside environment (heatsink).



G. Snyder, et al., Nature Materials Vol 7 (2008)

¹ http://www.ipcc.ch/publications_and_data/ar4/wg1/en/errataserrata-errata.html#table214

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Emerging Technologies and the Pathway for Commercialization

This Award is part of EPA's effort to assist in the commercialization of new technologies that have significant potential to reduce CO₂ emissions if they are more widely adopted. In the future, if this and other emerging technologies are more widely adopted, they could become prime candidates for inclusion into the ENERGY STAR Program, which would further accelerate the commercialization pathway and provide additional savings to consumers.

Products Potentially Eligible for the 2017 Award Include:

- Wine Coolers
- Laboratory Grade Refrigerators
- Residential Refrigerators*
- Commercial Refrigeration*

Utility Rebates and Incentives

EPA will work with efficiency program sponsors across the nation to identify and encourage rebate offerings for the use of solid-state refrigeration products. Utility and product manufacturer stakeholders interested in more information on establishing a rebate program, or about existing incentives should contact EmergingTech@energystar.gov.

Other EPA Resources

- **Questions about proper refrigerant recovery or appliance recycling?** Please contact EPA's Responsible Appliance Disposal Program. For more information visit: <https://www.epa.gov/rad>
- **Questions about the type of refrigerants or refrigeration systems in food retail locations?** Please contact EPA's GreenChill Program. For more information visit: <https://www.epa.gov/greenchill>



*The 2017 Award criteria only include wine coolers and laboratory-grade refrigerators, as these were the only market spaces where the EPA has identified efficient solid-state products. EPA will evaluate other product categories as submitted, per the Award [criteria](#).