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What Are the Emissions Benefits from Regulating Heavy Vehicle Idling?

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Abstract: Numerous states regulate long-duration diesel engine idling as a way to reduce emissions and improve air quality. What impact do those regulations actually have on emissions, and how do they affect adoption of idling reduction (IR) technology?

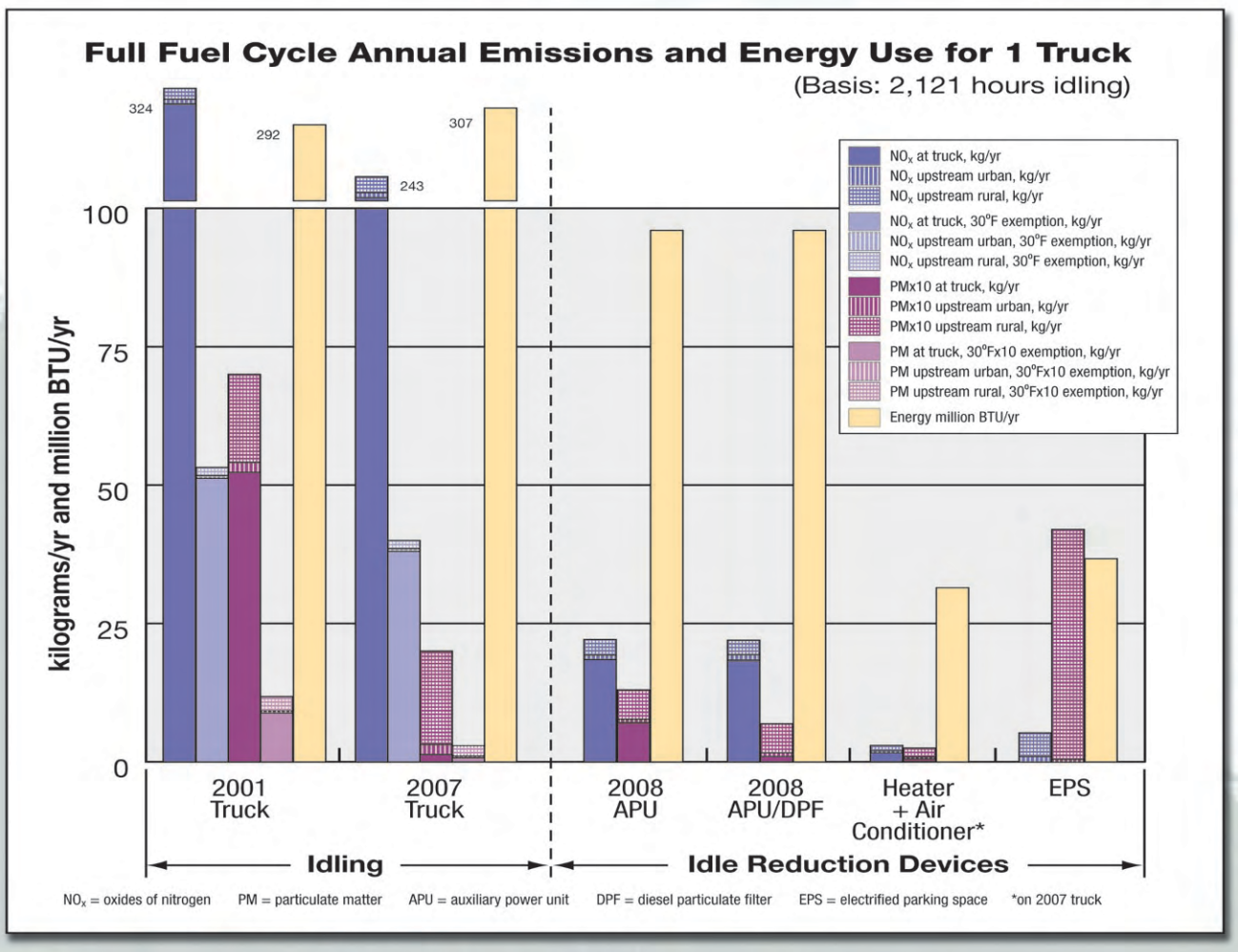
Current idling regulations are inconsistent from state to state; some proposed regulations could further increase these disparities and impede implementation of IR technology.

This study compares the potential emissions reductions from such regulations as a function of regulatory limits and exemptions.

Motivation: Truck drivers idle their engines so they can rest comfortably in their sleepers. Idling uses substantial quantities of diesel fuel and creates emissions.

The current analysis assumes the following:

- Cab comfort devices were assumed to operate 7 hours/day, 303 days/year, except for the heater and air conditioner, each of which runs 152 days/year.
- Heater and 2001 truck idling emissions and fuel consumption were derived from Environmental Protection Agency (EPA) (Lim, 2002) measurements, assuming 50% air conditioning and 50% heat.
- The air conditioner was assumed to run off batteries, charged during the driving cycle of a truck meeting 2007 standards.
- Emissions from 2007 engines were based on California Air Resources Board's estimates (CARB ISOR, 2003), as no measurements are available. Fuel consumption was assumed to be 5% greater than current trucks' due to emissions control equipment.
- Auxiliary power units (APUs) were anticipated to surpass 2008 standards when 2007 trucks are introduced. Fuel consumption was derived from measurements of a Caterpillar APU. Addition of a diesel particulate filter (DPF) was anticipated to reduce particulate matter (PM) emissions by 90%.
- Fuel cycle impacts were generated by adding urban and rural emissions of NO_x, PM, and total energy (caused by fuel production and delivery) to the impacts from combustion of the fuel, as calculated by the Argonne GREET (Greenhouse gases, Regulated Emissions, and Energy use in Transportation) model. Similarly, impacts from fuel production and electricity generation were estimated from GREET.



Particulate matter (PM)

There is special concern because PM from diesel exhaust has been declared to be an air toxic. PM emissions for all of the IR devices are estimated to be much lower than those from idling current engines. Direct PM emissions from APUs may be somewhat higher than from idling 2007 engines. However, our estimates indicate that the full fuel cycle PM emissions would be lower, due to lower fuel consumption. The implications are that aftermarket APUs, which meet 2008 small engine standards, installed on trucks of model year 2006 and before, would be highly beneficial from an emissions perspective. Such APUs would have higher direct PM emissions than 2007 and beyond truck models, but result in slightly lower full fuel cycle PM emissions. The auxiliary heater plus battery-powered air conditioner is the lowest total emissions option examined. For urban areas seeking to maximize emissions reduction, the electrified parking space (EPS) provides the lowest truck-plus-urban emissions total. The total PM emissions of the EPS option are high due to inclusion of coal in the average electric generation mix, but the coal-related emissions occur outside urban areas. Under the right circumstances, NO_x is converted in the atmosphere into fine PM and/or ozone, both regulated pollutants. Thus, the sharp reductions in NO_x provided by all idle reduction options offer additional air quality benefits.

Idling reduction (IR) devices: All of the idling-reduction options enable significant reductions in energy use and all emissions compared to idling of current trucks. There are pros and cons for each type of device considered here. APUs supply all necessary services and can be used anywhere, any time the driver needs them. Electrified parking spaces (EPS) have zero impacts at the parking location, and most of their life cycle impacts (except PM from coal processing) are below those of the APUs because electricity generation at a large power plant is almost twice as efficient as it is in the APU (17 vs 31%). In addition, almost no power plant energy is in the form of oil. But parking must be restricted to equipped spaces, and there are economic problems getting that infrastructure (and any needed on-board equipment) in place. The first market for EPS use is likely to be for fleets with fixed routes.

Regulatory impacts: An exemption allowing idling of sleeper cabs, would, of course, result in no reduction in the significant impacts from overnight idling. A low temperature cutoff, above which trucks would not be permitted to idle, would reduce sleeper impacts, but would compromise driver comfort when the temperature is just above the cutoff. We show the impact of a cutoff that would allow idling about 50 days per year (assumed to be 30°F for a moderate climate zone).

If a locality instituted a short-time exemption (e.g., 30 minutes of idling allowed), sleeper impacts could be reduced more, but with potentially severe driver comfort issues. Such a timed exemption would enable significant idling during the course of the work day.

For more information:

Analysis of Technology Options to Reduce the Fuel Consumption of Idling Trucks:
http://www.transportation.anl.gov/pdfs/TA/15.pdf

Heavy Vehicle Idling presentation:
http://www.transportation.anl.gov/pdfs/TA/314.pdf

National Idling Reduction News:
http://www.eere.energy.gov/vehiclesandfuels/pdfs/newsletters/jan06_network_news.pdf

List of regulations:
http://www.atri-online.org/2005.ATRI.IdlingCompendium.pdf

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