

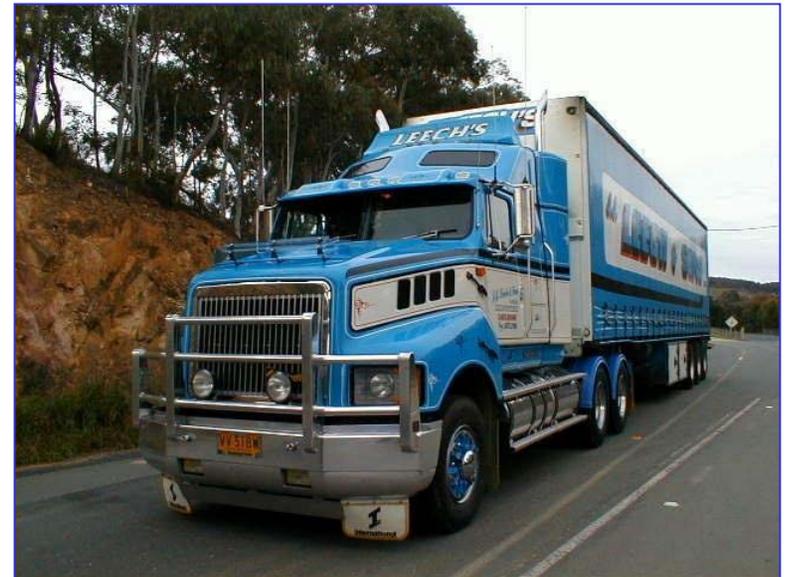


# Technology Options to Reduce Truck Idling

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# Argonne has completed a truck idling study

- Idling overnight has impacts
  - wasted money
  - excess petroleum use
  - more air pollution
  - extra noise
- Report is available
- Results summarized here
- Applicable to locomotives
- Potential benefits estimated





# This presentation outlines...

- The extent of truck diesel engine idling
- Technology options to reduce idling
- Estimated energy and emissions impacts
- Estimated costs



# Why is the truck's engine idled?

- To keep the cab/sleeper heated or cooled
- To mask out noises
- To keep the fuel warm in winter
- To keep the engine warm to avoid cold starting it in winter
- Because all the other drivers do it
- Safety





# Current practice for trucks

- 458,000 combination trucks travel >500 miles from home daily
- Good idling statistics not available
- Industry source estimates 6 hours/d
  - 10 h/d winter, 4.5 h/d summer
  - total 1830 h/y
  - **~840 million gallons of diesel fuel consumed annually in U.S. by idling long-haul trucks**



## Current practice (cont.)

- Actual practice varies
  - from 1-2 night/week (<1000 h/y)
  - to never turning off (>5000 h/y)
- About 238,000 places to park
  - So some trucks park during the day or on the side of the road



# Alternative devices have pros and cons, but...

| Technology                       | Benefits                            | Drawbacks  |
|----------------------------------|-------------------------------------|--|
| Direct-fired heater              | Heat anywhere; small                | Cannot supply cooling; requires battery power        |
| Auxiliary power unit             | HVAC and power anywhere             | Heavier, larger, more expensive than heater          |
| Thermal storage                  | HVAC for cab/sleeper only, anywhere | Large mass of storage medium; requires battery power |
| Direct heat with storage cooling | HVAC and engine heat anywhere       | Requires battery power                               |
| Truck stop electrification       | HVAC and power                      | Only at limited locations; not commercial            |



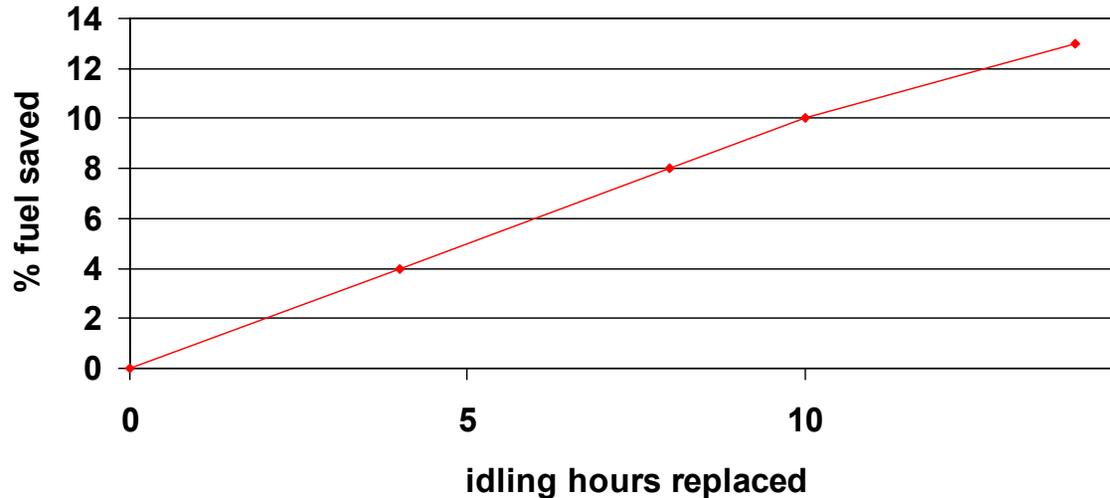
# Alternatives reduce operating costs

- Less diesel fuel is burned
  - idling typically 1 gal/h
  - alternatives typically ~0.2 gal/h
  - at \$1.75/gal, saving \$1.40/h
  - this is the major saving
- Less frequent oil changes
- More miles until overhaul required
  - not seen if vehicles replaced before overhaul
  - second owner reaps benefit



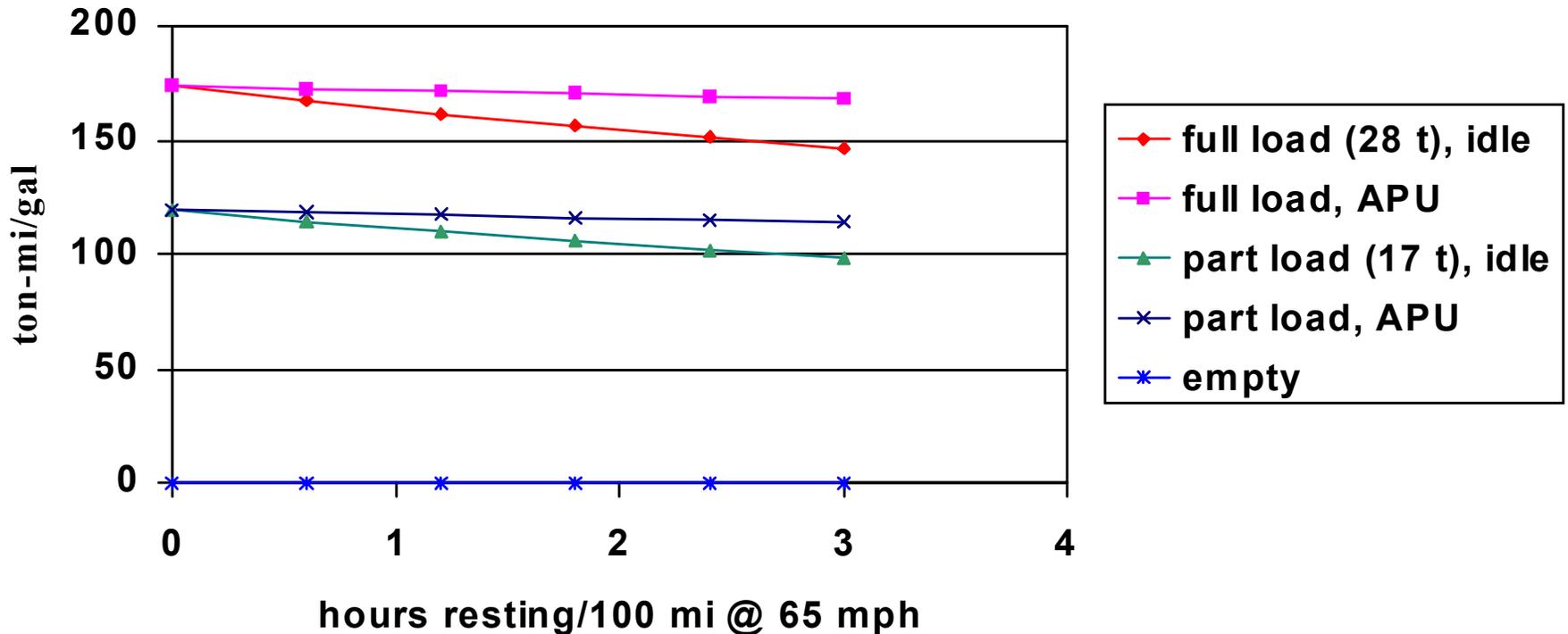
# Reducing truck idling saves fuel

- A truck traveling 500 mi/d @ 7 mpg uses 71.4 gal
- If the engine idles the remaining 14 h @ >1 gal/h, fuel use is 85.4 gal
- If APU runs instead @ <0.18 gal/h, total fuel use 73.9 gal
- Fuel use is reduced 13% with no loss of driver comfort
- Savings are less if fewer idling hours are replaced





# Idling and loading affect ton-mi/gal





# Estimate of typical maintenance saving

- If oil change costs \$150 and is required every 15,000 miles, cost/mile = \$.01
- If overhaul costs \$5000 and is done after 500,000 miles, cost /mile = \$.01
- Maintenance thus totals \$.02/mile
- If each hour idled equals 7 miles, then maintenance \$.14/h (wear based on fuel use)
- Need industry input to verify conversion from idling hours to miles



# Payback times are short

| Type                             | Cost (\$)           | Y @1000 h | Y @ 3000 h | Y @ 5000 h |
|----------------------------------|---------------------|-----------|------------|------------|
| Direct-fired heater              | 3200                | 2.5       | 0.85       | 0.51       |
| Thermal storage                  | 2700                | 1.9       | 0.63       | 0.38       |
| Direct heat with storage cooling | 4200                | 3.8       | 1.3        | 0.75       |
| APU                              | 7100                | 6.0       | 2.0        | 1.2        |
| Truck stop electrification       | 1700 +<br>2500/spot | 3.8       | 1.3        | 0.76       |



# All alternatives reduce impacts

| <b>Technology</b>                                      | <b>Energy Use<br/>(<math>10^{12}</math> Btu)</b> | <b>Petroleum<br/>(<math>10^6</math> gal)</b> | <b>CO<sub>2</sub> Emissions<br/>(<math>10^6</math> tons)</b> |
|--|--|--|--|
| Truck Engine<br>Idling                                 | 107.5  | 838.1  | 9.6  |
| Direct-fired heater<br>plus idle cooling               | 64.7   | 504.4  | 5.8  |
| Direct-fired heater<br>plus thermal<br>storage cooling | 10.2   | 79.2   | 0.9  |
| Auxiliary power<br>unit                                | 19.3   | 150.9  | 1.7  |
| Truck stop<br>electrification                          | 34.2   | 2.1  | 2.5  |

(National totals @ 1830 h/y)



# Alternatives to idling do

- Reduce energy use and diesel fuel consumption
- Reduce air pollution
- Achieve acceptable payback times
  
- Conclusions are based on typical technologies and best data available
- No endorsements are implied



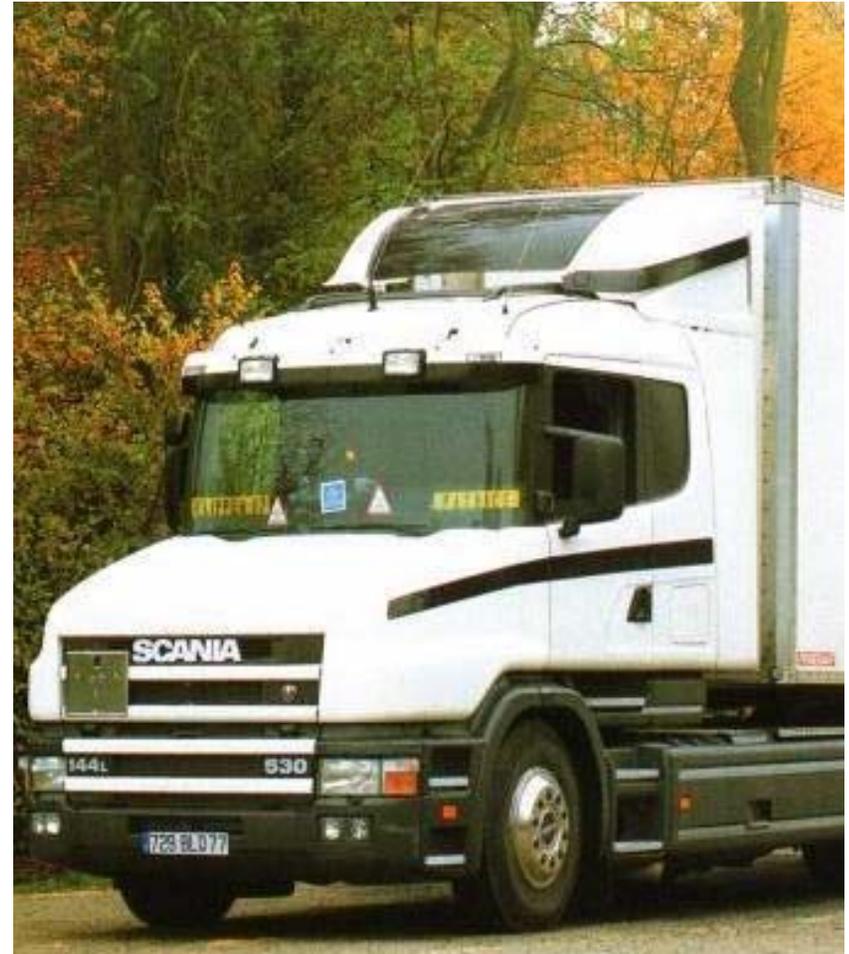
# What should be done

- Get better data on current practice
- Get better data on emissions
- Check mileage equivalent to idling
- Continue information dissemination
- Consider governmental incentives
  - tax credits
  - low-interest loans



# Acknowledgments

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