Long-Haul Truck Idling Burns Up Profits

Long-haul truck drivers perform a vitally important service. In the course of their work, they must take rest periods as required by federal law. Most drivers remain in their trucks, which they keep running to provide power for heating, cooling, and other necessities. Such idling, however, comes at a cost; it is an expensive and polluting way to keep drivers safe and comfortable. Increasingly affordable alternatives to idling not only save money and reduce pollution, but also help drivers get a better night's rest.

A long-haul truck idles about 1,800 hours per year for rest periods alone. *Photo credit: Shutterstock 5034154*

Idling Wastes Fuel and Increases Engine Wear

Idling a heavy-duty truck consumes about 0.8 gallon of fuel per hour. Even when diesel costs as little as $2.50 a gallon, fuel for one 10-hour rest period will cost $20. Typically, a long-haul truck idles about 1,800 hours per year, using about 1,500 gallons of diesel. Argonne National Laboratory (Argonne) estimates that, in the U.S., rest-period truck idling consumes up to 1 billion gallons of fuel annually at a cost of around $3 billion. Idling also accelerates engine wear and tear. Where manufacturer warranties and maintenance intervals apply to "hours operated" rather than "miles traveled," the cost of idling is greater than just fuel.

Idling Degrades Air Quality

Argonne estimates that rest-period idling results in the emission of about 11 million tons of carbon dioxide, 55,000 tons of nitrogen oxides, and 400 tons of particulate matter annually in the U.S. These emissions contribute to climate change and diminish local air quality, which can affect the health of not only those living in the community, but the truck drivers themselves.

Idling May Be Illegal

Many state and local laws restrict the idling of heavy-duty trucks, and violating idling laws can result in steep fines. Clean Cities' IdleBase (cleancities.energy.gov/IdleBase), a database of idling laws and ordinances, catalogs known idling restrictions and penalties for all classes of on-road vehicles. The American Transportation Research Institute (atri-online.org) provides a downloadable cab card for laws specific to heavy-duty trucks.

Alternatives to Idling Heavy-Duty Trucks

Some current idling alternatives use up to 95% less fuel, saving money, reducing air pollution, and helping truck drivers get a better night's sleep. Depending on how much a truck idles and current fuel prices, alternatives to idling can pay for themselves in as little as six months.

Auxiliary Power Units

Auxiliary power units (APUs) provide drivers with on-board power for climate control and electrical devices. Most APUs are powered by diesel, but battery-powered APUs and alternative-fuel APUs are also available. Some APUs are equipped to plug into a power pedestal for grid power (see Electrified Parking Spaces on the next page).

Considerations: On-board power allows use wherever needed. APUs have an initial high cost and are heavy, although most states have weight exemptions for APUs (see energy.gov/eere/vehicles/map-state-recognition-auxiliary-power-weight-exemption). Diesel APUs can keep the driver comfortable for as long as needed, but require regular maintenance. For trucks model year 2010 and newer, idling emissions are so well controlled that a diesel APU's particulate matter (PM) emissions will actually be higher than the truck engine's emissions. In California, diesel APUs on trucks newer than model year 2007 must be equipped with a diesel particulate filter. Battery APUs are essentially battery-electric air conditioners with heat supplied either by electrical resistance heating or by a diesel bunk heater.

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Cooling Technologies

Storage air conditioners use the running engine's energy to charge a battery (battery-electric air conditioning) or freeze a block of ice (thermal storage) to provide air conditioning when the truck is stopped. Another option, suitable for hot, dry climates only, is evaporative cooling, which cools the air through the evaporation of water.

Considerations: Storage cooling has low maintenance costs and emissions, but the devices may be heavy, and typical battery life is 2 years. For battery-electric air conditioners, lithium-ion battery technology reduces weight and increases life, but at higher cost. Many storage-cooling options are plug-in capable. Because storage cooling may provide cooling for only 8-10 hours, it cannot be relied on to provide full service for a 34-hour restart period unless it can be plugged in or recharged by idling the engine (1-3 hours) (NACFE 2014). Solar panels can provide additional battery charge. For storage cooling, charging the storage medium increases the engine's operational fuel consumption by a small amount. There are no emissions at the site of use, and total emissions are low because the unit is charged by on-road, emission-controlled operation. Storage cooling may also require a larger alternator (NACFE 2014). Any cooling system can be paired with a heating system to provide heat in cold weather.

Heating Technologies

There are two types of fuel-fired heaters: cab/bunk heaters and coolant heaters. Both draw fuel from the vehicle's fuel tank. Cab/bunk heaters supply warm air to the cab/sleeper, while coolant heaters, mounted in the engine compartment, heat the vehicle's coolant, which is circulated through the regular heat transfer system. Coolant heaters keep the engine warm, reducing the impact of cold starts, and may provide some cab heat. Another technology type, the heat recovery system, relies on a small electric pump to circulate (via the vehicle's heat-transfer system) the heat remaining in the engine ("waste heat") after it is shut off, for up to 4 hours.

Considerations: These systems use little or no fuel, have low emissions, are quiet, and have fast payback for drivers who have a regular need for heat. These heaters are sometimes used in conjunction with APUs and other idle-reduction technologies.

Automatic Engine Start/Stop (AESS) Systems

AESS systems, also called idle management systems, turn the engine on and off as necessary to maintain sleeper-cab temperature and sufficient battery charge. These systems do not eliminate idling but reduce it, along with associated fuel use, engine wear, and emissions.

Considerations: AESS systems are inexpensive, but they offer minimal savings in extreme weather. The use of these systems may not ensure compliance with state idling restrictions. (In California, trucks may idle only if they have a "Clean Idle" sticker.) Intermittent engine noise may disturb the driver.

Electrified Parking Spaces

Electrified parking spaces (EPS), also known as truck stop electrification (TSE) or shore power, allow truckers to shut off their engines and "plug in" for HVAC and other amenities. Single-system electrification provides HVAC directly to the truck via a gantry- or pedestal-mounted duct. Dual-system electrification provides plug-in power for a truck's on-board auxiliary HVAC systems and accessories. Some installations provide power for transport refrigeration units.

Considerations: Because EPS use no diesel fuel, there are no emissions at the point of use. EPS are a good option for very hot nights, but availability is limited. Single-system EPS also offer a power-only option, at a lower hourly rate, to allow drivers to plug in a simple electric resistance heater in the winter. Drivers might not choose EPS if they have to pay out of pocket and request reimbursement. For the EPS equipment owner, a high occupancy rate is needed to provide good return on investment. EPS have been installed successfully at several dedicated terminals.

NACFE 2014. North American Council for Freight Efficiency (NACFE) and the Carbon War Room: *Confidence Report on Idle-Reduction Solutions,* 2014.

With single-system EPS, a truck driver attaches a duct that provides heated or cooled air to the truck. Power outlets and amenities such as internet access may also be provided. *Used with permission of IdleAir.*

With dual-system EPS, a truck driver plugs in to power an on-board APU, air conditioner, or heater. Some sites offer the higher-voltage power required for trailer refrigeration, as shown here. *Used with permission of Shorepower Technologies.*

A truck equipped with an APU. APUs provide power for climate control and electrical devices. *Photo courtesy of Terry Levinson.*

Complementary Technologies

A number of technologies can facilitate idling reduction. Many fleets have reported significantly reduced idling with the use of telematics/GPS systems, which provide fleet managers with data about vehicle location and engine status, including idling episodes. These data sets allow managers to identify idling patterns and determine which solutions make the most sense. Other technologies, such as cab insulation, window glazing, and reflective paint, may reduce a stationary vehicle's energy requirements and allow the use of smaller, lighter, and less-expensive idle-reduction equipment. Passive measures, such as parking in the shade in summer or facing south in winter, may also reduce power needs.

Choosing a Solution and Calculating Payback

Long-haul truck idling does not have one "best solution"; the best solution for any particular truck (or fleet) will depend on many factors, including the cost of fuel, how much a truck idles, what services it needs when stationary, whether the truck must adhere to idling laws/restrictions, and the acceptable length of time to return on investment (ROI). Argonne offers a comprehensive calculator (www.transportation.anl.gov/pdfs/idling_worksheet.pdf) that helps owner-operators and fleet managers determine payback for idling-reduction technologies. The table below shows payback for cab comfort options when fuel is $3.00/gal. All options pay back in 5 years or less.

Cab Comfort Options for Heavy-Duty Trucks: Fuel Use, Costs, and Typical Payback

Power Source	Services	Fuel Use (gal/hr)	Typical Equipment Cost ($)	Charge ($/hr)	Typical Payback[a] (yr)
Idling	All	0.6–1.5	NA	NA	NA
Auxiliary power unit	All	0.2–0.5	8,000–12,000[b]	NA	3.6
Diesel-fired heater	Heat	0.04–0.08	900–1,500[b]	NA	0.6
Heat recovery	Heat (limited duration)	Negligible	600	NA	<1
Storage cooling	Air conditioning	0.15	8,500–8,800[b]	NA	5
Automatic engine start/stop system	All (intermittent)	0.25	1,500–2,500[b]	NA	1
EPS (single system)	All	NA	5[c]	1.85[d]	NA
EPS (dual system)	All	NA	Up to 2,500[c]	1.00	1

NA = not applicable; EPS = electrified parking space.

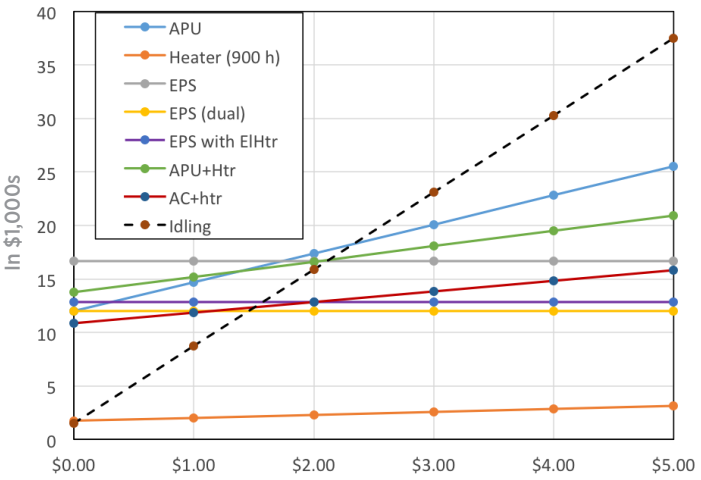
[a] Assumptions for payback: $3.00/gal fuel, 1,800 hr/yr idling, 0.8 gal/hr for idling, 0.3 for APU; mid-range prices; heat and AC each run 6 mo/yr; vehicle fuel economy 7 mpg; auto start-stop assumed to run engine 30% of stationary time. Changes in any of the assumptions (e.g., hours idled per year) will affect payback time.

[b] Includes installation. (North American Council for Freight Efficiency [NACFE] and the Carbon War Room: *Confidence Report on Idle-Reduction Solutions,* 2014.)

[c] Cost for window adaptor for single-system EPS and cost for onboard equipment for dual-system TSE.

[d] This is a standard rate, but discounts are available for stays >10 hours. In addition, power-only service is available for $0.99/hr.

Cost of Idling vs. the Use of Idle-Reduction Technologies Over 5 Years as a Function of Fuel Price for a Truck That Idles 1,800 hr/yr



Any of the idling-reduction options presented saves money compared to idling when fuel costs more than $2.25/gal. Where heat is needed, combining a heater with either an APU or EPS use reduces total cost.

The figure shows the cost of idling vs. the use of idling-reduction technologies as a function of fuel price for a truck that idles 1,800 hours per year. When fuel costs more than $2.25 per gallon, idling is more costly than any of the other options. Regardless of whether air conditioning in summer is provided by an APU or EPS, in winter the addition of a heater provides an obvious cost savings. The cost to use plug-in technologies does not depend on fuel price, so these solutions provide some insurance against high fuel prices. Similar analysis for idling half as much (900 hr/yr) reveals that devices with high capital costs, such as APUs, cost more since there are fewer hours over which to amortize the initial investment. However, if used less, these devices are likely to operate for more years and eventually pay back the investment.

Other Considerations

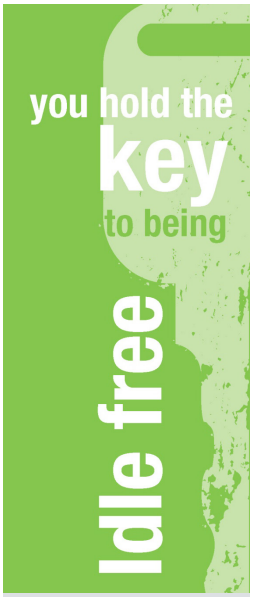
- Many idling laws—and many grant-funding opportunities for idling-reduction equipment—require that the idling-reduction devices used be U.S. Environmental Protection Agency (EPA) or California Air Resources Board (CARB) verified.
- Idling reduction is not a concern just for conventionally fueled vehicles; alternatively fueled vehicles also waste fuel—and generate emissions—by idling. Technology solutions for these vehicles are beginning to emerge.
- In California, APU use does not put a truck driver in automatic compliance with idling laws. Any diesel APU on a truck equipped with a 2007 or newer engine must be fitted with a verified Level 3 PM device or have its exhaust plumbed into the vehicle's exhaust system upstream of the PM after-treatment device. A "Verified Clean APS" label must also be affixed to the vehicle's hood.

What Can You Do?

- Fleet owners/managers: Consider investing in idle-reduction technologies that save fuel, reduce emissions, and keep drivers comfortable.
- Drivers: Consider whether some of your idling time could be reduced without affecting safety, operations, or comfort.
- Depot/delivery center owners/managers: Investigate approaches to scheduling that reduce driver waiting time. If long waits are unavoidable, consider making a waiting room available for the drivers or installing electrified parking spaces.

Resources

- Argonne National Laboratory's Idling Savings Calculator (www.transportation.anl.gov/pdfs/idling_worksheet.pdf or www.transportation.anl.gov/downloads/idling_worksheet.xls)
- *National Idling Reduction Network News* (energy.gov/eere/vehicles/vehicle-technologies-office-national-idling-reduction-network-news)
- IdleBox (cleancities.energy.gov/idlebox)
- DOE's Alternative Fuels Data Center (AFDC) (afdc.energy.gov/conserve/idle_reduction_heavy.html)
- U.S. EPA's SmartWay Technology Program (epa.gov/smartway/forpartners/technology.htm)
- DOE's AFDC Truck Stop Electrification Locator (www.afdc.energy.gov/tse_locator)



Clean Cities supports idling reduction through its online toolkit, IdleBox (cleancities.energy.gov/idlebox).

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For more information, visit: cleancities.energy.gov

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