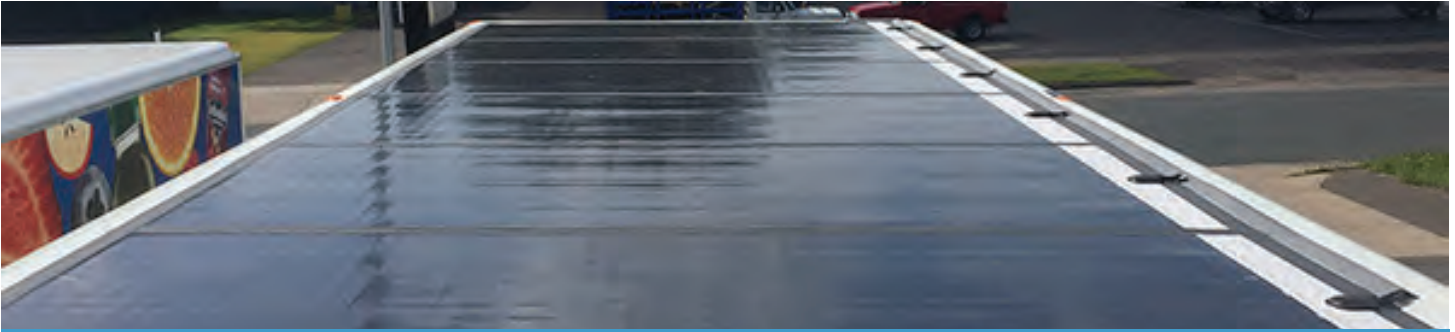




# enow™

## CASE STUDY: SOLAR-BASED REFRIGERATION





## ENOW “RAYFRIGERATION” ZERO EMISSIONS TRU

### The Problem: Fossil Fuel-Burning Diesel Engines and Emissions

- For decades, the standard system used to cool refrigerated trucks and trailers employs an exterior compressor unit powered by a diesel engine. We see and hear them on interstate highways, city streets, in parking lots, roadside rest stations every day.
- Depending on the region, season and route, these engines often run much of the day, all day and overnight. The noise, smoke, emissions, and substantial fuel and maintenance costs, have become the accepted norm in the trucking industry.
- In recent years, the number of refrigerated vehicles has also increased dramatically. Today, there are more than 500,000 trailers with diesel fuel-burning refrigeration systems in the U.S. alone.

### The Solution: Solar-Powered All-Electric System Design

- In 2012, eNow saw the problem and began developing solar systems with advanced photovoltaic (PV) panels. Unlike stationary, heavy, glass-encased solar modules used on buildings, these panels were lightweight, flexible, thin (.125”) yet rugged. eNow’s mobile solar system design has been field-tested on a wide range of vehicles, under harsh conditions, and in hot and cold climates. Now, more than 4,500 trucks/trailers have installed eNow’s system.
- eNow then worked with Johnson Refrigerated Truck Bodies and Emerson Climate Technologies to engineer a hybrid cooling system and insulated box truck. The team jointly developed the first zero-emissions Transport Refrigeration Unit (TRU) for commercial use on a truck making deliveries in an urban area.
- For power, eNow’s advanced solar-based auxiliary power system would charge and maintain optimal power all-day on a high-capacity auxiliary battery system consisting of four 12-volt batteries.
- For this medium-temperature refrigeration application, the team chose both a eutectic medium (cold plates) system and an evaporative compressor system. The cold plates and auxiliary batteries would be initially charged when the truck is plugged into utility or shore power overnight. During the day, the evaporator system along with the cold plate system would keep the van at an even 34° for its typical 6 to 8-hour delivery run.

### The Results: Dramatically Lower Emissions and Lower Fuel and Maintenance Costs

- In 2017, the new zero-emissions TRU, branded “Rayfrigeration,” was tested in a summer-long trial in California’s San Joaquin Valley using a Challenge Dairy Class 7 truck delivering fresh dairy products throughout the Fresno area. Despite the exceptionally hot climate, urban traffic and a long daily delivery schedule, the eNow Solar-based TRU system’s performance surpassed all expectations.
- In the first five months of testing, emission reductions of 98% nitrous oxide, 86% carbon dioxide, and 97% particulate matter were achieved – compared to traditional systems powered by diesel engines. The eNow team calculated that average emissions of CO<sub>2</sub> over a four-day week with an average delivery day of 7.7 hours was reduced from 2,525 lbs./week to 159 lbs. Nitrous Oxide emissions were reduced from 7162 grams to 1.
- During the trial, Rayfrigeration was also projected to reduce operations and maintenance costs by up to 90% over a diesel-powered TRU. (Cost savings are achieved by eliminating fuel and maintenance costs for the diesel APU engine, and increasing battery life which reduces replacement costs, thanks to a consistent charging by eNow solar.)
- The 1,800-Watt eNow solar system provided more than enough energy to maintain optimum temperature throughout a typical day of opening and closing the doors while the truck delivered fresh dairy products in California’s summer heat. Now, Challenge Dairy plans to transition its entire fleet of distribution trucks to solar-powered TRUs.

### Notes:

- The San Joaquin Valley Air Pollution Control District and EPA District 9 funded part of the Rayfrigeration initiative through the Technology Advancement Program that encourages innovation through the development of new emission reduction technologies.
- This refrigeration system technology is now available only through eNow. [www.enowenergy.com](http://www.enowenergy.com)



133 Hallene Road, Warwick, RI 02886 • 401 732 7080 • [enowenergy.com](http://enowenergy.com)

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