Idling Reduction for Medium-Duty Fleets

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Basics: What Exactly Is Idling?

Idling is running a vehicle engine while the vehicle isn't moving. Vehicle operators idle for a number of reasons—some better than others.

Basics: Petroleum Use and Emissions

- **In the U.S., idling consumes about 6 billion gallons of oil, costing about $20 billion!**
- **For rest-period truck idling alone, emissions total *more* than 130 tons of particulate matter (PM), 12 million tons of CO_2, 35,000 tons of NOx, and 36,000 tons of CO.**
- **Half of idling fuel losses are estimated to be from everyday (noncommercial) drivers.**

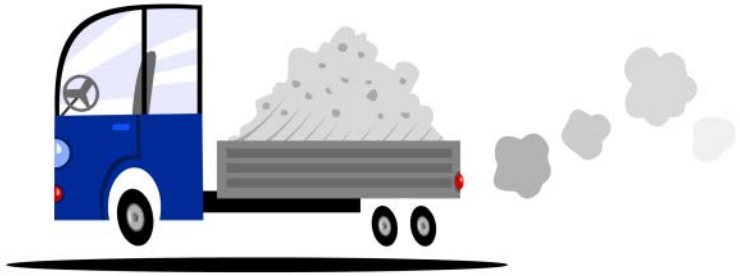
Basics: What Kinds of Vehicles Idle?

Light duty

- Passenger vehicles, including taxis, police cruisers, and some light trucks

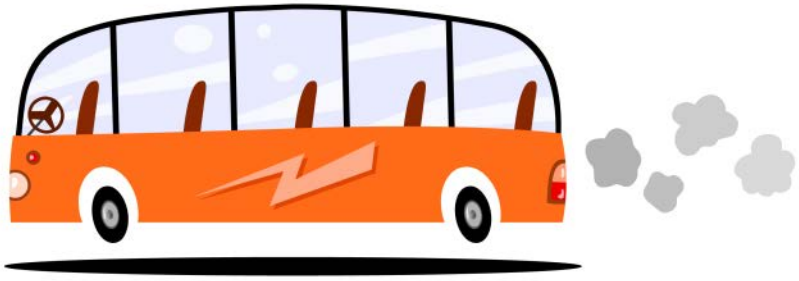
Medium duty

- Utility vehicles, delivery trucks, shuttle buses, ambulances



Heavy duty

- Long-haul trucks, tour buses, school buses



All vehicle types may idle,
but not necessarily for the same reasons.

Basics: Why Do Drivers Idle?

- **Habit**
- **Power**
  - For onboard auxiliaries (e.g., lights, computers)
  - For work trucks (power take-off, or PTO)
  - For moving in creep mode

Basics: Idling for Power

Power for Auxiliaries

- For driver and passenger safety and comfort
- To provide power for warning lights and communications equipment
- To maintain proper temperature for sensitive equipment and goods

Basics: Idling for Power, cont.

Power Take-Off (PTO)

- *Power take-off* refers to a device that diverts power from a vehicle engine to power another device (e.g., hydraulic lift on a bucket truck).
- PTO powers nonpropulsion functions on work trucks.

Basics: Idling for Power, cont.

Other Workday Idling

- “Creeping” in queue
- Waiting to load or unload goods or passengers, including:
  - Delivery trucks
  - Transit buses and motor coaches
  - Shuttle buses
  - Taxis

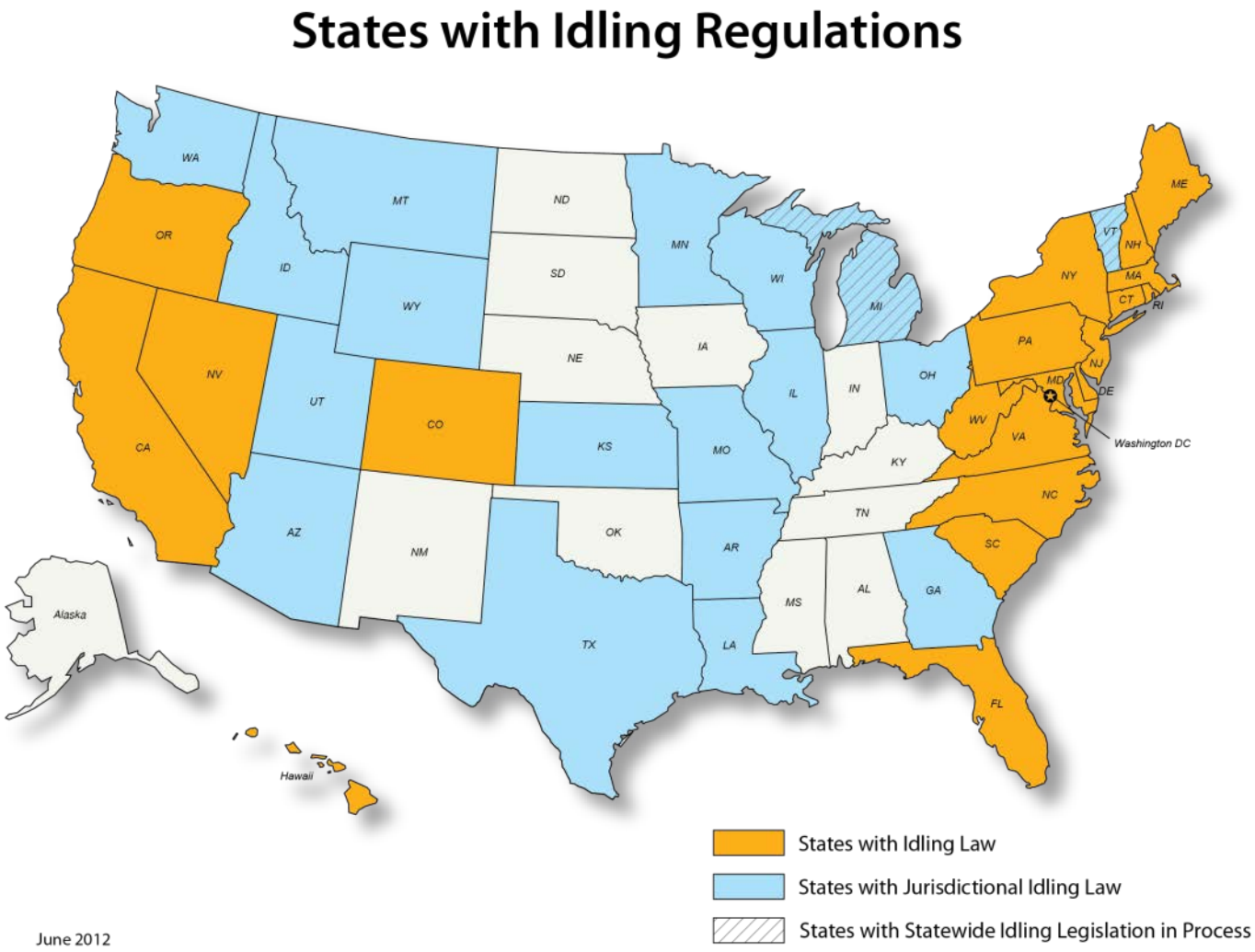
Basics: What's Wrong with Idling?

- **The cost of fuel (for which the vehicle owner gets *0 mpg*)**
  - Idling wastes about 6 billion gallons of fuel per year; about half of that is from trucks idling overnight and during the workday
- **Increased petroleum consumption and reliance on nonrenewable resources**
- **Engine wear**
  - Increased maintenance costs

Basics: What's Wrong with Idling? cont.

- **Air pollution**
  - Harmful emissions, including greenhouse gases and those that cause smog
  - Potentially costly regulatory consequences
- **Noise**
- **Idling is *illegal* in some states and municipalities**

Basics: Idling May Be Against the Law



Idling can be reduced in several ways

- Simply turn the engine off!
- Reduce the need for power
  - Reduce heat transfer with insulation
  - Reduce solar load with shades or glazing
  - Recover waste heat from coolant
  - Reduce peak with load management
  - Can be retrofit or OEM option
- Install idling-reduction technology
- Get a hybrid vehicle

Engine controls are inexpensive

- Timer shuts engine off after set time
- Automatic start-stop senses cab temperature
  - Turns engine on when too warm or cold
  - Minimal savings in extreme weather
  - May disturb sleep
  - Adds to engine wear, emissions

- Cylinder deactivation limits combustion to part of engine
  - Enables small reduction of fuel use and emissions
  - Not commercial

Availability: IR Equipment for Trucks and Buses

On-Board Options

- Auxiliary power units (APUs)
- Automatic engine stop-start controls

- *For heat (and/or engine warming) only*
  - Fuel-fired heaters
  - Coolant heaters
  - Waste-heat recovery systems
  - Engine block heaters (to preheat engine)

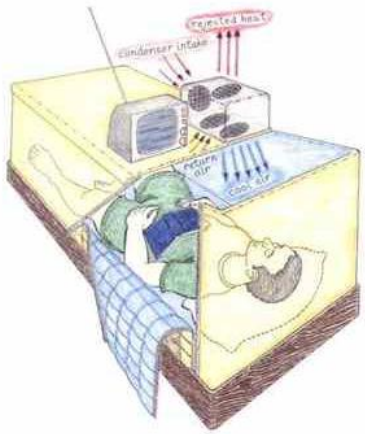
- *For cooling only*
  - Thermal storage cooling systems
  - Battery-electric air conditioners

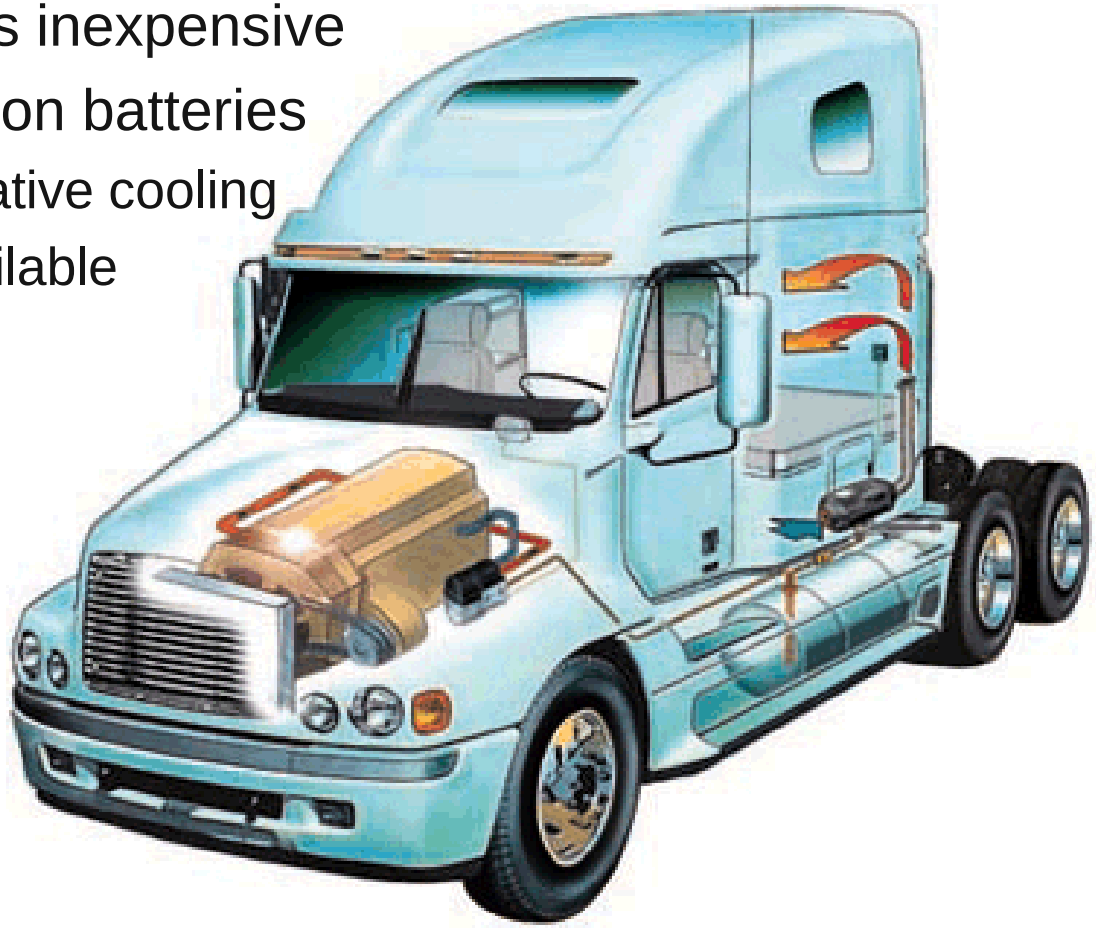
Various on-board designs provide full service

- Supply HVAC, electricity, and charge battery
- Auxiliary power unit (APU) or gen set
  - Diesel-fueled engine and generator
  - Some models can be plugged in
  - Fuel cell in development
- Inverter/charger with batteries
  - Heat pump system now available

Heaters and air conditioners are available

- Small, inexpensive, diesel-fueled heaters are efficient
  - For cab and engine
  - Used in Europe, on trucks, buses, boats
- Waste heat recirculation is inexpensive
- Most air conditioners rely on batteries
  - One system uses evaporative cooling
  - Thermal storage also available
  - May just cool bed





More Options for Trucks and Buses

Off-board Options (Electrification)

- Single-system
  - Hookup, via a window adaptor, provides heating, cooling, and amenities such as TV (no on-board equipment required)
- Dual-system (shore power)
  - Power connection allows driver to plug in to power on-board equipment, such as heater, A/C, computer, and appliances such as microwaves

Find TSE sites for heavy-duty trucks at
www.afdc.energy.gov/afdc/progs/tse_listings.php

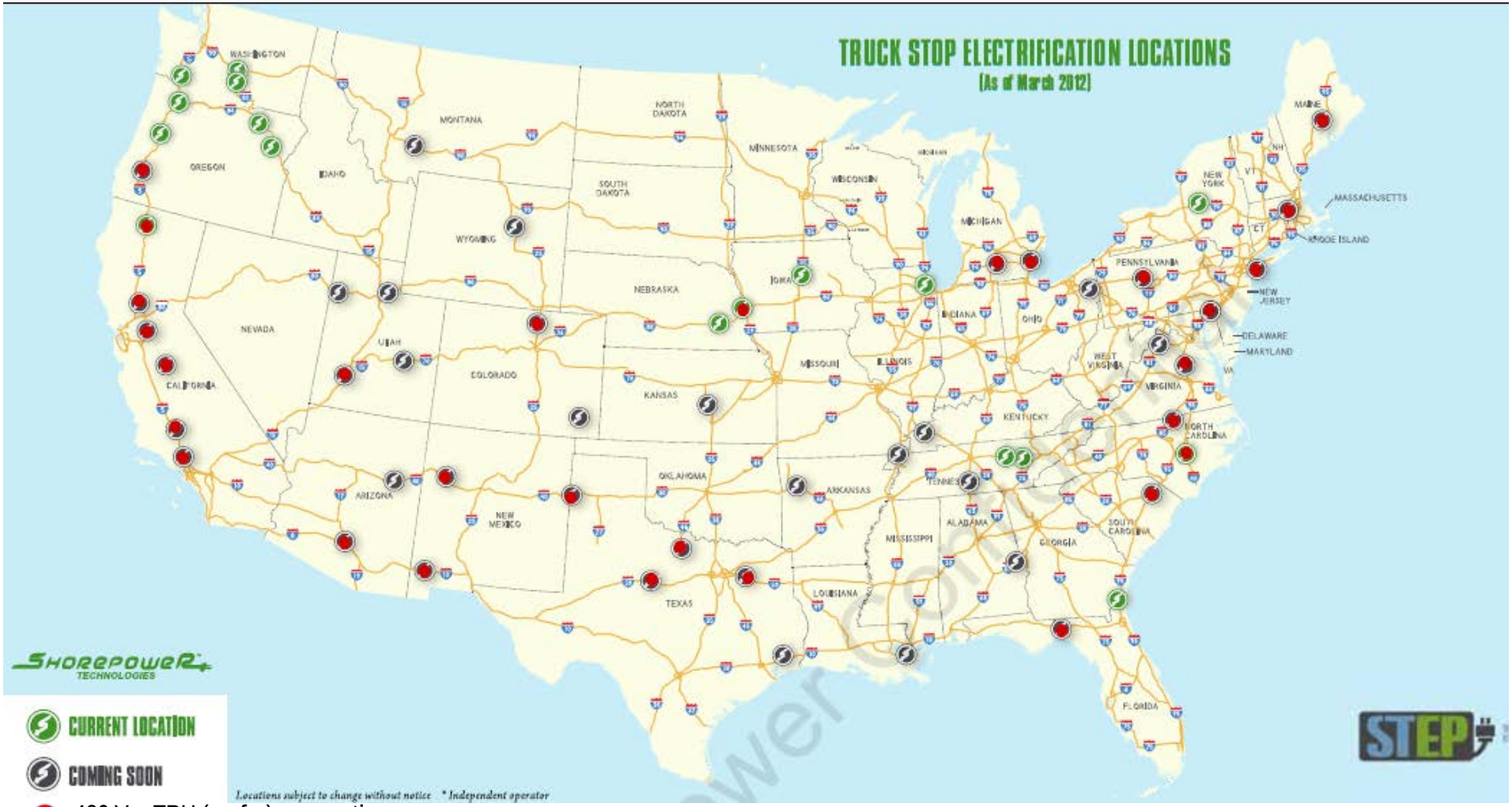
Dual system TSE supplies electrical services*

- On-board electric HVAC required
  - Cost up to $2,500
- Parking space costs up to $6,000
- Plug-in pedestal like campground
- Use costs $1.00/h
- Standardized plugs desirable
  - 120V and/or 240V AC
- Payback projected <2 years for trucker
- Can plug in reefer at some locations
- Chicken and egg problem

Control Kiosk and Power Pedestal Installations

*TSE= truck stop electrification, also called
EPS= electrified parking space

Dual System Locations

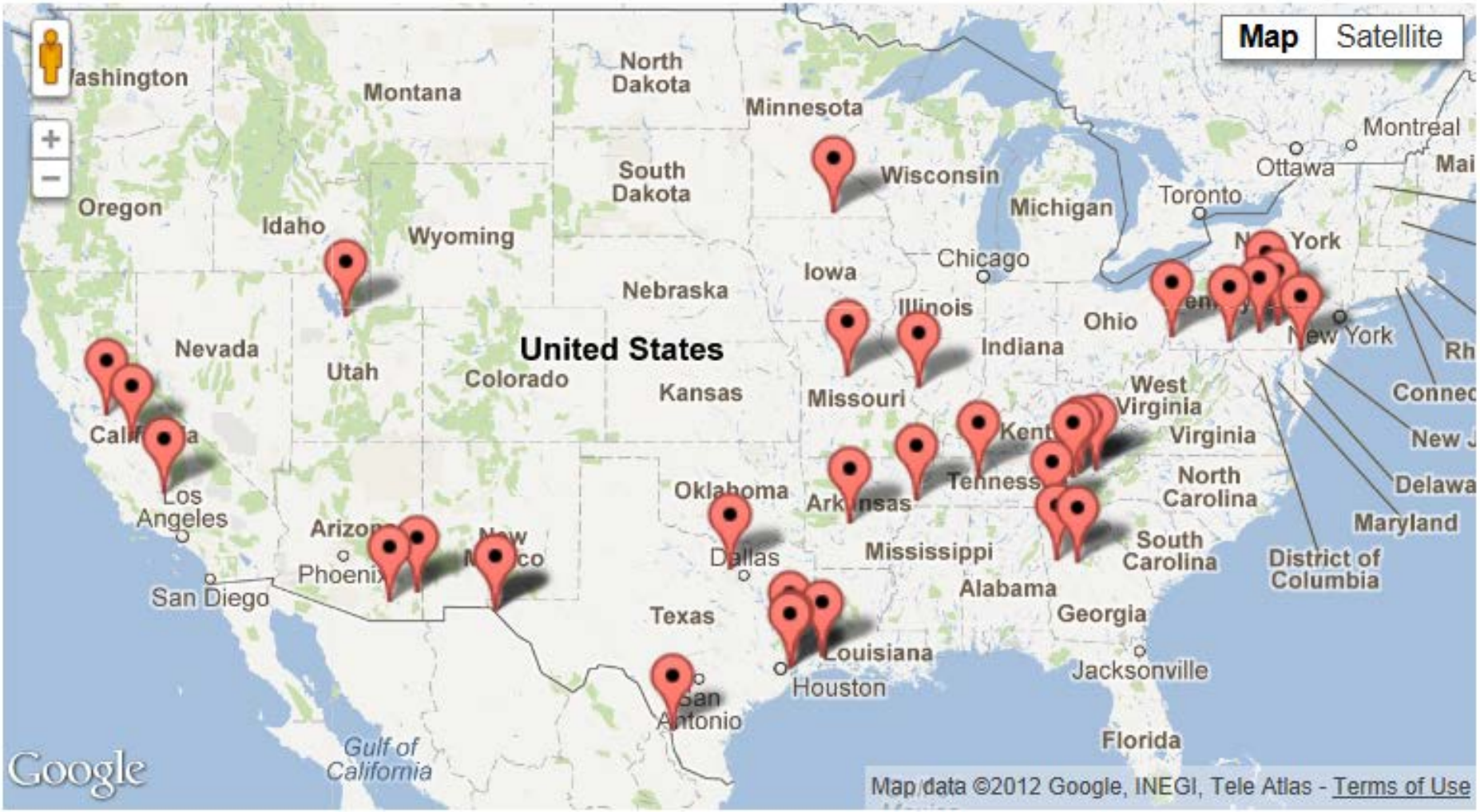


480 V e-TRU (reefer) connection

Single system electrified parking spaces require no investment by truck owner

- User satisfaction high
  - No investment by truck owner
  - Costs less than fuel for idling
- Truck stop gets part of revenues
- System owner could sell emission credits
- About 100 locations available nationwide
- Several purveyors offer similar service
- Can be used by any vehicle
- Available for ambulances now

Largest Single System Purveyor's Sites



Technologies have pros and cons

System	Services	Advantages	Disadvantages
Idling	All	No investment	High emissions, noise, fuel use
Automatic start-stop	All, intermittently	Low cost	Noisy, minimal benefit in winter
APU or similar device	All	Anywhere, anytime	High cost and weight
Truck stop electrification	All	No local emissions, pay-per-view, quiet	Requires equipped location, cost
Heater	Heating	Low cost and weight	Not full service
Air conditioner	Cooling	Low cost	Not full service, energy storage may be heavy

Options for Medium- and Light-Duty Vehicles

Driver Education, Policy Implementation, and/or Schedule Adjustments

- Vehicle/fleet telematics (to monitor driver behavior, including idling time) can support education and policy.

Devices and Technologies

- Idle limiters (engine shutdown timers)
- Automatic engine stop-start controls with battery-charge monitor
- Air and coolant heaters
  - Air heaters operate with a flame and blower
  - Coolant heaters circulate warmed engine coolant; can provide heat for several hours
- Small fans (blow heat out of a hot vehicle)
- 12-volt air-conditioner for ambulance cab

Watch for IdleBox!

- IdleBox, a soon-to-be-launched electronic “toolbox,” will include information on approaches to idling reduction, tools for educating drivers, and a national database of idling regulations (IdleBase) for on-road vehicles.
- *If you’d like to be alerted when IdleBox is launched, please give me your contact information after the presentation.*

DRAFT poster from IdleBox

More Options for Medium- and Light-Duty Vehicles

- **Hybrid Drivetrain**
  - Solves “creep” idling problem
- **Auxiliary Power**
  - Auxiliary battery/power cells
- **Electrified Parking Spaces**
  - Technology is emerging for some medium-duty vehicles such as ambulances
  - Some refrigerated trucks can plug into shore power

Hybridization can reduce idling for PTO or in queues

Type of Hybrid	Hybrid Drivetrain	Hybrid PTO	Companies	Comments
Hydraulic	X		Eaton	Eliminates creep idle
Battery Plug-In	X	X	Odyne	Li-ion battery, eliminates creep idle
Battery		X	Vanner	Monitors battery when using PTO

Hybrid digger derrick with turret-mounted winch

SmartWay verifies idle-reduction technologies

EPA has determined that devices among the product lines of the following companies save fuel and reduce emissions when compared to idling the main engine for Class 8 trucks. Separate verification is required for each vehicle type.

- **Electrified parking spaces**: CabAire, Craufurd, EnviroDock, IdleAire, Philips and Temro, Shorepower™, Xantrex
- **Auxiliary Power Units and Generator Sets** (APU/GS): ACEMCO, Airworks, Big Rig, Carrier Transicold, Diamond, Dunamis, Hodyon, Kohler, Life Force, Mantis, McMillan, Midwest, Navistar, Parks, Pony Pack, Power Technology Southeast, RigMaster, Star Class, Thermo King, TRIDAKO, Volvo, Willis
- **Fuel-operated heaters**: Automotive Climate Control, Espar, Teleflex, Volvo, Webasto
- **Battery air-conditioners**: All Around Contracting, AuraGen, Bergstrom, Cool Moves, DC Power, Diamond, Dometic, Driver Comfort, Energy Xtreme, Freightliner, Glacier Bay, Hammond, Idle Free, Indel, NAS, Navistar, Paddock Solar, Peterbilt, Safer, Sobo, Sun Power, Thermo King, Volvo
- **Thermal storage systems**: Autotherm, Webasto

You can estimate your payback period

- The more you idle, the more you can save!
- Idling reduction equipment can pay for itself quickly
- Worksheets for trucks and cars available on Argonne website

How Much Could You Save by Idling Less?

Instructions: In each row, start at the left and fill in the blanks with information about your equipment and costs. Then multiply or divide as shown. Some answers are used again. Where you see an arrow, copy the answer into the blank at the end of the arrow, so you can use it in the next step.

Calculate Costs for Avoidable Idling

1	How much fuel is used for idling? If you don't know, look up the number in the table below.		Realistically, how many hours each year might you use IR devices instead of idling?[a]		What is the price of diesel fuel?			Avoidable Idling Fuel Costs
	0.8 gallons/hour	x	2,000 hours/year	x	$ 2.75 /gallon		=	$ 4,400 /year +
2	0.8 gallons/hour	x	2,000 hours/year	x	What is your average fuel economy? 6.1 miles/gallon	=	"Miles of idling"[2] (idling is like putting miles on your engine) 9,760 miles/year	
3	How much does an oil change cost? $ 150 /oil chg.	÷	How many miles between oil changes? 30,000 miles/oil chg.	=	$ .005 /mile	x	"Miles of idling" 9,760 miles/year	= $ 48.80 /year + Preventive Maintenance Costs[1]
4	How much does an engine overhaul cost? $ 10,000 /overhaul	÷	How many miles between overhauls? 500,000 miles/overhaul	=	$ 0.02 /mile	x	"Miles of idling" 9,760 miles/year	= $ 195.20 /year = Overhaul Costs[1]
5							Add right-hand column	= $ 4644 /year Total Avoidable Idling Costs

Calculate Costs for Idling Reduction (IR)

6	How much fuel is used by the IR device? 0.2 gallons/hour	x	How many hours each year could you use IR devices instead of idling?* 2,000 hours/year	x	Price of diesel fuel (should equal price listed in line 1) $ 2.75 /gallon	=	Fuel cost for IR device $ 1100 /year	
7					Maintenance cost for IR device $ 100 /year	+	$ 1,100 /year	= $ 1,200 /year Operating Cost for On-board IR Device
8	Cost per hour to plug into EPS[b] $ 2.00 /hour	x	Enter hours plugged into EPS* 0 hours/year	=	Cost to plug in $ 0 /year	+	$ 1,200 /year	= $ 1,200 /year Total Operating Costs for IR

Calculate Savings from IR

9	Capital cost of on-board IR device $ 8,000	÷	Savings Line 5 – Line 8 $ 3,444 /year saved	=	Payback Time 2.3 years		

[a] IR: Idling Reduction [b] EPS: Electrified Parking Space * Total number of hours from lines 6 and 8 should equal the number of hours in line 1

How much fuel is used for idling (gallons/hour)?

Locate your idling engine RPM and the percentage of time you run your air conditioning (AC) while idling. The corresponding number is approximately how much fuel you use to idle. For example, 800 RPM with no air conditioning consumes about 0.64 gallons of fuel an hour.[1,2]

RPM	AC off	AC on 50%	AC on
800	.64 gal/h	.70	.76
900	.73	.79	.85
1000	.81	.87	.94
1100	.92	.98	1.05
1200	1.03	1.09	1.15

[1] "Analysis of Costs from Idling and Parasitic Devices for Heavy Duty Trucks," Technology and Maintenance Council Recommended Practice Bulletin 1108; issued 3/95 (reprinted 2003 by TMC/ATA)

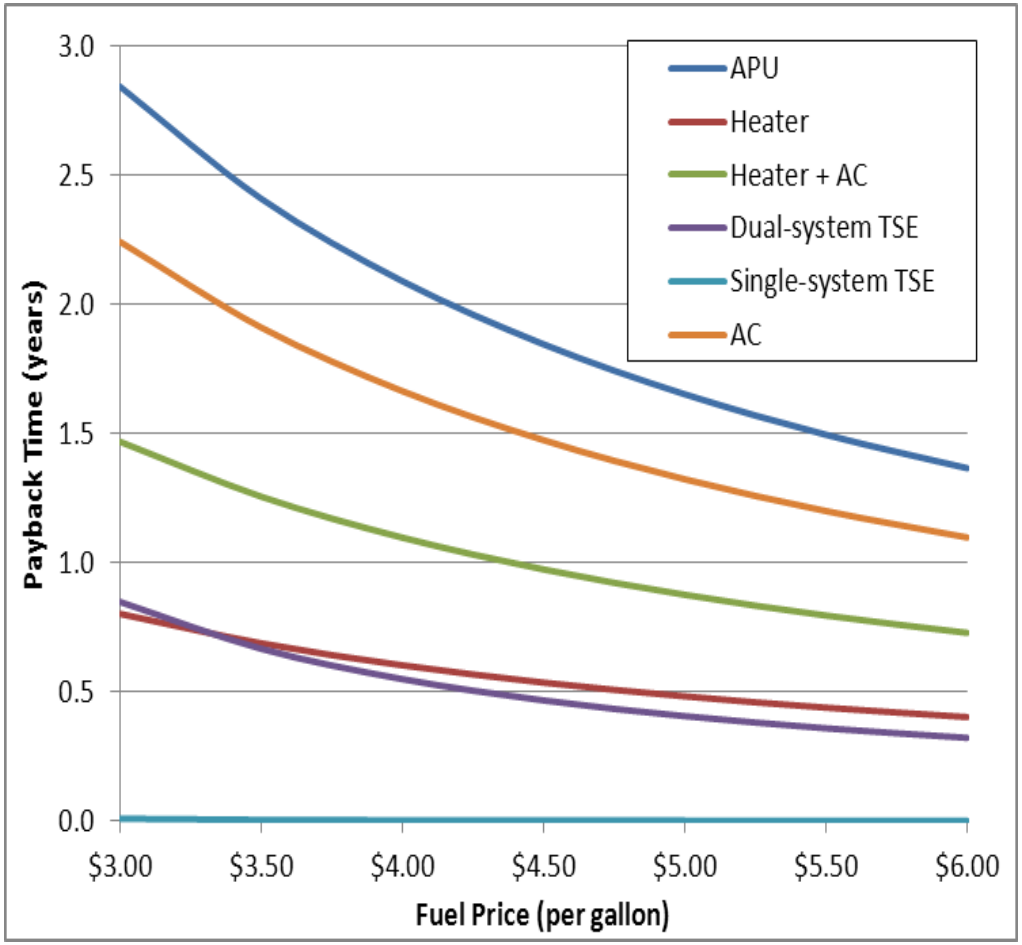
[2] Lutsey, N.P., J.P. Wallace, C.J. Brodrick, H.A. Dwyer, and D. Sperling, "Modeling Auxiliary Power Options for Heavy-Duty Trucks: Engine Idling vs. Fuel Cells." *Society of Automotive Engineers* 2004-01-1479, October 2004.

Estimated costs for alternatives vary widely

Data for Class 8; costs and energy use would be lower for medium-duty trucks.

System	Services	Fuel Use/hr	On-board cost ($)	Maintenance ($/hr)	Infrastructure cost ($/space)	Usage Charge ($/hr)
Idling truck	All	0.6-2 gal	0	0.12	0	0
Cab/bunk heater	Heating	0.04-0.08 gal	1,250	0.05	0	0
Storage AC	Cooling	~0.20 gal	4,000	0.13	0	0
APU or gen set	All	0.25-0.40 gal	8,500	0.20	0	0
Single-system EPS	All	~2 kWh	10	0	Pedestal 10,00-12,000 Refurbished gantry 5,000-9,000	2
Dual-system EPS	All	~1.5 kWh	50-2500	0.07	Up to 6,000	1

Idling reduction is the low-hanging fruit of fuel economy



Idling reduction equipment pays for itself in 6 months to 2 years (at 2012 fuel prices). This graph represents the payback time for a long-haul truck that idles an average of 40 hours per week.

How can we implement—and afford—idling reduction?

- **Bank loans**
- **National grants, loans, and rebates**
  - EPA's Diesel Emissions Reduction Program (DERA)
  - EPA SmartWay Finance Program
  - Manufacturer rebates and loans
  - Nonprofit organizations (e.g., Cascade Sierra Solutions)
- **State grants and loans (including programs targeted to small businesses)**
  - State Clean Diesel grant programs (EPA) and Congestion Mitigation and Air Quality (CMAQ [DOT]) grant programs
  - Some other state agencies and programs

For More Information

A free monthly, electronic newsletter that provides:

- Information about current funding opportunities and recent awards
- News about changes in ordinances, laws, regulations, and enforcement
- Alerts about upcoming meetings, events, and other resources of interest
- Links to idling cost calculators and other idling reduction resources

www.eere.energy.gov/vehiclesandfuels/resources/fcvt_national_idling.html

For More Information

Argonne National Laboratory's Idling Reduction Page
www.transportation.anl.gov/engines/idling.html

Alternative Fuels & Advanced Vehicles Data Center (AFDC) Idling Reduction Page
http://www.afdc.energy.gov/conserve/idle_reduction_basics.html

National Idling Reduction Network News
www.eere.energy.gov/vehiclesandfuels/resources/fcvt_national_idling.html

SmartWay Verified Technologies
http://www.epa.gov/smartway/technology/index.htm

American Transportation Research Institute's Compilation of Idling Regulations
http://atri-online.org/2012/07/20/idling-regulations-compendium/

For More Information

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