Lean, Green, and Legal: Idling Reduction is a Win-Win-Win Proposition

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June 9, 2010
Many vehicles idle to stay warm or cool

Trucks
- To keep the fuel and engine warm
- For the resting driver’s comfort overnight
- To mask out noises and smells
- For personal safety

Buses
- To warm up
- While waiting

Locomotives
- So they start in the morning
- For hotel load
- To keep the battery charged
- To heat toilet water
- For air brakes
- Habit

Construction equipment

Passenger cars, too!
Workday idling uses more fuel than idling overnight!

Idling occurs at
- Truck stops and rest areas
- Ports and terminals
- Busy delivery sites
- Border crossings
- Drive-thrus, including restaurants
- Tourist destinations (tour buses)
- Schools and hospitals!

All vehicle types may idle during the day
- Idling reduction devices do not enable slow movement in a queue (“creep mode”), but hybridization does
- Scheduling can reduce idling
Several technologies can reduce idling

- All reduce fuel use, emissions, and noise
  - Most could be used for all heavy vehicle modes
  - Insulation and glazing can reduce requirements

- **On-board equipment**
  - Automatic engine stop-start controls
  - Auxiliary power units (APU) and similar devices
  - Cab and block heaters
  - Air-conditioners
    - Battery or thermal storage
    - Evaporative cooling
  - Coolant heat recovery

- **Wayside units**
  - Single-system electrification
    - Requires no on-board equipment
  - Dual-system (shore power)
    - Driver plugs in on-board equipment
    - Can plug in dual-capable APU
## Technologies have pros and cons

<table>
<thead>
<tr>
<th>System</th>
<th>Services</th>
<th>Advantages</th>
<th>Disadvantages</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling</td>
<td>All</td>
<td>No investment</td>
<td>High emissions, noise, fuel use</td>
</tr>
<tr>
<td>Automatic start-stop</td>
<td>All, intermittently</td>
<td>Low cost</td>
<td>Noisy, minimal benefit in winter</td>
</tr>
<tr>
<td>APU or similar device</td>
<td>All</td>
<td>Anywhere, anytime</td>
<td>High cost and weight</td>
</tr>
<tr>
<td>Truck stop electrification</td>
<td>All</td>
<td>No local emissions, pay-per-view, quiet</td>
<td>Requires equipped location, cost</td>
</tr>
<tr>
<td>Heater</td>
<td>Heating</td>
<td>Low cost and weight</td>
<td>May also need air conditioner</td>
</tr>
<tr>
<td>Air conditioner</td>
<td>Cooling</td>
<td>Low cost</td>
<td>May also need heater, may be heavy</td>
</tr>
</tbody>
</table>
Ideal devices are not yet available

- Completely integrated into the truck design by the OEM
  - No duplication of generator or compressor
  - Added mass and cost minimized
- Supply heat, air conditioning, power
- Plug into external power source when available
- Provide stand-alone service for 36 hours
- Supply heat by direct combustion
- Provide creep capability

Existing devices enable vehicle to be lean, green, and legal!
Reducing idling keeps you lean

Idling wastes expensive fuel
- Over 60 million barrels a year (> $7 billion) just for trucks
- ~8% of commercial truck vehicle fuel
- Equivalent to about 1.5% of our imports

Idling causes engine wear
- Reduces mileage to overhaul

Idling adds to maintenance costs

Use of IR devices reduces fuel costs

Transportation consumes > 2/3 of our 7 billion bbl/y
Worksheet lets you estimate savings

Available as Excel spreadsheet or pdf at http://www.transportation.anl.gov/engines/idling.html.
Idling reduction is low-hanging fruit

*On-board equipment pays for itself in 3 years or less!*

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**Graph Title: Increasing level of cab comfort**

- **Legend:**
  - Pink line: Heater only (used 50% of year)*
  - Orange line: Heater plus evaporative cooler
  - Green line: Heater plus air conditioner
  - Blue line: APU
  - Red line: Top-of-line APU ($10,000)
  - Light green line: Dual system EPS

**Axes:**
- **Y-axis:** Payback time (years)
- **X-axis:** Diesel price ($/gallon)

*Actual amount of time heater can be used varies by location*

[Assumes 40 h idling per week]
Savings to truck owner rise with idling hours

- Options with low investment save most for low idlers
- Options with low hourly cost save most for high idlers
- All alternatives produce savings for >18 hours/week idling ($4.50/gal diesel fuel)
Reducing idling is green because it reduces pollution

- Idling produces air emissions
  - 520,000 t NO\textsubscript{x}, 500 t PM, and 25 million t CO\textsubscript{2} from trucks
  - Often near dense or sensitive populations
  - Emissions blamed for increasing lung disease
- Noise is also a serious problem
- Idling-reduction devices have lower impacts than idling
We compared full fuel cycle emissions for idling and alternatives.
Idling often isn’t legal; regulations vary by location

- ATRI keeps current list of regulations
  - Is updated frequently because of continued legislative activity
  - Last updated January 2010
  - Includes 4-page cab card for truckers to carry
  - Lists 40+ different sets of rules for states, counties, or cities
  - Includes links to legislation for reference
  - Included on AFDC website

- Idling time limits, exemptions, penalties all vary
  - Maximum allowed time is 0-15 minutes
  - May vary with temperature
  - Buses, cars may be included
  - Sleepers may be exempt
  - May be enforced or not
  - Penalty may include prison time!
Attention All Drivers
Engine Idling Time
5 Minutes Max.
Mass. DEP Regulation
310 CMR. 7.11(1)

Attention Truck Drivers:
State Regulation
Engine Idling Time Limited
To:
5 Minutes Maximum
By Order of District of Columbia Dept. of Health/Air Quality Division

Attention
Idling of Motor Vehicles Prohibited

Diesel Engine Idling Prohibited
3 Minute Limit
Pursuant to Municipal Ordinance #9-80-095

Students Breathe Here
Please Turn Your Engine Off While You Wait.

IDLE FREE ZONE

No Idling
Cleaner Air = Cleaner Water
For people and for fish, please turn off your engine.

BUS DROP #3

Lenox is an "Idle-Free" Town
Protect our health and environment. Turn off your engine when parked.

DRIVER'S IDLING MORE THAN 3 MINUTES PROHIBITED

Turn off your engine
Clean Air Zone

NO STANDING ANYTIME
NO ENGINE IDLING MAX FINE $2000
TOW BUSES
Exemptions to anti-idling laws also vary

- Armored vehicles
- Emergency vehicles
- Federal Hours of Service
- Inspections or maintenance
- Loading/unloading passengers
- Natural gas and electric vehicles
- Power take-off equipment
- Queuing, including access to military installations
- Recharging of hybrid vehicles
- Sleeping or resting in a sleeper berth
- Snow removal equipment
- Temperature
- Traffic conditions
- Within mines or quarries

And a 400 pound exemption for IR equipment may apply!
“News” provides current status

- Published monthly
- Lists funding opportunities
- Provides status of 400-lb weight exemption
- Alerts readers to changes in regulations and enforcement
- Describes new programs and recognitions of excellence
- Lists upcoming meetings
- Provides links to information posted online
- Includes information about truck stops and rest areas
- Provides links to idling cost calculators
- Let me know if you want to get it by e-mail!
Thank you!

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Sponsor: DOE Office of Vehicle Technologies
Clean Cities Program

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Back-up slides for reference
For further information on this topic:

http://www1.eere.energy.gov/vehiclesandfuels/resources/fcvtnational_idling.html
http://www.atri-online.org
http://www.transportation.anl.gov/engines/idling.html
http://www.afdc.energy.gov/afdc/vehicles/idle_reduction.html
http://www.afdc.energy.gov/afdc/locator/tse/
http://www.afdc.energy.gov/afdc/applications.html
Bus idling and its impacts can be reduced

- Hot issue even though energy use and emissions small
  - School buses impact children
  - Tour buses eyesores at monuments
- Use idle-reduction devices
- Buy a hybrid bus
- Use no-tech solutions
  - Engine can be turned off
  - Revised parking arrangements reduce exposure
  - Alternative fuels reduce emissions
Marine vessels run engines in port

- **Ocean-going ships in port**
  - Have large power requirements
  - Use on-board generators
  - Low-sulfur fuel oil reduces emissions
  - Can plug into shore power (“cold ironing”)

- **Inland marine**
  - Ferries use full power to hold to dock
    - Strong-arm docker R&D in progress

Four copper cables supply power from substation
Locomotive installation is proceeding rapidly

- Fuel savings make payback rapid
  - Switchers idle 60% of time, line haul almost 40%
- Only 7 companies own 20,000 locomotives
- Limited number of equipment manufacturers
- Retrofit of locomotives common practice
- Idling reduction facilitates $NO_x$ compliance
  - Can sell emission credits*

*See: Trading Locomotive Emissions: A Potential Success Story (AWMA 2002)
EPS costs borne by infrastructure owner

- Capital costs lower for dual system than single
- Operating costs dominated by
  - Service on debt
  - Labor costs (some single systems)
  - Electricity cost to lesser extent
- Revenues depend on parking space occupancy
  - Major supplier had achieved about 25%
  - Recently raised hourly charge
- Long-term financial viability remains to be seen
Idling uses over 8% of commercial truck fuel

<table>
<thead>
<tr>
<th></th>
<th>Gasoline</th>
<th>Diesel</th>
<th>Other</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Overnight idling</td>
<td>0</td>
<td>666</td>
<td>0</td>
<td>666</td>
</tr>
<tr>
<td>Workday idling</td>
<td>1,416</td>
<td>1,002</td>
<td>73</td>
<td>2,491</td>
</tr>
<tr>
<td>Total long-duration idling fuel use</td>
<td>1,416</td>
<td>1,668</td>
<td>73</td>
<td>3,157</td>
</tr>
<tr>
<td>Total fuel use for commercial trucks</td>
<td>13,922</td>
<td>22,681</td>
<td>378</td>
<td>36,982</td>
</tr>
<tr>
<td>Idling % of total use by fuel type</td>
<td>10.2%</td>
<td>7.4%</td>
<td>19%</td>
<td>8.5%</td>
</tr>
</tbody>
</table>
Hourly cost saving depends on fuel price

- Hourly costs fixed for wayside systems
- Rise with fuel cost for on-board options, including idling
- Operating cost for all options lower than idling if fuel >$3/gal
## Estimated costs for alternatives vary widely

<table>
<thead>
<tr>
<th>System</th>
<th>Services</th>
<th>Fuel Use/hr</th>
<th>On-board Cost ($)</th>
<th>Maintenance ($/hr)*</th>
<th>Infrastructure cost ($/space)</th>
<th>Usage Charge ($/hr)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Idling 2001 truck</td>
<td>All</td>
<td>0.77 gal heating</td>
<td>0</td>
<td>0.12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.98 gal cooling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Idling 2007 truck</td>
<td>All</td>
<td>0.53 gal heating</td>
<td>0</td>
<td>0.12</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td></td>
<td></td>
<td>0.72 gal cooling</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cab/bunk heater</td>
<td>Heating</td>
<td>0.06 gal</td>
<td>1,250</td>
<td>0.07</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Storage air conditioner</td>
<td>Cooling</td>
<td>0.20 gal</td>
<td>4,000</td>
<td>0.13</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>APU or generator set</td>
<td>All</td>
<td>0.23 gal</td>
<td>8,000**</td>
<td>0.33</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Electrified parking space (single on gantry)</td>
<td>All</td>
<td></td>
<td>10</td>
<td>0</td>
<td>16,700</td>
<td>2.45</td>
</tr>
<tr>
<td>Electrified parking space (single on pedestal)</td>
<td>All</td>
<td>2.4 kWh heating</td>
<td>10</td>
<td>0</td>
<td>9,000-11,000</td>
<td>1-2</td>
</tr>
<tr>
<td>Electrified parking space (dual system)</td>
<td>All</td>
<td>1.7 kWh cooling</td>
<td>10</td>
<td>0</td>
<td>Up to 6,000</td>
<td>1</td>
</tr>
</tbody>
</table>
Emissions vary with climate and electricity mix