

Iowa Clean Cities Coalition is a program of

A man with short, wavy, light-colored hair and glasses, wearing a green polo shirt, is leaning over the side of a white vehicle. He is focused on a red component of the ABS system. The vehicle's body is made of perforated metal. A red rectangular component is visible on the side panel, with the letters "ABS" printed in black below it. The man is holding a red cylindrical tool or part. The background shows a paved area and some greenery.

TRANSPORT REFRIGERATION UNITS

Opportunities for Electrification and Emission Reduction Incentives

INTRODUCTION

Transport Refrigeration Units (TRUs), also called Truck Refrigeration Units, are climate control devices that allow you to heat or cool the trailer when the engine is shut off. TRUs typically run off the main diesel engine while running down the road. However, when the trailer is parked, loading, or unloading, the TRU can continue to be powered by the main engine or run off a separate standby engine. These are typically diesel engines and emissions can have a direct impact on the air quality surrounding drivers and workers while the trucks are stationary.

Transport Refrigeration Units are now available in both Electric Standby (ES-TRUs) and All-Electric options. These still use the truck's main engine to drive the compressor while in transit, but allows the truck to operate from electric shore power while parked, loading, or unloading. All-electric TRUs runs completely off of the electric shore power, used for on-site storage or overflow storage, whereas an ES-TRU, also referred to as a hybrid TRU, can be used on the road for diesel and electric shore power while parked.

Electric Standby or all-electric TRUs reduce or eliminate the amount of diesel fuel used and significantly reduce or eliminate carbon emissions. ES-TRUs and all-electric TRUs use fewer parts and require less maintenance than their diesel counterparts. Eliminating the heat produced by a standby diesel engine results in a longer equipment lifecycle. ES and all-electric TRUs also provide significant fuel savings and reduce noise at the facilities where parked.

Typical TRU users

- Companies hauling or storing fresh or frozen products
- Food manufacturers or distributors
- Beverage distributors
- Nursery and flower companies
- Ice companies
- Pharmaceutical companies

Facilities to provide power while parked

- Loading dock or loading bay
- Warehouse
- Distribution center
- Factory
- Truck terminal
- Truck stop
- Grocery stores

EQUIPMENT

The following five companies either manufacture TRUs or retrofit existing reefers. It is important to note that these companies sell diesel, hybrid and all-electric TRUs:

- **Carrier Transicold** (Manufacturer): www.carrier.com/truck-trailer/en/north-america/products/na-truck-trailer/special-products/vector-8100
- **Thermo King** (Manufacturer): www.na.thermoking.com/tk-innovation/global/en/products/trailer-single-temperature.html
- **Kingtec** (Manufacturer): www.kingtecusa.com/index.html#services
- **Zanotti** (Manufacturer): www.zanottitransblock.com
- **Electric Reefer** Solutions (Retrofits): www.electricreefersolutions.com

INFRASTRUCTURE

Hybrid and all-electric TRUs need to be supported by their respective infrastructure. This infrastructure comes in the form of a parking space plug or dock plug. This plug will transfer electricity directly from the main building to either the charging space or the dock, enabling drivers to shut off their main engines during the loading and unloading process. An assessment of the facility is necessary to determine existing infrastructure and number electrical connection points and their locations. This determines how much, if any, new infrastructure needs to be installed to support a TRU. The same goes for the truck wanting to install a TRU.

Infrastructure connection options are already available from both Carrier Transicold and Thermoking. Customers interested in moving to all-electric and ES-TRUs can add options to help place and manage the connection between the unit and the available power source. Other companies specialize in Electrified Parking Spaces (EPS) and several can be found on the EPA's SmartWay List of Verified Idle Reduction Technologies. www.epa.gov/verified-diesel-tech/smartway-verified-list-idling-reduction-technologies-irts-trucks-and-school

DIESEL EMISSIONS REDUCTION ACT (DERA)

The Diesel Emissions Reduction Act (DERA) is a grant program that appropriates funds for projects that will reduce diesel emissions. TRU infrastructure and the actual TRU itself both qualify for funding under DERA.

Administered by the Environmental Protection Agency (EPA), the DERA grant program is used to achieve significant reductions in diesel emissions. There is a national clean diesel program and a state clean diesel program.

- **National Clean Diesel Program:** solicits proposals nationwide for projects, encompassing 70% of the appropriation. www.epa.gov/cleandiesel/clean-diesel-national-grants
- **State Clean Diesel Program:** funds projects solely within the state, representing 30% of the appropriation, including an incentive for states that match the original amount allocated to them. The Iowa Department of Transportation (DOT) is the administrator of the State of Iowa's DERA allocation. www.iowadot.gov/dera.

ELIGIBILITY AND COST-SHARE REQUIREMENTS

TRUs qualify for the DERA program in through two eligible activities: as non-road engines/equipment and as the electric infrastructure to provide power (under Electrified Parking Space technology). Engine replacement consists of replacing just the engine and not the compressor/cooling unit. Equipment replacement consists of replacing the entire existing TRU, including the diesel engine and the compressor/cooling unit, with a newer, cleaner TRU. Equipment replacement may also consist of replacing the entire trailer and TRU.

Eligible Activity	DERA Funding Limits	Minimum Cost-Share
Electrified Parking Space Technology	30%	70%
Non-Road Engines Replacement	40-60%	40-60%
Non-Road Equipment Replacement	25-45%	65-75%

For more Information on DERA cost-share requirements, see *Iowa's 2017 DERA Program Info Guide* iowadot.gov/dera/pdfs/DERA_Grant_Program_Info_Guide.pdf

FREQUENTLY ASKED QUESTIONS

The following questions have been addressed by EPA pertaining to eligibility of TRUs and associated infrastructure.

- **Question: Is the replacement of a diesel transport refrigeration unit (TRU) eligible for funding under this RFP? What about TRU trailers that are stationary?**
 - **Answer:** Yes. Replacement of diesel TRUs with new, clean diesel TRUs, hybrid TRUs, or eTRUs is covered under this RFP as long as the existing non-road engine meets the eligibility criteria outlined in Section III.D.15.b, Table 3. Eligible TRUs may be mobile or stationary.
- **Question: Are Electrified Parking Space (EPS) idle reduction technologies that provide power to both hybrid and electric-only TRUs eligible?**
 - **Answer:** In general, yes. However, to be eligible the project must be able to demonstrate a reduction in diesel emissions. Depending on the configuration of the TRU, plugging into EPS technology while the TRU is stationary may or may not achieve a reduction in diesel emissions.
- **Question: Is the cost of construction to add electrified parking spots or truck stop electrification an eligible expense?**
 - **Answer:** Funding can cover up to 30% of the cost (labor and equipment) of eligible electrified parking space technologies, including the cost of modifications, attachments, accessories, or auxiliary apparatus necessary to make the equipment functional. This includes the installation (i.e., construction) of electrical infrastructure to support the EPS technology.

For the complete list of frequently asked questions about the 2017 Clean Diesel Program, please visit: www.epa.gov/sites/production/files/2017-04/documents/fy17-dera-faq_04-27-17.pdf

OVERVIEW OF NON-ROAD ENGINE REGULATIONS

Because the DERA program aims to reduce diesel emissions, the focus is on replacing older diesel engines with newer, cleaner options. Therefore, the eligible engines are categorized based on what they are replacing. TRUs are considered a non-road engine. Figure 1 displays DERA's non-road engine funding restrictions, which take into account the current engine horsepower, current engine model year, and tier.

Figure 1: Non-Road Engine Funding Restrictions

Current Engine Horsepower	Current Engine Model Year (EMY) and Tier	Vehicle/Equipment Replacement: EMY 2017+				Verified Exhaust Control
		Tier 0 -2	Tier 3 - 4i	Tier 4	All-Electric	
0 - 50	2005 and Newer: Unregulated - Tier 2	No	No	Yes	Yes	Yes
51 - 300	1995 and Newer: Tier 0 - Tier 2	No	Yes*	Yes	Yes	Yes
51 - 300	1995 and Newer: Tier 3	No	No	Yes	Yes	Yes
301+	1985 and Newer: Tier 0 - Tier 2	No	Yes*	Yes	Yes	Yes
301+	1985 and Newer: Tier 3	No	No	Yes	Yes	Yes
Current Engine Horsepower	Current Engine Model Year (EMY) and Tier*	Engine Replacement: EMY 2017+*			Verified Engine Upgrade	
		Tier 0 -3	Tier 4	All-Electric		
0 - 50	2005 and Newer: Unregulated - Tier 2	No	Yes	Yes	Yes	
51 - 300	1995 and Newer: Tier 0 - Tier 3	No	Yes	Yes	Yes	
301 - 750	1985 and Newer: Tier 0 - Tier 3	No	Yes	Yes	Yes	
751+	1985 and Newer: Tier 0 - Tier 2	No	Yes	Yes	Yes	

*Tier 3 and Tier 4 interim (4i) allowed for vehicle/equipment replacement only when Tier 4 final is not yet available from OEM for 2017 model year equipment under the Transition Program for Equipment Manufacturers (TPEM).

**Previous engine model year engines may be used for engine replacement if the engine is certified to the same emission standards applicable to EMY 2017.

Source: www.epa.gov/sites/production/files/2017-02/documents/fy17-state-program-guide-2017-02.pdf

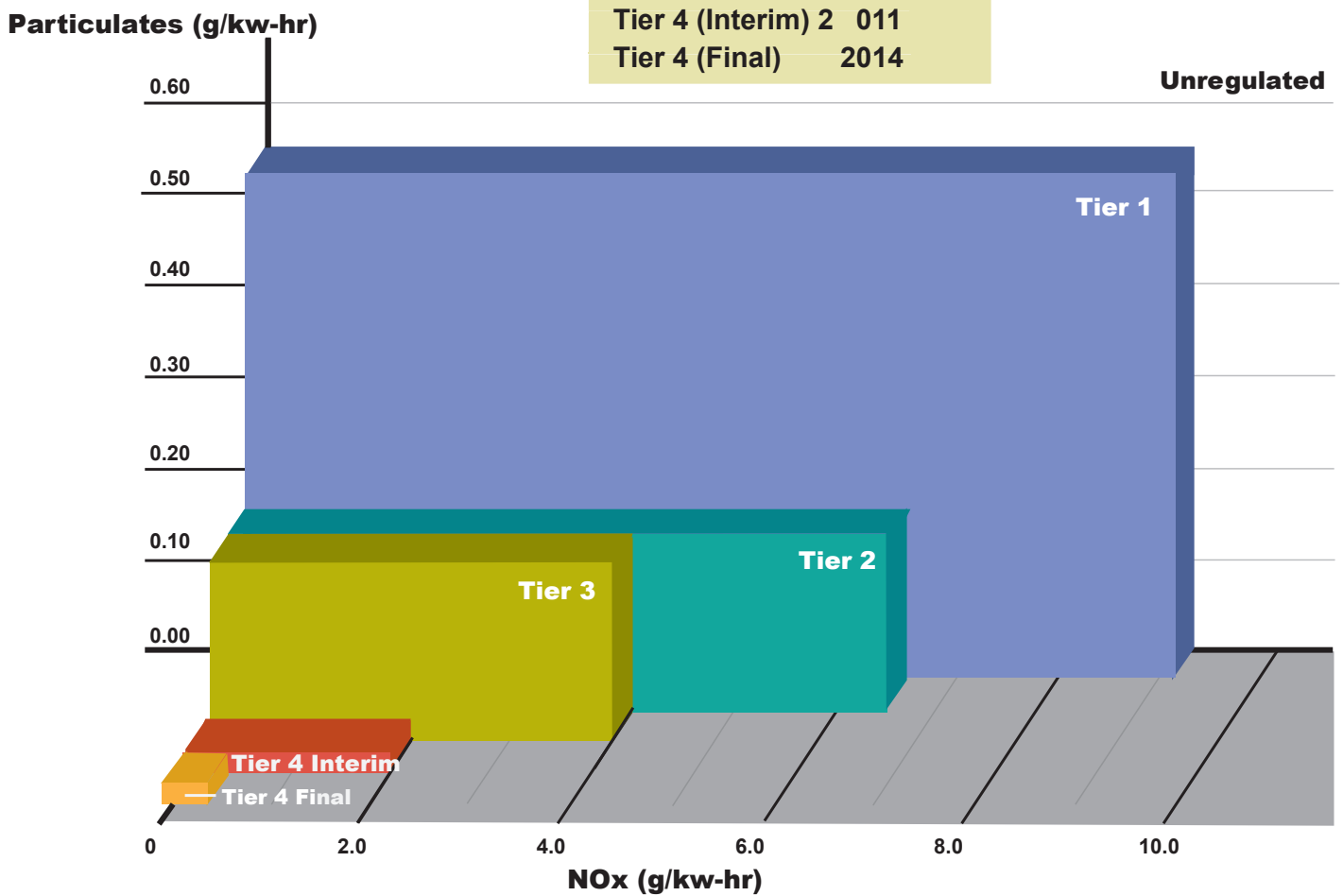
Tiers, as mentioned in Figure 1, are a way to regulate emissions. Over the years, the tiers' regulations have gotten more and more stringent as each new tier is released. They regulate how much particulate matter (PM) and Nitrous Oxides (NOx) can be emitted from a non-road engine based on the engine's horsepower and engine model year. Tier 0 means that the engine has no regulations, Tier 1 introduces some regulation, Tier 2 even more regulation, all the way until Tier 4, the most recent and most regulated tier.

The DERA program will not fund an engine replacement for a Tier 0-2 engine, but will fund a Tier 3 or 4i (if Tier 4 is not yet available for that specific engine) and Tier 4. Figure 2 shows how the tiers' regulations have become stricter from the year they were first released, Tier 1 in 1996, to the present, Tier 4 in 2014.

Figure 2: EPA's Tier Regulations for Non-Road Vehicles

US EPA Non-Road Regulations (130-560kw)

Tier 1	1996
Tier 2	2001-2003
Tier 3	2005-2006
Tier 4 (Interim) 2 011	
Tier 4 (Final)	2014



Source: www.dieselforum.org/files/dmfile/CleanDieselTechnologyforOff-Road.pdf

HELPFUL LINKS

Technology Assessment, California Air Resources Board CARB:

www.arb.ca.gov/msprog/tech/presentation/tru.pdf

How Do TRUs Work? www.shipabco.com/refrigerated-trailers-work/

Case Studies

- Electric-Powered Trailer Refrigeration Unit Safety Integration Demonstration
www.shorepower.com/wrf_nyserda_final_report.pdf
- Electric Power Research Institute case study with Sacramento Municipal Utility District
www.epri.com/#/pages/product/000000000001009990/
- Electric-Powered Trailer Refrigeration Unit Market Study and Technology Assessment:
shorepower.com/wp-content/uploads/2014/11/ElectricPoweredTrailerRefrigeration1.pdf

For further assistance and information, contact Iowa Clean Cities Coalition Coordinator at cleancities@iowaeda.com.

ABOUT THE IOWA CLEAN CITIES COALITION

The Iowa Clean Cities Coalition is a designated member of the United States Department of Energy's (US DOE) Clean Cities program and housed at the Iowa Economic Development Authority. The Iowa Clean Cities Coalition works to advance the nation's economic, environmental and energy security by supporting local actions to advance alternative fuels and improve efficiency in on-road transportation.

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