



Heavy Vehicle Idling

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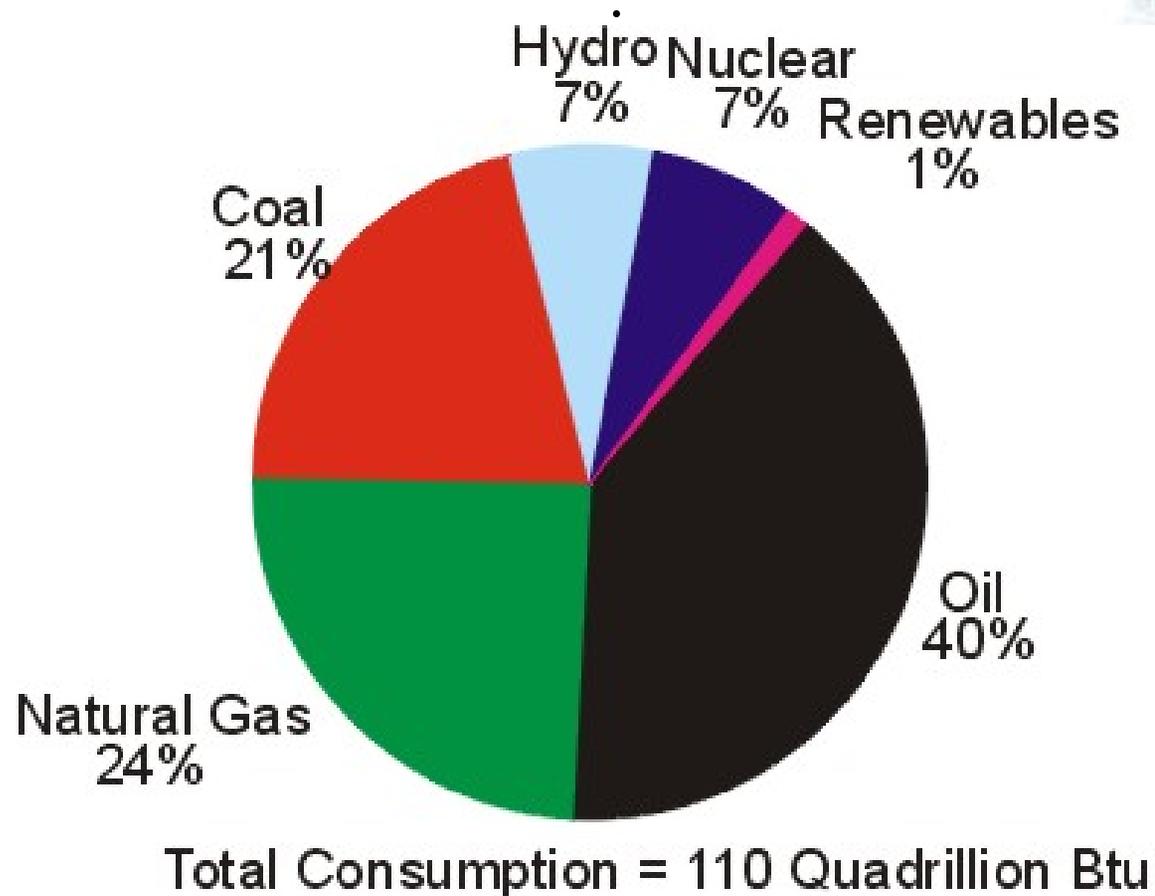
**Center for Transportation Research
Argonne National Laboratory**



*A U.S. Department of Energy Laboratory
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Oil supplies 40% of North American energy

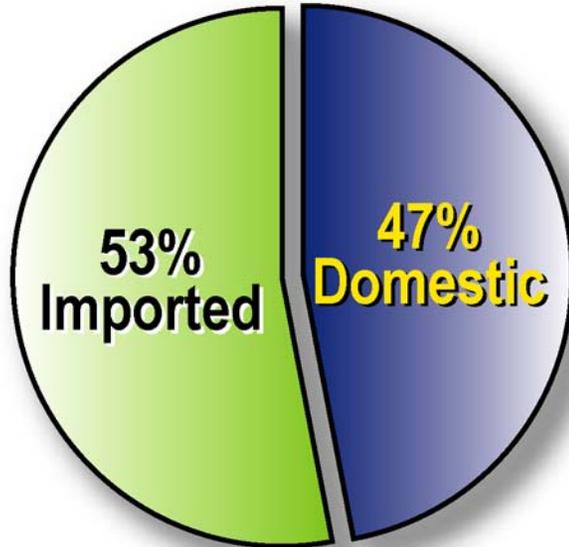


Source: EIA

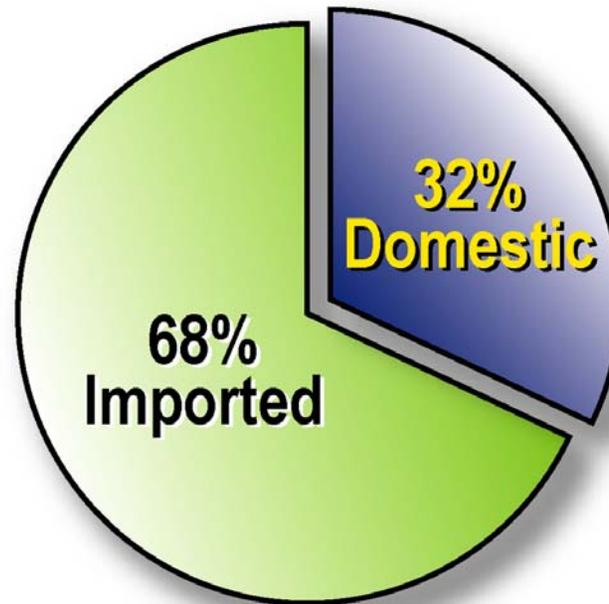


US dependence on oil imports still grows

- **22% of imports from Persian Gulf, Vs. 18% in 1/2003**
 - Prices are rising again
 - True costs may not be reflected by pump prices



2004



2025



Data from API and DOE (EIA)

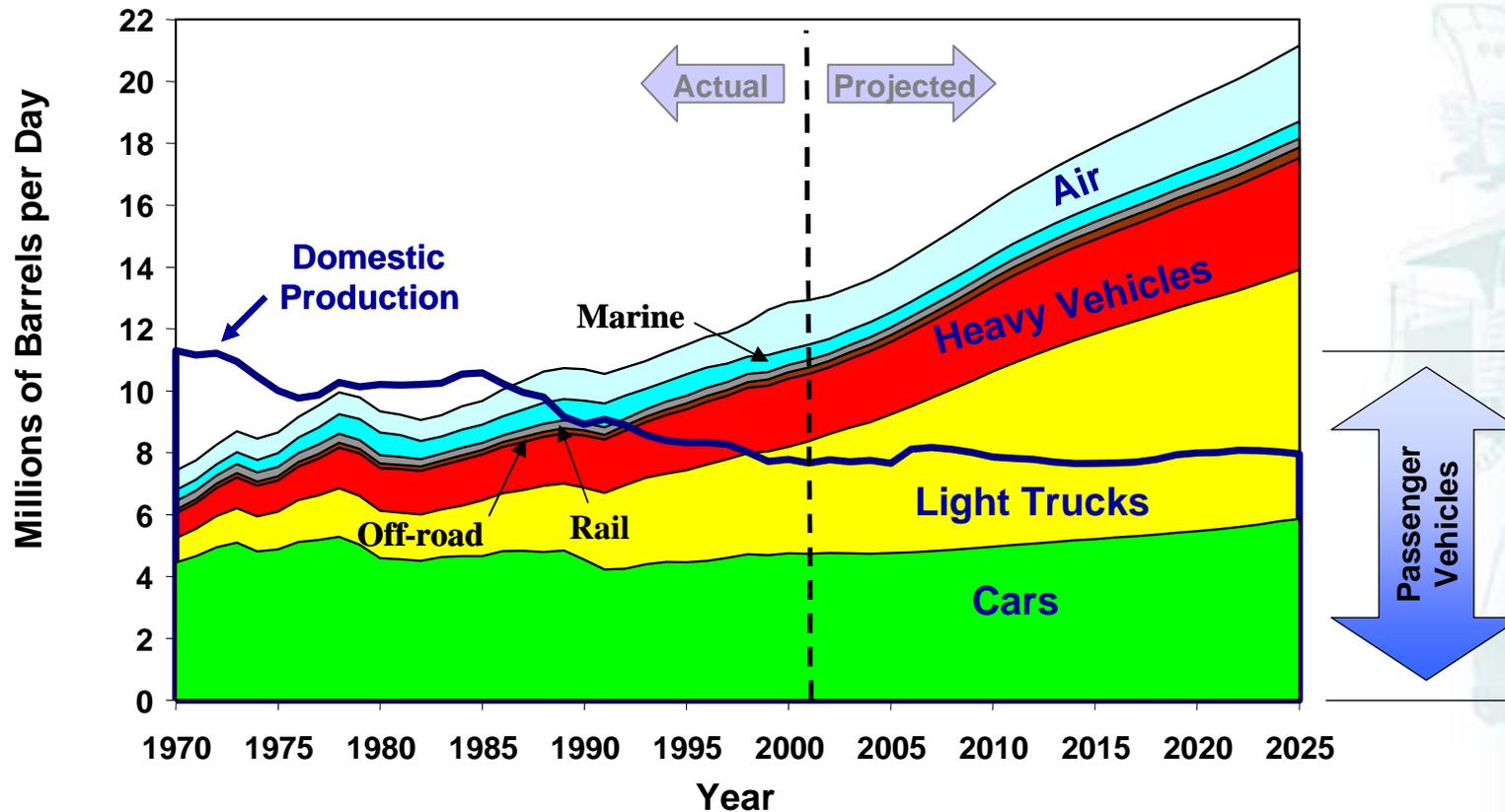
Over 2/3 of our 20 million barrels per day is consumed for transportation.

- Up from 52.3% in 1973
- Transport still relies on oil for 97% of its energy



Heavy vehicles use 28% of transport fuel

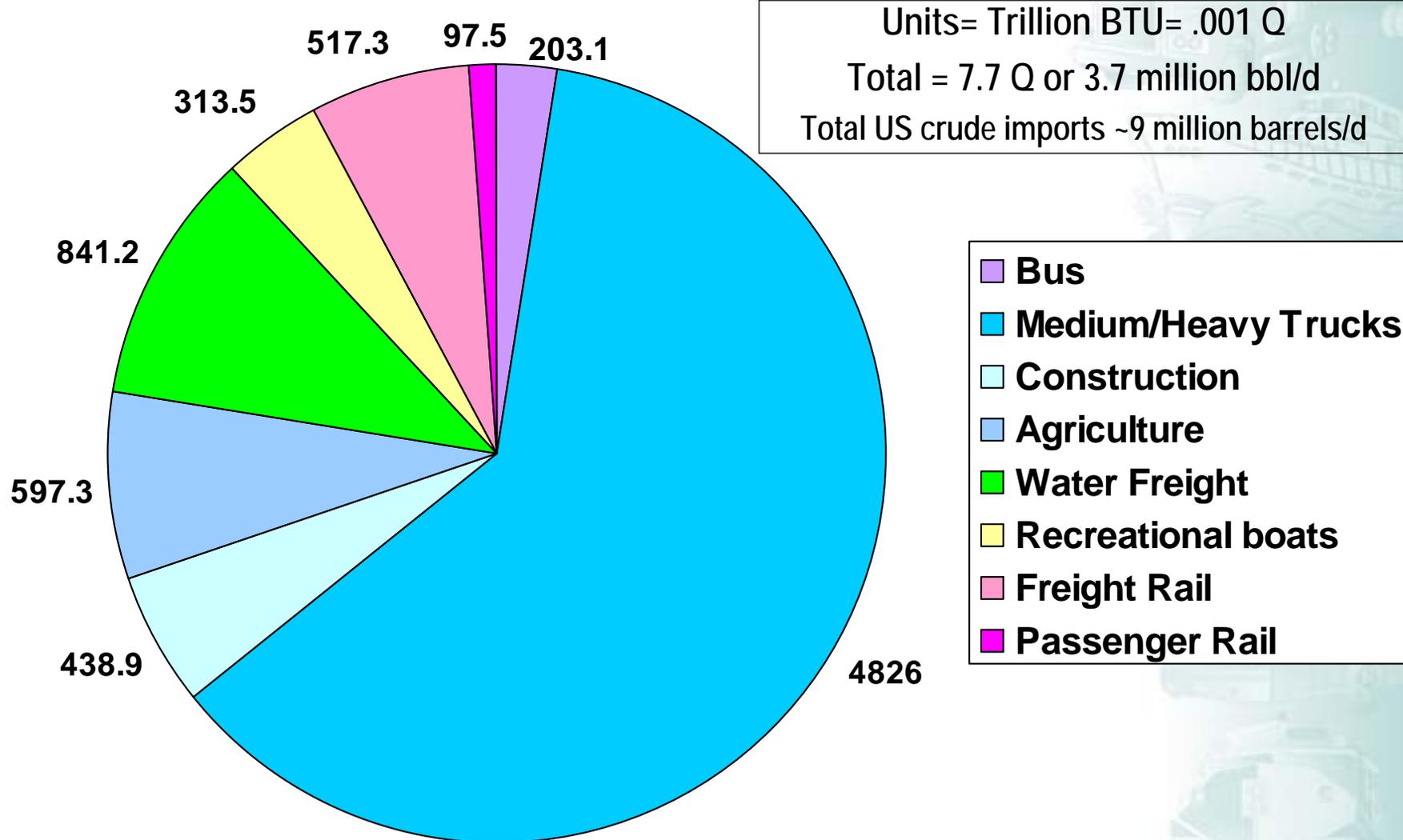
U.S. Transportation Petroleum Use



Source: Transportation Energy Data Book: Edition 22, September 2002, and EIA Annual Energy Outlook 2003, January 2003

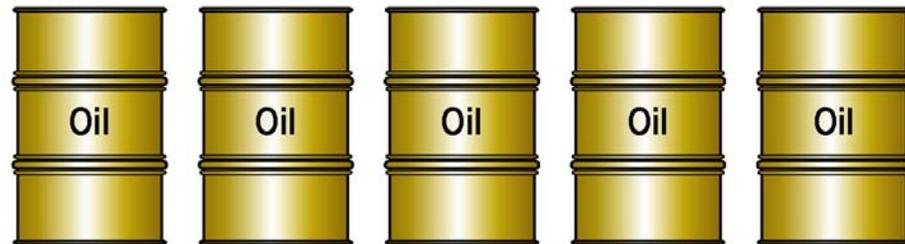
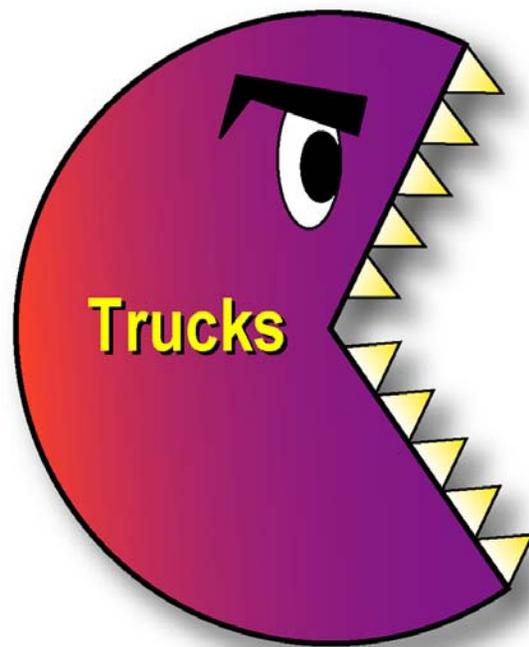


Trucks dominate heavy vehicle energy use



Data from Transportation Energy Data Book

We need to keep heavy vehicles from consuming more and more fuel.



We examined impacts of heavy vehicle idling

- **Petroleum use**

- Over 1 billion gallons/year (almost \$ 2 billion)
- ~2% of heavy vehicle fuel
- Equivalent to about 1% of our imports

- **Emissions**

- **Noise**

- **Engine wear**

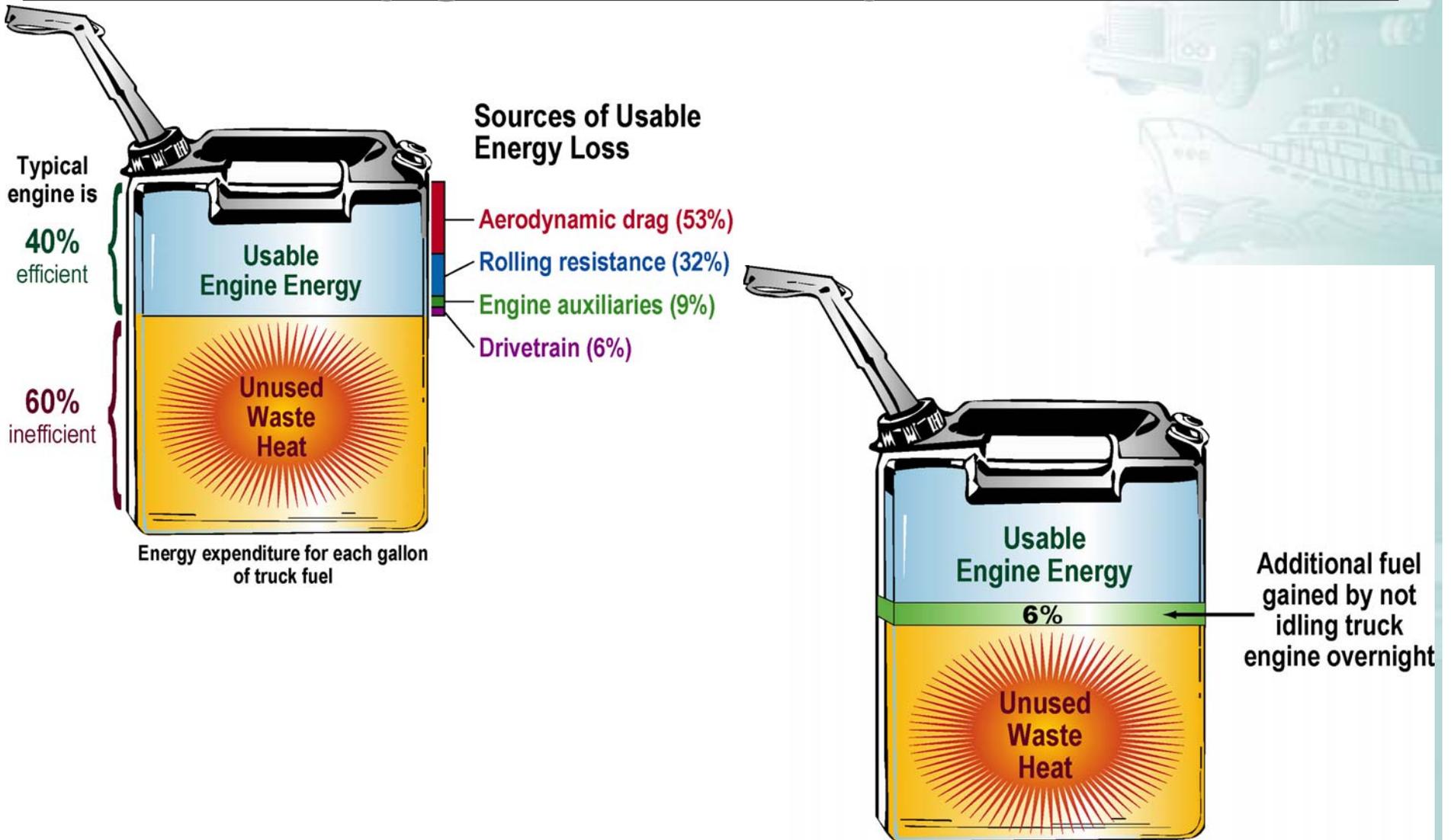
- Reduces mileage to overhaul

- **Added maintenance costs**



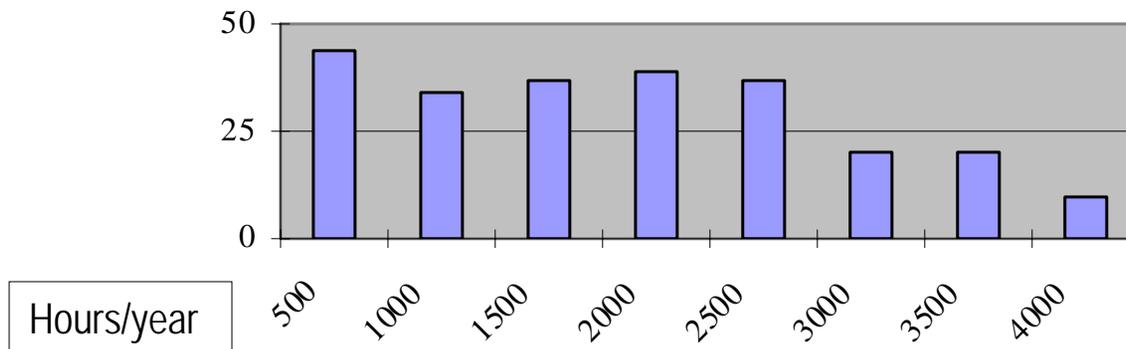
Typical 4400 hp locomotive diesel engine
... weighs 46,000 pounds

Eliminating overnight engine idling can extend every gallon of fuel by 6%.



How much do long-haul trucks idle?

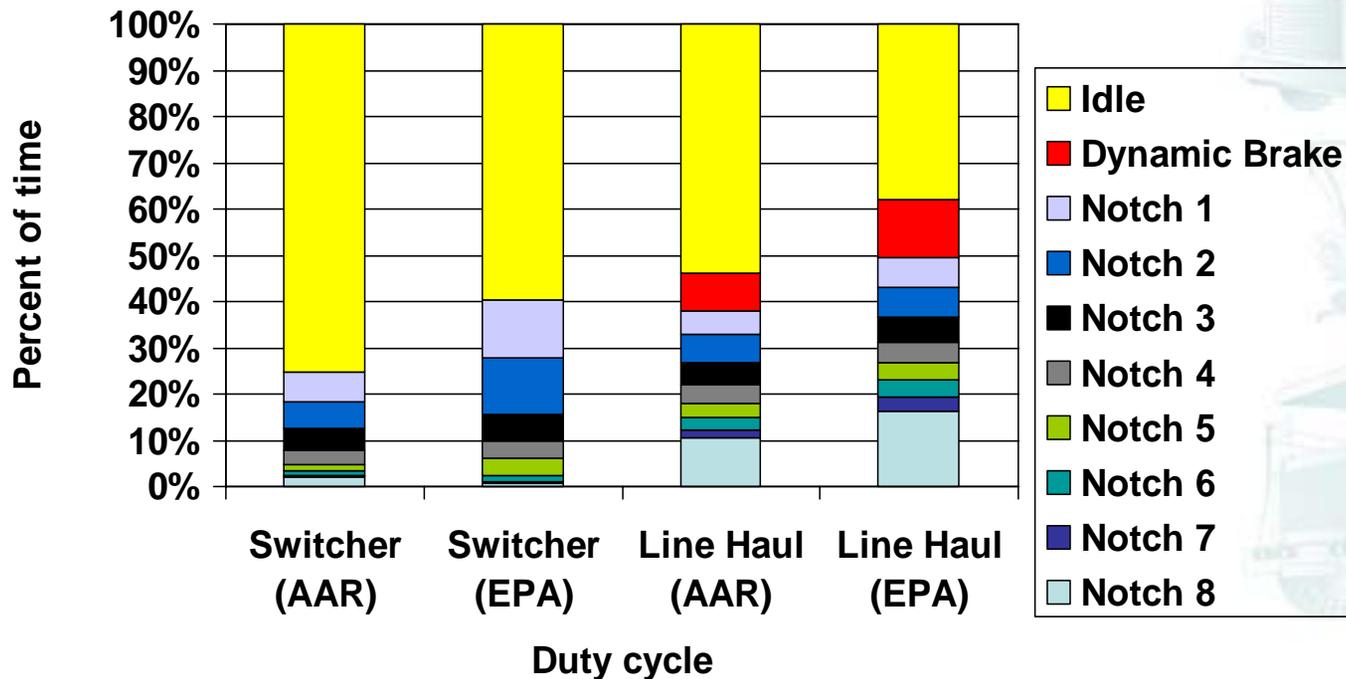
- Estimate 6 hours/day, 310 days/year: 1860 hours/year
 - Caterpillar study consistent with this
- UC Davis survey reveals broad distribution



- Annual national impacts
 - Emission of 140,000 t NO_x, 2400 t CO, and 7.6 million t CO₂
 - Waste of 838 million gallons diesel fuel (5% of heavy truck fuel)
 - Value about \$1.4 billion



Locomotives idle up to 75% of the time



- **Petroleum used for fuel and lubrication**
 - Over 230 million gal/y (6.3% rail freight energy) is wasted
 - Up to 0.1 gallons per gallon of fuel (CSX)
- **Added maintenance costs estimated as \$1/h idling (UP)**
- **Emissions recently limited by EPA**



Many heavy vehicles idle to stay warm

- Trucks
 - To keep fuel and engine **warm**
 - For services to resting driver
 - HVAC
 - Power for appliances
 - To mask out noises and smells
 - Because other drivers do it
 - For safety
- Buses
 - To **warm** up in morning
 - To maintain HVAC while waiting
- Locomotives
 - To keep engine **warm** to ensure it starts
 - In yard
 - Antifreeze generally not used
 - For hotel load while waiting
 - On sidings and at terminals
 - To keep battery charged
 - To **heat** toilet water
 - Service loss if frozen
 - To avoid Terminal Brake Test
 - Perceived futility of shutdown
 - Ingrained operating habits



Trucks don't just idle at truck stops

- **Overnight idling occurs**
 - At truck stops and rest areas
 - Not enough parking spots where needed
 - In shopping center parking lots
 - On ramps and roadsides
 - Near first morning appointment
 - Enables prompt arrival
 - At home base
- **Other long-duration idling occurs**
 - At ports and terminals
 - At busy delivery sites
 - At border crossings



Scheduling can help reduce idling at these locations.



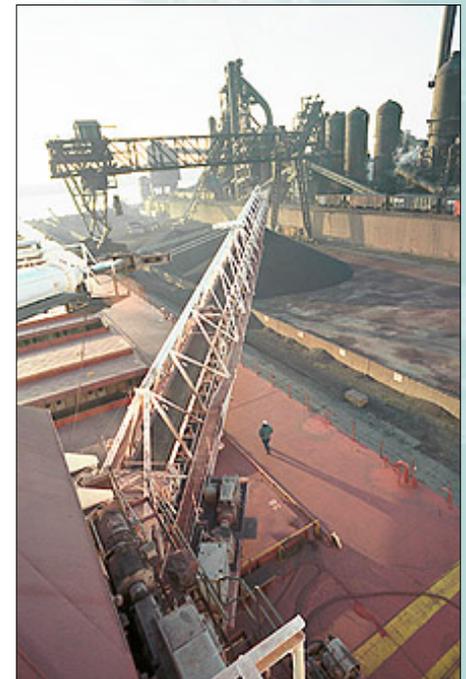
Buses idle at various locations

- **Hot issue**
- **Energy use relatively small**
- **Emissions proportionally small**
- **Tour buses idle near monuments**
 - **Very visible**
 - **Parking bans just move the buses**
- **School buses idle at schools**
 - **Sensitive population**
 - **Many localities regulating**
- **Transit buses idle at depots**
- **Inter-city buses idle while waiting for passengers**
- **Many buses idle to warm up in the morning**



Marine vessels run engines in port

- **Ocean-going ships in port**
 - May have large power requirements
 - Have on-board generators of appropriate size
 - Use high-sulfur fuel oil so are emission problem
 - Could use cleaner fuel or plug into shore power
 - Navy uses shore power
- **Inland marine**
 - Also may need power to load and unload
 - Some ships use locomotive engines
 - Could use locomotive APU to keep warm?



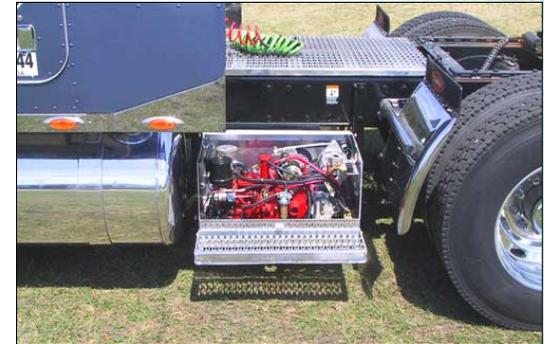
Off-road vehicles idle also

- **Do not idle overnight**
 - Construction light in winter
 - Security is major concern
- **May idle on job**
 - To be ready
 - To keep operator comfortable
 - Some small heaters installed
- **Idling restricted to control emissions**
 - Boston: Big Dig
 - New York City: Ground Zero
- **Vehicles have other functions besides transport**
 - Brought to work site on flat bed



Several technologies can reduce idling

- Most could be used for all heavy vehicle modes
- All reduce fuel use, emissions, and noise
- On-board equipment
 - Automatic engine stop-start controls
 - Cylinder deactivation
 - Auxiliary power units (APU) and similar devices
 - Cab and block heaters (fuel-fired or electric)
 - Air conditioners
- Wayside units
 - Shore power plug-ins
 - Electricity only
 - All services
 - Fluid circulation systems



Bus idling and its impacts can be reduced

Idle-reduction devices:

- **Small on-board diesel heaters**
- **Electrical block heaters**
- **Immersion heaters for coolant**
- **Fluid circulation at depot**



No-tech solutions:

- **Engine can sometimes be turned off**
- **Alternative fuels reduce emissions but not energy use**
- **Revised parking arrangements reduce exposure**

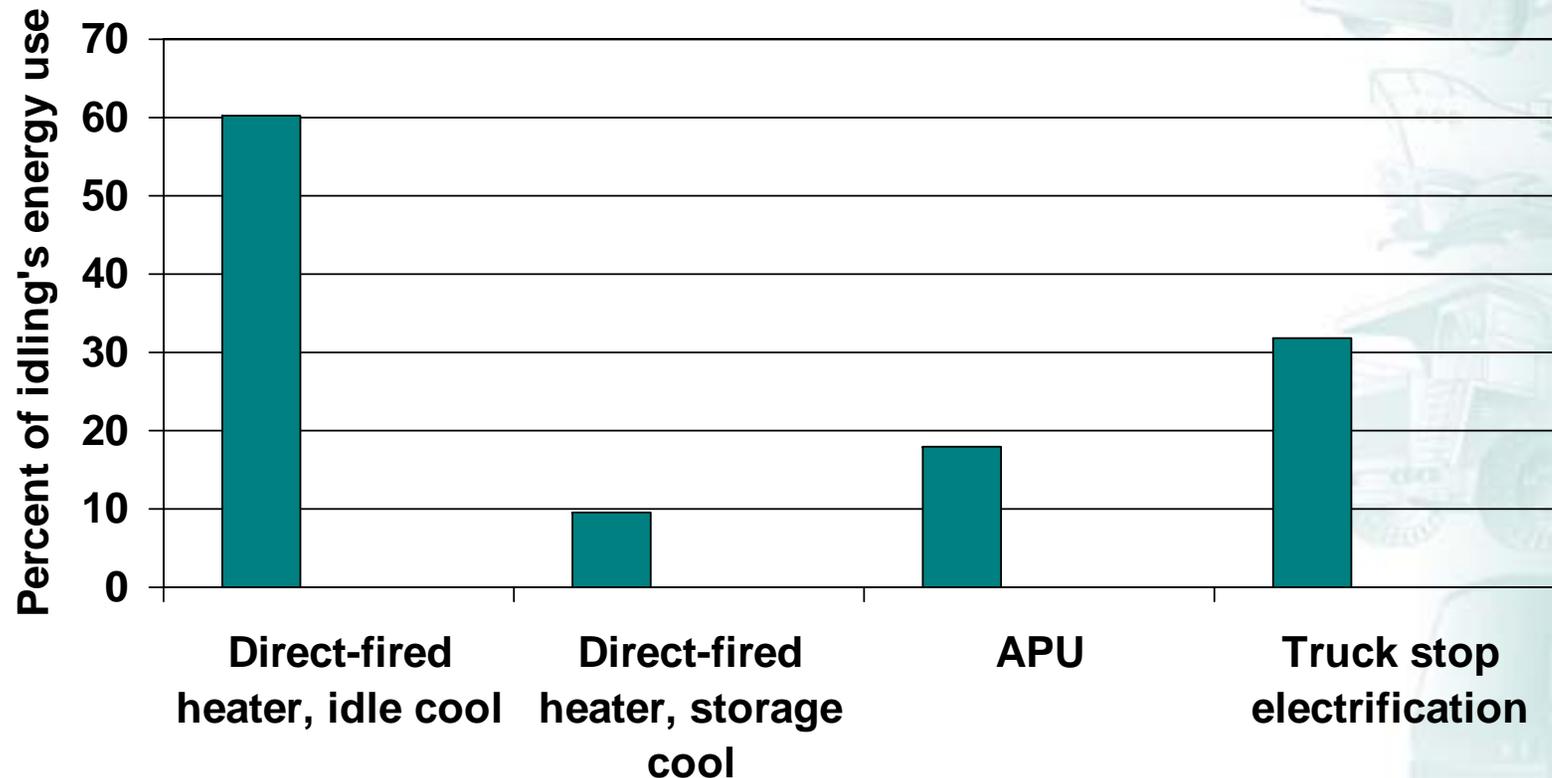


Technologies have pros and cons

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
Wayside unit	All	Quiet, no local emissions	Requires equipped location
Heater	Heating	Low cost and weight	Not full service
Air conditioner	Cooling	Low cost	Not full service, battery heavy



Alternatives to idling reduce impacts



Similar reductions occur for CO₂ emissions and petroleum consumption except truck-stop electrification uses <1% petroleum.



Payback time depends on operating practices

- Fuel savings are the main financial benefit
 - Payback is faster if more idling hours are displaced
- Savings also accrue from reduced maintenance costs
 - Routine maintenance can be performed less often without idling
 - Mileage to overhaul can be increased without idling
 - Worksheet for trucks is based on TMC RP 1108
- Low-idling history should increase vehicle resale value
- APU has residual value

Calculate Your Idling Costs
Based on Transportation Council Report #1108, revised March 1995, and Agip's National Laboratory Report, June 2002

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.

					Fuel Costs
1	How many hours each year could you use auxiliary devices instead of idling? hours/year ×	How much fuel is used for idling? Look up the number in the table below. gallons/hour ×	What is the price of diesel fuel? \$/gallon		= \$ /year
2	How much does an oil change cost? \$/oil chg. =	How many miles between oil changes? miles/oil chg. =	What is your average fuel economy? miles/gallon =	"Miles of idling" (filling in the parking miles on your engine)	Preventive Maintenance Costs
3	How much does an engine overhaul cost? \$/overhaul =	How many miles between overhauls? miles/overhaul =	"Miles of idling" (filling in the parking miles on your engine)	"Miles of idling" (filling in the parking miles on your engine)	Overhaul Costs
4					Total Costs
5	Total Costs for Idling (add right-hand column)				= \$ /year

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

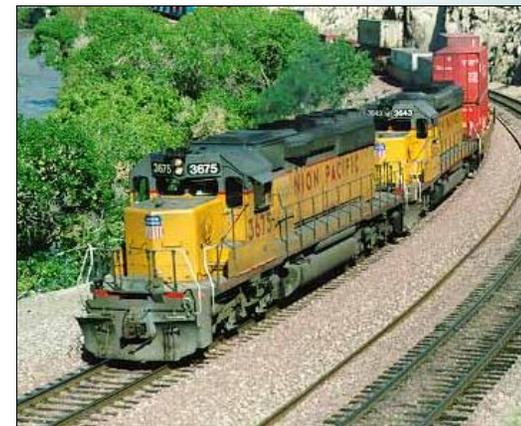
Locate your engine RPM and parasitic brake horsepower (BHP) at idle. The corresponding number is about how much fuel you use to idle. For example, 1000 RPM at a BHP of 10 consumes about 1.2 gallons of fuel an hour. Typical accessories require between 10 and 20 BHP.

RPM	Brake Horsepower of Accessories				
	0	5	10	20	30
800	0.6	0.7	1.0	1.4	1.7
1000	0.75	1.0	1.2	1.55	2.0
1200	1.0	1.2	1.5	1.8	2.25



Locomotive installation proceeding rapidly

- Only 7 companies own 20,000 locomotives
- One of these manufactures its own APUs
 - They have over 1400 installed already
- Limited number of equipment manufacturers
- Retrofit of locomotives common practice
- All available devices have short payback times
- Idling reduction facilitates NO_x compliance
- Emission credits can be sold



Recent developments impact truck idling

- **New technology options are available**
- **Agencies have been busy with programs**
- **Legislation has been written**
 - **Many states and localities are restricting idling**
- **Hours of service rules have changed**
 - **May increase need for idle-reduction devices**
- **EPA guidelines allow emission credits in SIPs**
- **Trade organizations have been formed**

BUT most trucks still idle overnight!



Why are trucks still idling?

- **Regulatory picture is unsettled**
 - **Will the device I buy meet all regulations?**
- **Technology choices may be confusing**
 - **Which is right?**
 - **Will service be available?**
- **Capital is scarce**
- **Owner/operators are independent**



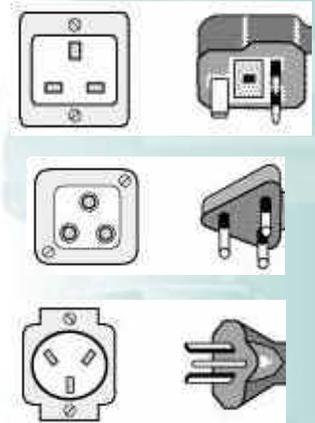
How can we speed up idling reduction?

- **Encourage a level playing field**
- **Create financial incentives**
- **Demonstrate technology effectiveness**
- **Develop more attractive technology**
- **Continue education**
- **Facilitate coordination among stakeholders**



How can we level the playing field?

- **Encourage uniform regulations**
 - Facilitate communication among regulators
 - Advocate national guidelines
 - Analyze the impacts of proposed regulations
 - Avoid regulations that categorically forbid engine use
 - Pay attention to enforcement, too
- **Reduce investment risk by standardization**
 - Industry can develop codes and standards
 - Government can endorse
 - Capabilities could be specified
 - Uncertainty about product design removed
 - Equipment would be compatible

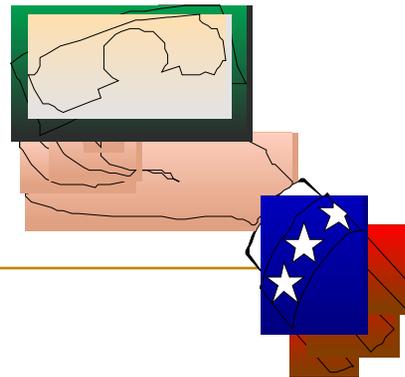


Real help is needed

We received this note:

"As an owner of 1 truck, I am interested in reducing my idling. I would like to install an auxiliary power unit, but cannot find the funds to do this. **Does the government have a program that could help an owner-operator get the money to buy one**, like a grant or small business equipment loan?

I know there are a lot of people who would take advantage of anything that would help in defraying the cost, not only as a way to save money, but it would also help the environment."



What financial incentives could be used?

- Excise tax exemption for idle-reduction equipment
- Weight waiver (250 pounds in Energy Bill)
- Tax credit for equipment
- Refund tax for APU fuel
 - Some states refund tax for all non-road fuel
- Low-interest loans
- Grants (e.g., California's Carl Moyer Program)
- Leasing opportunities
- Emission credit trading
 - EPA guidelines allow credits in SIPs



These could be made available for all modes.



DOE idling reduction R&D began in 1986

- “Don’t Idle Your Profits Away” published 1986
- APU research funded (diesel in late 1980’s, fuel cell now)
- More Electric Truck development supported
- Detailed studies (trucks began 1996, locomotives 2001)
- Information published and disseminated
 - Comprehensive updated report in preparation
- Demonstration projects funded
- Clean Cities is embracing idling reduction



Technologies are being demonstrated

- EPA, NYSERDA, and EPRI funding TSE
- DOE demonstrating on-board units
- EPA, DOE, and Texas funded locomotive APU projects



NEP gave EPA and DOT a new focus in 2001

- **EPA Mission-** To protect human health and to safeguard the natural environment– air, water, and land
- **DOT Mission-** To ensure a fast, safe, efficient, accessible and convenient transportation system
- **New Focus-** To develop ways ... to reduce emissions and fuel consumption from long-haul trucks at truck stops by **implementing alternatives to idling...**
- **EPA and DOT programs will be highlighted**



Each stakeholder has an important role

- DOE focuses on energy and emissions R&D
- EPA creates environmental policy and deploys innovative environmental strategies
 - States and municipalities set and enforce regulations
 - Need to be consistent
- DOT emphasizes infrastructure and safety
- Industry makes it happen
 - Manufacturers build equipment
 - Owners and operators purchase and use

Collaborative effort is putting the pieces together.



NATIONAL IDLING REDUCTION PLANNING CONFERENCE

*Developing comprehensive, nationwide
solutions for heavy-vehicle idling reduction*

MAY 17-19, 2004

ALBANY, NEW YORK



- **All groups are included**
 - Government at all levels
 - All heavy vehicle modes
 - Industry: users, truck stop operators, manufacturers
 - Researchers
- **All relevant topic areas will be covered**
 - Technology and research
 - Legislation and regulation
 - Energy, environmental impacts, and economics
- **Objective is coordinated action**



Thanks to key people for funding and planning

- **Sid Diamond- DOE OFCVT: for major funding**
- **Other major sponsors: EPA, DOT, NYSERDA**
- **Exhibitors**

- **Frank Stodolsky- ANL: for the idea**
- **Paul Bubbosh- EPA**
- **Diane Turchetta- FHWA**
- **Joe Tario- NYSERDA**
- **Terry Levinson- ANL**
- **Sophia Kitts- ORISE**

