



PIONEERS IN  
SOLAR-POWERED REFRIGERATION

**eNow**™







eNow 53-foot all electric solar-based trailer rolls out at 2018 ACT Expo.



## ABOUT THE ENOW SOLAR BATTERY CHARGING SYSTEM

### USING ENOW SOLAR TO CHARGE BATTERIES WILL:

- Save money on fuel by eliminating idling
- Extend run time for auxiliary equipment by maintaining operational battery charge regardless of engine use
- Extend HVAC run time to 14+ hours
- Reduce battery replacement costs by extending battery life
- Reduce wear on the alternator, lowering maintenance costs
- Eliminate maintenance calls due to dead batteries
- Comply with all anti-idling regulations

Eligible for the 30% solar tax credit

The eNow system works with any type of battery to provide energy for any auxiliary system from any manufacturer. It can be mounted on the tractor or trailer, or both. Our advanced technology makes this possible: eNow's focus on engineering, manufacturing, and solar technology means that our systems are durable, reliable, and efficient, and fully optimized for the transportation industry.

Every eNow system is a "smart" system that includes our proprietary charge controller. The charge controller has built-in safety features to protect the batteries from overcharge or surges, as well as features to direct power where needed (to the crank battery, for example). And because it's waterproof, the eNow charge controller can be mounted in a wide range of locations on the tractor or trailer.



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## ENOW “RAYFRIGERATION” ZERO EMISSIONS TRU

eNow demonstrated the effectiveness of its solar energy-producing systems for transportation by powering the first zero-emissions commercial-use Transport Refrigeration Unit (TRU) on a truck making deliveries in an urban environment.

The new zero-emissions TRU, branded “Rayfrigeration,” was tested in California’s San Joaquin Valley. In the first five months of testing, emission reductions of 98% nitrous oxide, 86% carbon dioxide, and 97% particulate matter were achieved. TRUs are refrigeration units mounted on trucks and are traditionally powered by high-polluting, small diesel engines to provide the needed cooling to transport chilled products. **The Rayfrigeration TRU is the first-to-market battery-powered unit for commercial use and was tested on a Challenge Dairy Class 7 truck delivering fresh dairy products throughout Fresno, CA.**

Designed to support medium-temperature refrigeration applications, the Rayfrigeration system employs two forms of energy storage: eutectic medium (cold plates) and a high-capacity auxiliary battery system. The cold plates and auxiliary batteries are initially charged from utility power delivered to the vehicle when plugged in overnight. When the truck is operated on a delivery route, power is provided by eNow’s solar photovoltaic (PV) panels mounted on the truck’s roof. eNow joined Johnson Refrigerated Truck Bodies, Emerson Climate Technologies, and Challenge Dairy Products in the summer-long trial that took place in California’s San Joaquin Valley.

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. This is after adjusting for the emissions from the power plant supplying grid electricity that was used overnight. (Emissions from solar are 0.)

In addition to eliminating harmful emissions, Rayfrigeration is projected to reduce operations and maintenance costs by up to

90% over a diesel-powered TRU. The cost savings are achieved by eliminating fuel costs, eliminating maintenance costs for the diesel APU engine, and increasing battery life (reducing replacement costs) thanks to consistent charge maintenance 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. The Rayfrigeration system features eNow solar in combination with a Johnson refrigeration unit and Emerson’s highly efficient compressor technology.

“The Rayfrigeration product is an important step forward in reducing emissions while maintaining the highest levels of efficiency and customer satisfaction for companies delivering perishable goods,” says Jeff Flath, President & CEO of eNow. “eNow’s solar technology is powerful, reliable, and efficient, and more than up to the task of providing emissions-free energy for critical tasks such as refrigeration of fresh foods, even the most challenging conditions. We are proud to be a part of this important project.”

The Rayfrigeration solar-charging technology is available through eNow, which currently has more than 4,000 solar systems operating nationwide on Class 8 trucks, buses, emergency and utility vehicles, supporting applications as diverse as heating and cooling, liftgates, wheelchair lifts, safety lights, telematics, and other transportation applications. Upon completion of the testing period, Challenge Dairy plans to transition its entire fleet of distribution trucks to solar-powered TRUs.

October 11, 2017 was officially declared “Rayfrigeration Day” in the City of Fresno, California. 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.



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## COST SAVINGS – SOLAR VS. DIESEL

### 53' Trailer Refrigerated Estimated Cost of Operation Mechanical Blower Diesel Only

<b>Route Hours Operation per Day</b>	<b>10.0</b>	<b>Hrs.</b>
Fuel Consumption - Average Per Hour	1.00	Gal/Hr.
Fuel Consumption - Total	10.00	Gallons
<b>Fuel Cost per Usage Unit</b>	<b>\$ 3.00</b>	<b>Per Gal</b>
<b>Fuel Cost - Total</b>	<b>\$ 30.00</b>	<b>Fuel Cost</b>
Maintenance cost per Hour	\$ 1.50	
<b>Maintenance - Total</b>	<b>\$ 15.00</b>	<b>Maintenance</b>
<b>Total Avg Cost per Hour</b>	<b>\$ 4.50</b>	
<b>In-Yard or Dock Hours Operation</b>	<b>2</b>	<b>Hrs.</b>
Fuel Consumption - Average Per Hour	1.00	Gal/Hr.
Fuel Consumption - Total	2.00	Gallons
Fuel Cost per Usage Unit	\$ 3.00	Per Gal
<b>Fuel Cost - Total</b>	<b>\$ 6.00</b>	<b>Fuel Cost</b>
Maintenance cost per Hour	\$ 1.50	
<b>Maintenance - Total</b>	<b>\$ 3.00</b>	<b>Maintenance</b>
<b>Total Avg Cost per Hour</b>	<b>\$ 4.50</b>	
<b>Cost to Operate on Route per day</b>	<b>\$ 45.00</b>	
<b>Cost to Operate on Dock per day</b>	<b>\$ 9.00</b>	
<b>Operational Days per Week</b>	<b>6</b>	
<b>Days at Dock or In-Yard Running</b>	<b>-</b>	
<b>Refrigeration (no route)</b>		
<b>Weekly Route Cost</b>	<b>\$ 270.00</b>	
<b>Weekly Dock Cost</b>	<b>\$ 54.00</b>	
<b>Total Cost per Week</b>	<b>\$ 324.00</b>	
<b>Total Cost per Month</b>	<b>\$ 1,404.00</b>	
<b>Cost per Year</b>	<b>\$ 16,848.00</b>	
<b>Diesel Fuel Gallons per Year</b>	<b>3,744</b>	

### 53' Trailer Refrigerated Estimated Cost of Operation Mechanical Blower 48 VDC - Solar Based System

<b>Route Hours Operation per Day</b>	<b>10.0</b>	<b>Hrs.</b>
Electric Usage - Per Hour (Reefer)	6.65	kW
Electric Consumption - Total	66.50	kWh
<b>Solar Generation per Daily Route</b>	<b>(24.60)</b>	<b>kWh</b>
Electric Cost per Usage Unit	\$ 0.14	kWh - CA
<b>Electric Cost - Total</b>	<b>\$ 5.87</b>	<b>Kw Cost</b>
Maintenance cost per Hour	\$ 0.50	
<b>Maintenance - Total</b>	<b>\$ 5.00</b>	<b>Maintenance</b>
<b>Total Avg Cost per Hour</b>	<b>\$ 1.09</b>	
<b>In-Yard or Dock Hours Operation</b>	<b>2</b>	<b>Hrs.</b>
Electric Usage - Per Hour	6.65	kW
Electric Consumption - Total	13.30	kWh
Electric Cost per Usage Unit	\$ 0.14	kWh - CA
<b>Electric Cost - Total</b>	<b>\$ 1.86</b>	<b>Kw Cost</b>
Maintenance cost per Hour	\$ 0.50	
<b>Maintenance - Total</b>	<b>\$ 1.00</b>	<b>Maintenance</b>
<b>Total Avg Cost per Hour</b>	<b>\$ 1.43</b>	
<b>Cost to Operate on Route per day</b>	<b>\$ 10.87</b>	
<b>Cost to Operate on Dock per day</b>	<b>\$ 2.86</b>	
<b>Operational Days per Week</b>	<b>6</b>	
<b>Days at Dock or In-Yard Running</b>	<b>-</b>	
<b>Refrigeration (no route)</b>		
<b>Weekly Route Cost</b>	<b>\$ 65.20</b>	
<b>Weekly Dock Cost</b>	<b>\$ 17.17</b>	
<b>Total Cost per Week</b>	<b>\$ 82.37</b>	
<b>Total Cost per Month</b>	<b>\$ 356.93</b>	
<b>Cost per Year</b>	<b>\$ 4,283.14</b>	
<b>kWh of Electricity per Year</b>	<b>17,222</b>	
<b>Annual Savings</b>	<b>\$ 12,564.86</b>	
<b>Annual Carbon Footprint Savings</b>	<b>83,116.80</b>	<b>Lbs. Co2</b>
<b>Annual Carbon Footprint Savings</b>	<b>37.78</b>	<b>Tons</b>

THE ANNUAL SAVINGS SET FORTH ABOVE ARE ESTIMATED BASED ON THE DAILY DUTY CYCLE OF VARIOUS FLEETS MONITORED BY ENOW. ACTUAL SAVINGS WILL VARY BASED ON A NUMBER OF FACTORS, INCLUDING BUT NOT LIMITED TO: (I) EQUIPMENT USED, (II) DAILY DUTY CYCLES, (III) THE TEMPERATURE PROFILE OF YOUR FLEET, (IV) GENERAL OPERATING CONDITIONS, INCLUDING LOCAL ENVIRONMENTAL CONDITIONS WHEN ANERE THE FLEET IS BEING USED. IN ADDITION, ACTUAL SAVINGS MAY BE FURTHER IMPACTED DUE TO HANDLING OF ENOW EQUIPMENTS, INCLUDING BUT NOT LIMITED TO, (A) IMPROPER USE, INTALATION, STORAGE, MAINTENANCE AND CLEANING, (B) DAMAGE FROM ABUSE, ALTERATION, VANDALISM, ACCIDENTS, DAMAGE TO THE APPLICABLE VEHICLE, AND FALLING DEBRIS INCLUDING ROACKS, BRANCHES AND THE LIKE, (C) ENVIRONMENTAL POLLUTIONS (WHETHER MAN MADE OR NOT), INCLUDING SOOT, OZONE POLLUTION, AIR POLLUTION, SALT DAMAGE, OR ACID RAIN, AND (D) DAMAGE OR CORROSION CAUSED BY THE ROOFING MATERIALS, CHEMICALS, OR SUBSTRATES, INCLUDING THOSE USED FOR CORROSION RESISTANCE, THERMAL EXPANSION AND CONTRACTION, AND MOISTURE BARRIERS AND SEALING.







Navistar's SuperTruck demonstration vehicle, CATALIST, recently exceeded improvement goals set by the Department of Energy program. CATALIST sipped diesel at 13 MPG, achieving a freight efficiency improvement of 104% compared to the DOE's control vehicle.

## A BRIEF HISTORY OF ENOW

### POWERING POSSIBILITIES

At eNow, we not only believe in renewable solutions for the transportation industry — we make them a reality.

We are an innovative, clean-technology company specializing in renewable energy systems. That means striking the perfect balance between sustainability, regulatory compliance and significant return on investment. Our goal is to provide industry-specific solar solutions to companies that embrace profit, planet, and people.

eNow debuted in 2011 with a focus on the trucking industry. Our proprietary, patent-pending solar systems economically convert, store, and distribute electricity, powering applications such as lift gates, in-cab HVAC, refrigeration, telematics and hotel loads. eNow's solar panels range from 25-375 watts, and our systems go up to 6 kilowatts.

We have installed more than 4,500 systems across the country, and the use of our systems is being explored in other industries, with inroads present in boating, RVs, and other fields.

### LEADERSHIP

eNow's leadership is steeped in solar expertise. Founder Jeffrey Flath was instrumental in the creation of a solar-powered billboard while president of Cooley Group, a global leader in the design and manufacture of high-performance, flexible composites.

Bob Doane, VP of Technology, has more than 30 years of experience in advanced technologies, including commercial-scale solar development.

And Philip Pierce, Research & Development Associate, has more than 35 years of experience in solar applications for aerospace, such as the development of solar power systems for satellites. He has been responsible for design, fabrication, and testing for performance and energy balance, most notably at Lockheed Martin Corporation.

Other eNow leaders have extensive backgrounds in technology, mechanical/electrical infrastructure applications, executive manufacturing management and commercial transportation industry sales.

## POWERING POSSIBILITIES™

## IN THE PRESS

[eNow Unveils 53-foot Trailer with 100% Electric Solar-Based Refrigeration System at ACT Expo 2018](#)

[eNow Powers Zero Emissions Refrigerated Truck](#)

[Run on Less Fleets Give Blueprint for Saving Fuel](#)

[eNow Sees Solar Playing a Larger Role in Trucking](#)

[Freightliner Offers eNow Solar Charging on Cascadia Tractors](#)

[Major Navistar Fleet, Mesilla Valley Transportation, Adopts eNow Solar System](#)

[Ask the Thought Leaders: What's the Future of Green Tech](#)

[Advances in Work Truck Power, Efficiency and Productivity on Display](#)

[eNow Announces Real-Time Monitoring Service](#)

[Wireless Monitoring System Checks Battery Health, Charge](#)

## VIDEO AND TELEVISION

[eNow Solar powers Challenge Dairy](#)

[Start-Up Cuts Fuel Costs – CNBC Power Pitch](#)

[Clearing the Air While Transporting Products – ABC news](#)

[Solar for Trucks – Run on Less](#)

[MVTs Certifies eNow](#)

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**TRUCKS** NEWS

REGULATION SAFETY LABOR TECH FINANCIAL SHOWS & EVENTS REVIEWS

### Sun-Powered Refrigerated Truck Trailer Slashes Diesel Emissions

April 23, 2018 by Carly Schaffner, @carlyschaffner

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Keeping fresh goods refrigerated during transport is important for food safety, but it requires a lot of energy and creates pollution. A solar-powered cooling system developed by eNow, a Warwick, R.I., builder of solar panels could address that problem. In one test, it cut harmful diesel emissions on a refrigerated truck trailer by almost 100 percent.

eNow put its system, dubbed "Rayfrigeration," through real-world tests in the most severe conditions to ensure it works as effectively as its pollutant emitting counterpart.

Refrigerated, or reefer trucks, have two engines. One is part of the drivetrain, and the other keeps the trailer cold.

"The trailers have their own separate diesel engines on them, so they have their own fuel supply," said Jeff Flath, eNow's president and chief executive.

The company has focused on the transportation industry since its 2011 founding. It builds power systems for big rig air conditioning, lift gates for straight and semi-truck trailers, safety lighting for emergency vehicles and telematics systems that require an energy source to ensure batteries are always charged.

But reefer trucks are a different animal. By replacing the diesel engine with a battery, there is huge opportunity to cut fuel and maintenance costs, Flath said.

eNow's system integrates its panels into a battery pack that has enough energy to operate the complete trailer system, he said. A typical reefer truck is in service between eight and 12 hours per day.

The company also eliminated most greenhouse gases from a trailer's on-board diesel-powered compressor.

Diesel and other fossil-fuel burning systems typically used to cool reefer trailers emit pollutants into the air such as hydrocarbons, carbon monoxide, nitrogen oxide, or NOx, and particulate matter.

The emissions from the trailer unit often go unmonitored.

"Many of the small engines used to power the conventional refrigeration units are essentially unregulated and so are highly polluting," said Bill Van Amburg, executive vice president of Pasadena-based clean emissions technologies booster CalStart.

In many cases they are more polluting than the big engines powering the trucks, Van Amburg said.

eNow installed its solar-powered cooling unit on a Challenge Dairy truck in Fresno, Calif. (Photo: eNow)

Photo: eNow

