

# Investigating the links between produce safety, energy efficiency, and waste reduction.



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Per the Intl. Institute of refrigeration, the cold chain consumes about 17% of the overall electricity used worldwide!

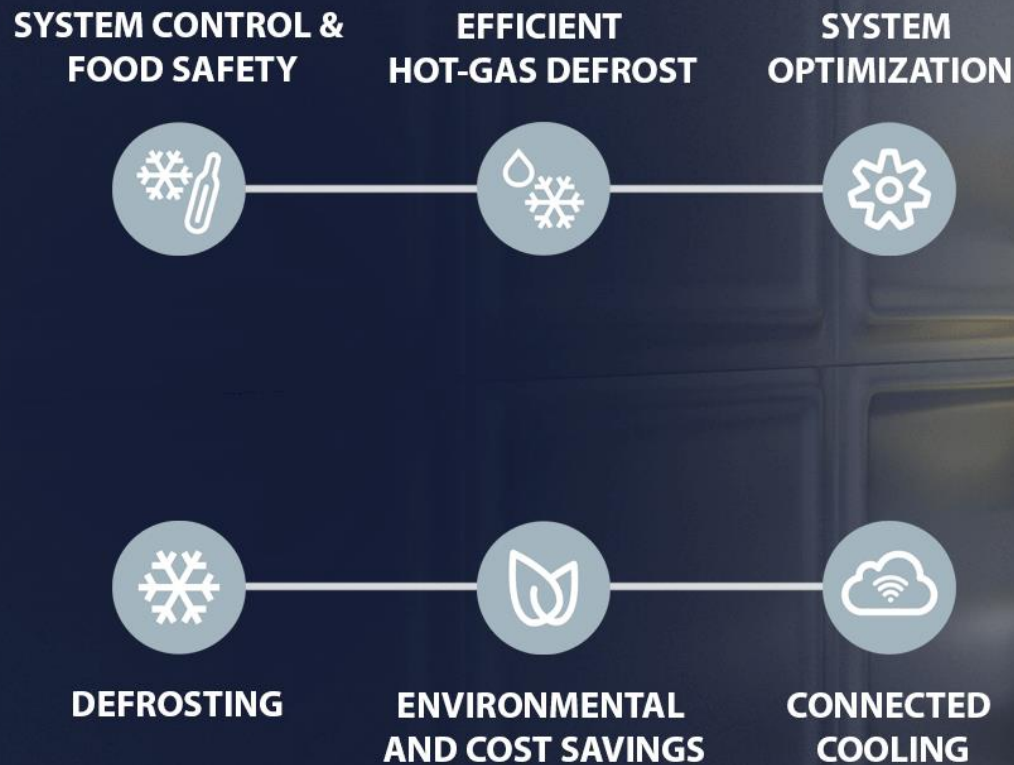


Photo: theengineringsmindset.com

- Cold storage facilities consume an average of 25 kWh of electricity and 9,200 Btu of natural gas per sq. ft. per year, amounting to roughly 50 percent of the average produce farm's energy budget.
- Problem: legacy cold rooms have outdated vertical condensing units with low efficiency, meaning a high  $\Delta T$  between refrigerant and evaporator. This leads to condensation; drip pans act as reservoir for halophilic pathogens like *listeria* and *clostridium* –clogs occur resulting in drip or condensate. One of the most commonly observed areas of concern on PSR initial inspection site visits.
- A kick in the seat of the Pants: §112.126(b) *you must implement measures to prevent contamination of your covered produce and food contact surfaces in your buildings, as appropriate, considering the potential for such contamination through: 1) Floors, walls, ceilings, fixtures, ducts or pipes; and 2) Drip or condensate.*
- Solution: Farms are eligible and should be encouraged to apply for smart controller system and newer horizontal condensing units as Energy Efficiency Improvement (EEI) Projects under the USDA Farm Bill Rural Energy For America Program (REAP) -2 cycles, 9/30, 3/31. Projects <\$80,000 only require an Energy Assessment, and will reimburse 25% of costs. Min. match =\$4,500. Min. project =\$6,000.

Smart cold rooms are the future of food storage. A cloud-based energy management system enables any food handler to optimize its energy-use based on factors such as real-time energy price fluctuations, external temperature, and grid demand.

<https://theengineeringmindset.com/its-time-for-a-smart-cold-room-revolution/>

- In a typical refrigerated packhouse, 15% of electricity consumption is used for running pumps, motors, fans, conveyors and lighting systems, 5% is for sanitation and cleaning, and the remaining 80% is used for cooling, freezing and refrigeration. For this reason, many cost-effective energy savings opportunities exist for large cold rooms.
- In food production, energy efficiency is particularly important as commodity prices, including food, tend to be linked to global energy prices. As world energy prices fluctuate and show upward trends, so do food prices, which in turn lead to a sharp increase in food insecurity. This could be avoided through the use of technology that a) consumes less energy and would create a food sector that is less dependent on fossil fuels, whose prices fluctuate, and b) is ready for integration with renewables, where cold rooms could act like a giant battery to balance energy peaks by running compressors when renewable energy on the grid is plentiful and shutting off when wind stops blowing or the sun isn't shining.

(inspriefarms.com)

Component	How	Energy Savings
<i>High-efficiency compressor</i>	New generation compressors use less energy to supply a given pressure.	4-10%
<i>Electronically commutated evaporator-fan motors</i>	They offer an operational efficiency of 50% to 60% These motors also run cooler and typically have a longer operating life.	5-19%
<i>Electronically commutated condenser-fan motors</i>	They use a built-in inverter and a magnet rotor, and as a result, are able to achieve greater efficiency in air-flow systems than conventional AC motors.	3-8%
<i>Variable speed drive (VSD) fitted to the compressor</i>	This type of compressor uses a special drive to control the speed (RPM) of the unit, which in turn saves energy compared to a fixed speed equivalent.	9-19%
<i>Structure insulation (+25 mm)</i>	Rigid polyurethane foam allows thermal-insulation for higher retention of desired temperatures.	6%
<i>Sealing</i>	High density/ automated doors and plastic strip curtains are a cheap and efficient method to keep the cool air inside when shifting produce to and from the cool room.	1-6%
<i>High-efficiency lighting</i>	LED solutions consume much less energy and have a longer duration than traditional incandescent bulbs.	<19%
<i>Energy management system and/or controls</i>	This controls how much energy components use, which makes it an important link in the system. Ensuring temperature settings leads to significant savings over time.	<60%
<i>Refrigerants</i>	Shifting to lower-GWP (Global Warming Potential) refrigerants could lead to significant savings over the life of the equipment. Some examples of low (GWF) are R134A and R407F.	Savings calculated on carbon price per tonne

Source: <https://www.inspriefarms.com/what-energy-efficiency-means-in-cold-storage/?lang=ke>

Local utilities offer energy efficiency audits and cost share; farm lending agencies also offer USDA RES/EEI backed guaranteed loans on a continuous application cycle. The combination of utility incentives, project match and guaranteed loans can cover 80% of the expense for a minimum cost project (\$6,000 of \$7,500). States are also piloting Small Manufacturer Energy Waste Reduction funding (Michigan.gov). Even if farms are happy with their current condensing units that they do not wish to replace, they can upgrade cold room insulation, siding (including condensation-resistant siding) and moisture control systems e.g. misters and humidifiers, outside air pre-coolers; *as long as they show a net energy reduction on utility bills and/or an improvement of infrared-sighted R-values during an energy assessment.*

## Consumers Energy Business Energy Efficiency Programs



### Agriculture

(Both Commercial and Residential Agricultural customers qualify for these measures)

ID	Farm Energy Audit		Incentive	Unit	# of Units	Total Incentive
AG101	Farm Energy Audit as Defined By USDA (Tier 2)		\$1,500.00	Farm		
ID	Ventilation (Pre-Notification Required) (Consumers Energy Electric Customers)		Incentive	Unit	# of Units	Total Incentive
AG111a	Circulation, Exhaust or Ventilation Fans	24 Inch to 35 Inch Fan Blade Diameter	\$30.00	Fan		
AG111b		36 Inch to 47 Inch Fan Blade Diameter	\$50.00	Fan		
AG111c		48 Inch to 72 Inch Fan Blade Diameter	\$100.00	Fan		
AG112a	High-Volume, Low-Speed Fans	16-Foot Fan Blade Diameter	\$250.00	Fan		
AG112b		18-Foot Fan Blade Diameter	\$400.00	Fan		
AG112c		20-Foot Fan Blade Diameter	\$500.00	Fan		
AG112d		22-Foot Fan Blade Diameter	\$700.00	Fan		
AG112e		24-Foot Fan Blade Diameter	\$800.00	Fan		
AG113	Fan Thermostat Controller		\$190.00	HP		

The potential for energy savings, crop quality improvements and food safety corrective action avoidance makes a cold room energy audit (or assessment) and energy efficiency improvement project a no-brainer for farms considering their food storage as a significant microbial risk factor. **Controlling condensate in cold rooms should not have to be a business decision that requires a farm to factor economic tradeoffs.**

References:

<https://www.rd.usda.gov/programs-services/rural-energy-america-program-renewable-energy-systems-energy-efficiency>

\*note, the spring 2020 application period has been extended from 3/31 to 4/15 due to COVID-19.

[https://www.energytrust.org/wp-content/uploads/2016/12/ind fs guide coldstorage.pdf](https://www.energytrust.org/wp-content/uploads/2016/12/ind_fs_guide_coldstorage.pdf)

<https://www.uvm.edu/extension/produceportal/case-studies/coolbot-shoestring>



## Small Manufacturers Energy Waste Reduction Incentive Pilot (SMEWRIP)

Energy Services is offering matching grants to small manufacturers located in Michigan to implement energy efficiency activities that can be completed between October 1, 2019 and July 31, 2020. The maximum award is \$15,000 per company, with a minimum 100% match requirement.

Awards will be given on a first come first serve basis with the objective of funding a highly diversified range of energy efficiency activities, such as:

- Technical assistance services from state, federal, and utility energy assistance programs
- Training courses / workshops focusing on energy efficiency
- Energy efficiency program adoption or enrollment
- Energy tracking / benchmarking systems
- Steam trap repairs
- Boiler, chiller, furnace, etc. tune-ups
- Infrared thermal imaging diagnostics
- Ultrasonic leak detection diagnostics
- ASHRAE Level II Energy Audits
- See the [Michigan Energy Measures Database \(MEMD\)](#) for additional potential activities