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Post Covid -19; Engineers rise to off-grid refrigeration challenge

NY, NY 27 MAY 2020: Seven initiatives to develop affordable refrigeration technologies in the developing world have been selected for grants ranging from $30,000 to $50,000.

The winning projects have been announced by Engineers Without Borders USA (EWB-USA) in its Chill Challenge initiative launched last year.

The Chill Challenge seeks to support affordable refrigeration technologies for off-grid households in the developing world. Seen as having enormous potential for improving the lives of millions of the poorest and most vulnerable people on the planet, off-grid refrigeration means less food waste, more opportunities for farmers and improved nutrition for households. In addition, as highlighted by the COVID-19 pandemic, refrigeration is critical for delivering vaccines and other health care services to remote off-grid communities.

The following teams will be awarded grants ranging from $30,000 to $50,000 to develop their innovative concepts:

Purdue University, Ray W Herrick Laboratories, West Lafayette, Indiana, USA
Cold storage battery for domestic refrigeration

This project will evaluate the use of heat from clay or brick cookstoves to drive an intermittent sorption refrigerator, which requires no electricity to operate. The generated refrigerant does not need to be immediately discharged, but can instead be stored and expanded later to provide cooling on demand.

In charging mode, a heat source is used to generate refrigerant which is stored for use during discharging. In discharging mode, the refrigerant is expanded to create cooling on demand. The cold storage battery is designed to be used alongside existing wood-fired cookstoves, although other fuel sources could be used including solar thermal energy.

New Leaf Dynamic Technologies, New Delhi, India
Ice maker powered by farm waste

New Leaf has developed, and is currently deploying, its GreenChill ammonia refrigeration system to provide safe storage and cooling of perishable agricultural produce. The system is powered by farm-waste such as straw, cow dung, biomass pellets, wood and hay, etc, and can cool up to 1,500 litres of milk or 15 tonnes of perishables goods without the need for electric grid power or diesel generator backup.

New Leaf estimates that the system will need about 105kg of wood equivalent biomass per day to produce 1000kg of ice. The system will also require about 500W of electrical supply to run auxiliary equipment, which will be provided by solar PV with battery backup. More than 25 systems have been installed in locations across India. Under this grant, the company will use its GreenChill technology to build a 1000kg/day ice maker to produce ice at a cost of 0.02 US$/kg.

Arup, London, UK
Passive cooling box

Consultant Arup's advanced digital engineering team will test a refrigeration system using passive cooling materials that emit heat as infrared radiation through the atmospheric transmission window into space. Phase change materials will provide cold storage. Arup has investigated the use of passive cooling materials in the built environment and, in partnership with housing nonprofits, is working to scale up deployment of reflective roofs in developing countries.

Under this grant, Arup proposes to build a completely passive cooling box capable of achieving the 3°C target temperature and maintaining that temperature across several days of adverse weather conditions. The container will rely on radiative cooling materials as a cold source and phase change materials as cold storage.

Radiative cooling materials are solid-state materials designed to emit heat, in the form of infrared radiation, through the "atmospheric transmission window" into space. Recent research has developed materials that are also highly reflective of sunlight, which permits them to cool themselves well below ambient temperatures, day and night, without any electricity or refrigerant required. It has been demonstrated that these materials can cool themselves substantially below 0°C when "parasitic" heat flows are

minimised.

Xergy Inc, Harrington, Delaware, USA
Off-the-grid refrigerator utilising solid-state refrigerants

To address the off-grid refrigeration challenge, Xergy will build a refrigerator utilising an intermittent adsorption refrigeration cycle driven by solar thermal energy.

The unit will use hydrogen and metal hydride as the working pair, and employ an advanced heat exchanger design, which the company believes will result in an efficiency of 70%. The system will store hot water to provide refrigeration for "dark days" without solar input. If successful, the team believes the refrigerator would provide a simple, easy to maintain solution for remote off-grid communities. Xergy has also proposed using the same refrigeration process in an icemaker.

Solar Cooling Engineering, Hohenheim, Germany
Solar ice maker using key components and engineering

The team from Solar Cooling Engineering, in collaboration with the University of Hohenheim, has been carrying out research on solar cooling for the last six years. Their work has included a solar ice maker developed for milk cooling, with 18 systems deployed in Tunisia, Kenya and Colombia.

Since 2018, the company has been promoting the use of SelfChill, solar cooling units which can be combined with locally produced refrigeration cabinets to provide flexible and lower cost refrigeration solutions in communities in developing countries.

For the Chill Challenge, Solar Cooling Engineering will use its SelfChill solar cooling units in an icemaker capable of producing 100-120kg of ice per day. These units use DC direct-drive vapour compression technology with R600a (isobutane).

The ice maker is powered directly by PV panels or, optionally, with electrical batteries. The provided control unit integrates a smart algorithm to command the compressors in dependence of solar energy availability.

A Bluetooth smartphone connection is included for monitoring, and the system is fully pay-as-you-go enabled.

Purdue University, Ray W Herrick Laboratories, West Lafayette, Indiana, USA
Combined Heating and Cooling for Agricultural Applications

This research will examine the potential for using a combined heating and cooling vapour compression system to produce ice and to dry crops.

While vapour compression refrigeration systems have a high initial cost, a combined system, which uses the evaporator capacity to create ice and the condenser heat to dry crops, may provide a way to offset that cost.

The research will evaluate food drying and storage practices, including their prices and seasonality. Potential applications of the technology will then focus on locations that produce food items that command high value and/or are available throughout the year, as these will provide more benefits than seasonal food items.

The team proposes to build a system that generates 100-150kg of ice per day, using a vapour compression cycle with R290 (propane) as the refrigerant and solar PV as an energy source.

Imperial College London, Clean Energy Processes (CEP) Laboratory, South Kensington, UK
Affordable decentralised off-grid ice making

The CEP Laboratory at Imperial College London and Solar Polar have been developing a thermally powered technology, called diffusion absorption refrigeration (DAR), which can be easily integrated with low-cost solar thermal collectors or that utilise waste heat to provide cooling. The simple construction and lack of moving parts of DAR devices promise low costs and long lifetimes.

Under this grant, the CEP team proposes to design and demonstrate an innovative, affordable ice maker based on DAR technology. The team will replace the ammonia-water pair typically used in DAR devices with alternative working-fluid pairs in optimised unit designs. The team expects that these innovative designs of the device and the molecular design of the new fluids will enable a COP almost 1.5x higher than that of conventional ammonia-water systems. Based on this technology, the CEP team proposes to build a simple, robust and affordable ice maker using hot water from solar-thermal collectors, specifically aimed at developing, remote or off-grid communities.

Challenge attracts 43 entries
The Chill Challenge was launched in September 2019, to solicit innovative proposals for more affordable refrigeration for off-grid communities. In response, EWB-USA received 43 proposals from 36 teams from universities, companies or NGO's, and individuals. Sixteen were US-based, and 20 were located overseas, including teams from Cameroon, Ethiopia, France, Germany, Nigeria, South Korea, Switzerland, Uganda and the UK.

Fourteen of the best proposals were shortlisted, and final grant winners were selected by a panel of reviewers, including EWB-USA volunteers and international refrigeration experts.

Engineers Without Borders USA was formed in 2002 to harness the power of engineers to complete high-impact projects in developing countries. Since then, EWB-USA has grown from a handful of passionate individuals to thousands of passionate volunteers working on hundreds of engineering projects across the globe.

7 refrigeration tips to save retailers money

Supermarket news article;
Cooling costs can eat into profits quickly, but grocers can fight back with these energy-saving tips Davina van Buren
May 19, 2020

According to the U.S. Small Business Association, cooling costs can account for up to 60% of total electricity consumption in facilities that rely on commercial refrigeration.

The bad news: walk-ins, reach-ins and display cases—essential elements in grocery stores—are among the biggest energy wasters. However, the good news is that this area represents a huge opportunity to increase energy efficiency.

Energy efficiency in action

When Boise Co-op opened a second location in 2015, the leadership team noticed energy costs were much lower than at the flagship store.

“This reaffirmed our belief that we needed to do some equipment upgrades,” said Mo Valko, director of marketing and merchandising . “There have been so many advancements in refrigeration technology in the past 10 years. Upgrading was an investment up front, but in the long run, it pays for itself in terms of incredible energy savings.” The co-op also worked with the local power company to perform an energy audit, a service typically offered for low or no cost.

“That can be a great way to get the most bang for your buck as far as savings. Maybe it’s not refrigeration, maybe it’s lighting — they can help you determine where your business is wasting energy and offer solutions.” Valko said there are also aesthetic benefits to the new system.

“They look nicer, are more modern, and have sensor lights. When no one is in the aisle, the lights go out, and as someone walks down the aisle the lights come on. Customers really like it.” If you’re looking to improve energy efficiency in your grocery operation,

refrigeration should be at the top of the list of options to explore. Here, we offer seven key tips to get you started.

1. Keep doors closed.

Small improvements to refrigerator doors can dramatically increase energy efficiency. First, check the seals around the frame. Loose seals allow cold air to escape, which makes the motor run harder to keep the space cool. You should also check door gaskets and auto closers regularly to make sure they are in good working order. Otherwise, warm air can enter refrigeration compartments, leading to energy waste and food safety concerns.

2. Organize everything.

Make sure like items are grouped together in the cooler or freezer in order to maximize productivity once inside — units should be kept as full as possible without overfilling. Allow space for good airflow and employee movement.

3. Load cold items immediately.

Refrigeration units work harder to cool warm or room-temperature items. Make sure cold deliveries are unloaded immediately to avoid placing strain on your cooling system.

4. Give it some space.

Just as you want good circulation inside the cooler, make sure the refrigeration system has enough space around the outside to ensure good airflow over the heat exchange coils (which should themselves be cleaned regularly).

5. LEDs for the win.

LED lighting offers a double whammy in terms of savings: not only do they consume less energy outright, they generate less heat, which means less electricity is needed to keep products cool. LEDs also improve visibility, especially in areas where customers tend to be more selective. The better that pricey steak looks under the light, the more inclined shoppers are to buy.

6. Close open display cases.

Open display cases can use up to four times as much energy as closed cases. It's a big investment, but if you want to see significant energy savings month over month, this is your ticket. At the very least, install night curtains on open cases when the store is closed.

7. Upgrade your equipment.

When purchasing any new equipment, make sure it contains the EPA Energy Star logo. Energy Star certified appliances—including commercial refrigeration equipment—save operators a minimum of 30% on refrigeration costs from day one. This represents an enormous savings opportunity, especially if your equipment is in need of replacement anyway. Often, the cost of new refrigeration equipment can be offset by rebates and vouchers from local energy companies. Ask your equipment retailer for details.

This article originally appeared on New Hope Network.