

Alternatives to Truck Engine Idling

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ABSTRACT

This report describes activities and observations gathered during a multi-year project to develop awareness of long-duration truck idling in Iowa and the Midwest. Near-term approaches to address long duration idling include a number of technologies that are generally classified as either mobile or stationary. Mobile technologies refer to truck mounted devices designed to offset use of the main engine to support necessary heating, ventilating, and air conditioning and other “hotel” loads. Stationary technologies provide some form of interface between the truck and the electric grid; because trucks frequently (but not always) park at truck stops, grid-based approaches are commonly referred to as truck stop electrification (TSE).

Based on the insights that emerged from this study, we have determined that implementing a practical TSE demonstration in Iowa in the near future will be limited by several factors that are explained more thoroughly in the report. Iowa is currently meets all air quality standards relevant to truck idling, and ranks just below average (30th) in terms of projected truck parking demand. This implies that resources to advance stationary TSE facilities would more appropriately be targeted to other areas of the country with higher traffic and more urgent air quality concerns.

Because it was determined that Iowa is a net supplier of truck services, it was recommended that Iowa’s near term contribution to advancing idle reduction could more cost effectively be served by focusing on the adoption of mobile technologies by Iowa based trucks that operate primarily out of state, and, in particular, in non-attainment or other regulated areas. We therefore proposed to wait and see whether unsubsidized TSE concepts prove commercially successful in other states, whether they become less expensive, or whether more mobile alternatives (including hybrids) emerge to service idle reduction across broader geographic and functional contexts.

Key words: auxiliary power unit—mobile idle reduction technology—truck idle reduction—truck stop electrification

PROBLEM STATEMENT

The hours of service (HOS) rules enforced by the Federal Motor Carrier Safety Administration (FMCSA) generally require commercial vehicle drivers to rest for a ten-hour (consecutive) off-duty period after accumulating eleven hours of driving time or being on-duty for fourteen hours (Freund 2004). These ten-hour off-duty periods generally occur when drivers are likely to engage in long-duration idling.

Drivers that are beyond returning to a home base commonly spend off-duty periods in truck mounted sleeper berths, parked at private truck stops, public rest areas, freight terminals, or other locations. During heating or cooling days, they typically have few options other than to idle the large 400–500 horsepower engines to power loads that typically require less than 10 horsepower to operate. This causes the main engine to run for long periods of time at low efficiency, and with disproportionately high emissions.

The need to power heating, ventilating, and air conditioning (HVAC) and other “hotel” loads for several hours at a time and to maintain functional engine and fuel temperatures during cold weather is generally what differentiates long-duration from short-duration idling. Short-duration idling is generally more likely to occur while the drivers are on-duty, for example while they are conducting vehicle checks, refueling, waiting to load or unload, taking lunch breaks, or while they are stuck in traffic.

Near-term approaches to address idling include a range of technologies that are generally classified as either mobile or stationary. Mobile technologies refer to truck mounted devices that offset use of the main engine to support HVAC, fuel warming, and other “hotel” loads. Stationary technologies provide some form of interface with the electric grid; because trucks frequently (but not always) park at truck stops, grid-based technologies are commonly called truck stop electrification (TSE). Other approaches may include regulatory and fleet programs that either punish or reward drivers for unnecessary idling. However, because these by themselves do not accommodate the HVAC needs of the drivers or the fuel and engine needs of the truck, these programs were generally ignored within the context of this project.

Current mobile technologies include engine timers that start or stop the main engine whenever a specified parameter is reached (such as time, temperature, or battery voltage); direct-fired heaters that provide cab, fuel, and engine heat, but not air conditioning or electricity; extra batteries that charge while the truck is running to power specially installed electric HVAC and appliances after the truck shuts down; and auxiliary generators, powered by a second diesel engine more appropriately sized for hotel loads, that provide HVAC and other capabilities. Several of these devices may be used in various combinations.

Direct-fired heaters and engine-off systems generally cost about \$1,200/truck. However the frequent cold starts that result when engine timers are used are generally hard on the main engine and disruptive to a driver’s rest period; direct-fired heaters do not accommodate air conditioning during peak ozone months, which is a key objective of idle reduction policy. Current battery technology is generally inadequate to support long duration load requirements within acceptable volume and weight limits.

For the purposes this report, mobile systems that are capable of providing fully functioning HVAC, electric power, and system support, with minimal limitations, are referred to as auxiliary power units (APU); current retrofit versions generally cost between \$6,000 and \$8,000/truck. Future versions are likely to evolve under the context of hybrid truck development.

TSE options are generally categorized as either full service or shorepower. Full service TSE integrates all of the HVAC and auxiliary functions into a completely land-based system. Shorepower requires compatible (electric) HVAC and support systems on the truck that are powered by land-based receptacles

installed where trucks frequently park. Depending on the number of spaces at a site, installation costs for full service TSE are generally between \$15,000 and \$18,000 per parking space. Commercial shorepower generally costs about \$6,000 per parking space; compatible electric HVAC retrofits can vary from \$100 for a resistance heater to \$3,000 for an inverter and fully functioning system.

Although truck manufacturers are starting to integrate shorepower as a factory option, most trucks operating today are not compatible. This is largely because there are few shorepower-equipped parking spaces available, and without them, there are few opportunities for truck owners to recover the cost of the added investment; this in turn limits the commercial viability of installing stationary infrastructure. A long-term strategy of IdleAire, one of two full service providers (the only one with facilities installed) is eventually to remove the stationary HVAC components from its full service platform and incrementally convert to less expensive shorepower as a larger number of compatible trucks enter the market (Doty 2004).

The key advantages of TSE relative to most fully functioning on-board options is that it completely eliminates site-specific emissions, facilitates the documentation of emission reduction credits (when applicable), and either eliminates or reduces the up-front investment needed by truck owners. The primary drawbacks are that it substantially limits the locations and conditions under which idle reduction can occur and currently requires the addition of a service fee and/or public funding to offset installation and maintenance costs of the stationary infrastructure. It is also unlikely that TSE will be practical for short-term idling that does not warrant the time and cost required to hook up and log into a TSE facility.

Fully functioning mobile devices allow idle reduction almost anywhere and anytime a truck idles, however, current options do not completely eliminate on-site noise or emissions, and are either functionally limited or require a payback period that exceeds what is acceptable to most truck owners. In regard to the objectives of this project, a significant difference between TSE and the mobile approaches revolve around the up-front involvement needed to advance further development.

TSE generally requires indirect investment by third parties, a payback that balances the price of diesel fuel against the grid price of electricity (along with added labor and other operating costs), and coordinated development across a spectrum of service providers, site owners, truck owners, regulatory bodies, and others. Completely mobile approaches require cost reduction by manufacturers, a straightforward investment by truck owners, and a payback that is directly tied to the price of diesel fuel.

PROJECT OBJECTIVES

The primary objective of this the project was to develop awareness of alternative truck idle reduction technologies in Iowa and along the Interstate 35 trade corridor. Secondary objectives were the following:

1. Organize a one- to two-day conference carried out sometime during May or June 2004 that supports commercial adoption of idle reduction technologies in Iowa
2. Develop interim involvement of stakeholders with appropriate expertise, practical knowledge, contacts, and peripheral resources to support implementation of truck idle reduction in Iowa
3. Carry out activities defined by an initial focus group survey to develop relevant knowledge of truck idle reduction technologies and implementation issues

A longer term mission was to prepare demonstrations of truck idle reduction technologies for Iowa.

PROJECT METHODOLOGY

Preparation for the conference was the central objective of the activities covered under this phase of the project. Supporting the conference required developing a summary understanding of key issues relating to truck idle reduction, aligning with key contacts and expertise, and defining and promoting the issue to a constituency base and target audience.

An amendment to the work plan during the first year added the task of initiating a demonstration of commercial shorepower in Iowa. This activity resulted in the development of two proposals and a summary assessment of idle reduction as it relates to the state. This included assembling data on air quality, truck traffic, truck stops, and truck parking in the state; targeting key geographic areas; and involving relevant stakeholders. It should be noted that neither proposal resulted in funding, but did succeed in generating focused discussion among a range of potential stakeholders.

The first was a multi-state proposal to the National Association of State Energy Officials' State Technologies Advancement Collaborative (STAC) that was led by the New York State Energy Research and Development Authority and that would have coordinated shorepower deployment in Iowa with parallel activities in California, Maryland, Massachusetts, New York, and North Carolina.

The second proposal was prepared specifically for Iowa and submitted to the U.S. Environmental Protection Agency's (EPA) National Transportation Idle Free Corridors Program. This proposal brought about the involvement of the Bi-State Regional Commission, Shurepower LLC, MidAmerican Energy, the Iowa Energy Center, and the Iowa Department of Natural Resources.

A common theme to each proposal was to launch a shorepower site in Iowa that would then expand to other locations from commercial service revenue. This would require the demonstration facility to be situated in one or more highly visible locations, compatible with emerging truck technologies, and coordinated with the development of stationary facilities in other states. The STAC proposal took the approach that grant funding would be secured first, a study would then be conducted to identify the best place(s) in Iowa to demonstrate the facility, and a TSE provider would be supported with project funding at one or more truck stops, with little or no investment risk to the host site.

The approach taken for the EPA proposal, however, required us to identify and secure agreement of the host site in advance of submitting the proposal. The evaluation that resulted highlights key limitations in launching TSE in Iowa. These issues are discussed further in the following section.

KEY FINDINGS

Overview

The EPA estimates that long duration truck idling consumes 960 million gallons of diesel fuel throughout the United States and generates 11 million tons of Carbon Monoxide, 180,000 tons of Nitrogen Oxides, and 5,000 tons of particulate matter (PM) annually (U.S. EPA 2004). This is based on assumptions of eight-hours of idling per day; 300 days per year; 0.8 gallons of fuel used per hour; and a fleet estimate of 500,000 long-range, heavy-duty trucks (Lim 2002). On a per-truck basis, this equates to 2,400 hours and 1,920 gallons per year per truck. It should be noted that the eight-hour-per-day value was based on the FMSCA off-duty requirement in effect at the time; new rules adopted in 2004 increased this requirement to 10 hours.

A separate report issued by Argonne National Laboratory in June 2000 estimates that long haul truck idling consumes 838 million gallons each year. This value is derived from average idling of 1,830 hours per truck per year based on direct discussions with industry; fuel consumption of one gallon per hour of idling based on testing commissioned by the American Trucking Associations (ATA); and a U.S. fleet of 458,000 long-range heavy-duty trucks identified in the 1997 Vehicle Inventory and Use Survey (VIUS) (Gaines, Stodolsky, and Vyas 2000).

A third report, issued by the U.S. Department of Energy (DOE) (Slezak 2004), indicates average idling of about 2,000 hours per year per truck, or between 20%–39% of the time the engine is running. This value is based on direct participation by fleets, owner-operators, and manufacturers in two workshops carried out in 2003. This report indicates that about half of the fleets and 17% of owner-operators that participated in tracking idling, presumably using on-board computers.

Assessment

All three of these reports indicate that idling varies considerably by driver, location, and time of year. For example, most drivers require HVAC during the mid-summer and mid-winter months. However, while some frequently shut down when the weather is more moderate, others almost never shut down. Some indicate that leaving the windows open poses a safety risk in certain areas of the country; others idle out of habit. Further complicating the estimates are that different trucks, engine speeds, and load requirements inherently consume different rates of fuel while idling. The three reports generally agree, however, that idling by interstate trucks consumes roughly 2,000 gallons of fuel per truck each year.

Because data available at the time did not specifically identify the number of trucks equipped with sleeper berths in the United States, all three reports either directly or by reference based fleet size on the approximate number of long-range heavy-duty trucks identified in the 1997 VIUS. The VIUS defines long-range trucks as those with either no home base or those that operated more than 500 miles from a home base most frequently during the year surveyed (U.S. Department of Commerce 1999). This implies that vehicles are typically on the road either continuously or for at least 1,000 miles round trip. Using an average driving speed of 50 miles per hour implies driving times of more than 20 hours per trip, not including time spent loading, unloading, refueling, stopping for lunch, or for a number of other short-term reasons.

Because the implied trip time of long-range trucks clearly exceeded the daily driving time allowed by FMSCA, it was assumed that the majority of trucks listed in this category included sleeper berths and inherently represented the population that relies on long-duration idling to service overnight HVAC and hotel loads. Under this premise, however, it could also be assumed that a significant number of long-range medium trucks also met these criteria; these trucks are defined by an operating range of between 201 and 500 miles from a home base, implying between 8 and 20 hours round trip.

The 2002 VIUS (released December 2004) was the first to specifically identify the number of trucks in the U.S. fleet that are equipped with sleeper berths. Of the 677,600 indicated nationwide, 11,000 were based in Iowa; 98% were on single, double, or triple trailer combinations, 99% of which used diesel fuel (U.S. Department of Commerce 2004). The VIUS did not specifically correlate trucks with sleeper berths to range of operation. However, it should be noted that range of operation was only used to estimate fleet size; per-truck fuel consumption is based on direct discussion with fleets, and is not necessarily contingent upon range of operation.

As such, applying 2,000 gallons per truck to the 667,600 trucks in the U.S. fleet with sleeper berths implies that total fuel consumed throughout the United States may actually be as high as 1.35 billion gallons annually. This equates to approximately 3.7% of the 37.1 billion gallons of on-highway diesel fuel purchased throughout the United States in 2003 (U.S. Department of Energy 2003).

Estimates of Idling in Iowa

Applying the same 3.7% ratio to the 509 million gallons of fuel purchased in Iowa indicates that 18.6 million gallons of the fuel sold may have similarly been consumed by idling, both in-state and out-of-state at publicly accessible parking facilities and a number of other locations. Alternatively, applying an average fuel use of 2,000 gallons per truck to the 11,000 trucks based in Iowa totals 22 million gallons, which is 18% higher than the 18.6 million gallons estimated from fuel purchased. This could be interpreted as an indication that Iowa is a net provider of fleet services to other areas of the country, and that more Iowa-based trucks idle out of state than vice versa.

Idling At Commercial Truck Stops and Public Rest Areas

A 2002 report by the FHWA indicates there are approximately 315,850 available truck parking spaces at commercial truck stops and public rest areas nationwide, indicating a 10% surplus over the estimated daily peak-hour demand of 287,000 (FHWA 2002). Even though the report indicates a nationwide surplus, however, concentrated shortages exist in several high-traffic states, including Illinois, Indiana, Ohio, and some of the northeast and west coast states. In Iowa, peak-hour demand is estimated at 2,990 spaces, compared to approximately 6,013 available spaces, indicating a surplus of about twice what is needed (FHWA 2002a).

Peak-hour demand tends to occur at night, with spaces starting to fill in the late afternoon and early evening hours. The model used by the FHWA to calculate peak hour demand is based on Annual Average Daily Truck Traffic (AADTT), cumulative eight-day driving limits (which did not change with the new HOS rules), and other adjusting factors (FHWA 2002b). Deriving the values from AADTT implies that the model does not cause multiple off-duty parking demands to overlap in a single space during the course of a day; a space used for off-duty parking during the day implies a vacancy at night. Surplus spaces vacated during non-peak hours were considered sufficient to accommodate other short-term parking that occurs during the day.

As such, each calculated unit of parking demand is interpreted to represent the idling associated with a single truck. Multiplying annual fuel consumption of 2,000 gallons per truck (including short-term idling) by peak hour demand for 2,990 parking spaces implies that approximately 6.0 million gallons of fuel are consumed by idling each year at the commercial truck stops and public rest areas located in Iowa. This is only 32% of the 18.6 million gallons estimated from fuel sold in the state, implying that almost two-thirds of idling by trucks equipped with sleeper berths occurs at locations other than in-state commercial truck stops and public rest areas. A similar value at the national level indicates that 43% of the 1.35 billion gallons is consumed at commercial truck stops and public rest areas throughout the country.

Regional Summary

A more direct way to characterize long-haul truck idling in Iowa is to consider that 1.6% of the U.S. fleet (with sleeper berths) is based in Iowa, but only 1.4% of national on-highway diesel fuel sales, and 1.0% of national peak-hour parking is estimated to occur in the state. This implies that, relative to other parts of the country, proportionately more trucks are based in Iowa than operate in it, and more operate in it than

park in it. In other words, Iowa could be considered a net provider of trucks that operate in other states, and in general, relatively more of a fuel depot than an overnight parking location.

Similarly, the percentages of trucks are higher than the percentages of fuel sales in each of Iowa’s bordering states, implying that the region as a whole is generally a net provider of out-of-state fleet services. In Illinois to the east and Missouri to the south, however, the percentage of parking demand is higher than that of fuel sales, implying that each is relatively more of an origin/destination, and consequently better suited to advancing early-stage TSE infrastructure. Other states, including Iowa, could be considered more pass-through in nature. Table 1 illustrates these percentages for Iowa and its bordering states.

Table 1. Percent of U.S. trucking totals by state

	% of U.S. fleet	% of parking demand	% of highway diesel fuel	Parking / fuel sales
Missouri	3.5%	4.0%	2.6%	1.53
Illinois	8.8%	5.1%	3.8%	1.34
Kansas	1.8%	0.9%	1.1%	0.79
Minnesota	2.7%	1.3%	1.7%	0.76
Iowa	1.6%	1.0%	1.4%	0.76
South Dakota	1.1%	0.3%	0.5%	0.65
Wisconsin	2.6%	1.0%	1.8%	0.53
Nebraska	3.8%	0.4%	1.0%	0.37
U.S. totals	677,600	287,316	37 billion gallons	1.00

Figure 1 illustrates AADTT (and associated idling) locations and relative densities throughout the United States (FHWA 2004). In general, AADTT appears to be more heavily concentrated in states to the east of Iowa, with Interstate 80 projected to serve as a significant channel through Iowa.

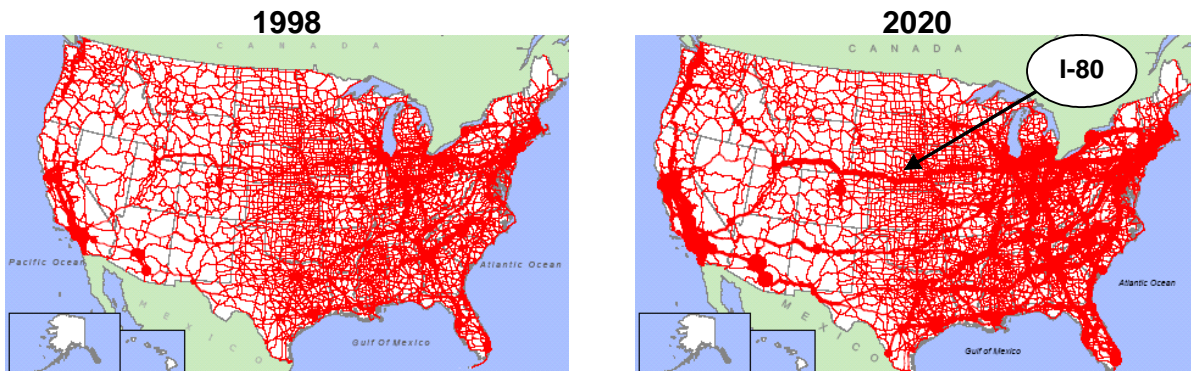


Figure 1. Projected AADTT for 1998 and 2020

Figure 2 associates the FHWA peak-hour parking demand estimate for Iowa to summary AADTT values surrounding key locations in the state (Iowa Department of Transportation 2002). It can be observed that the east-west traffic on I-80 is generally about three times that of the north-south traffic on either I-35 or I-29. It is also heavier to the east, and gradually disperses toward the west, except where I-80 meets I-35 in Des Moines. It could be inferred that part of the traffic that enters from the east generally starts to divert north after it enters Iowa. The Quad Cities and Des Moines appear to have the highest concentrations of truck activity. As will be discussed, the primary area of interest in regard to TSE narrows to the Quad Cities when air quality is taken into consideration.

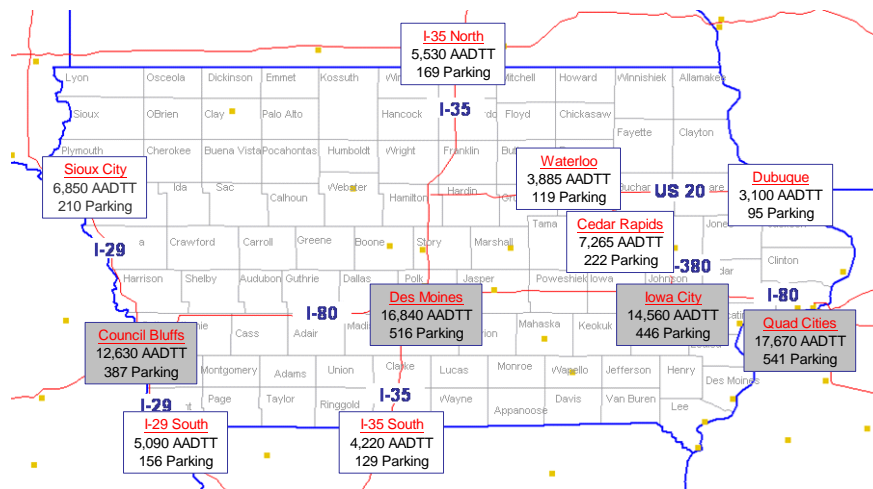


Figure 2. AADTT and parking estimates at key locations in Iowa

Air Quality

Actions to improve air quality in non-attainment areas are generally determined by the requirements of state implementation plans (SIPs), which define the strategies and control measures that local jurisdictions agree to implement to attain National Ambient Air Quality Standards (NAAQS). States or municipalities in non-attainment areas generally define the terms of the SIP, with requisite approval by the EPA (U.S. EPA 2004a). Such measures might include local ordinances, permit restrictions, or use of state and local funding to finance control technology that helps mitigate air quality problems. In cap and trade areas, industry-sponsored measures such as TSE, which permanently reduce emissions, may generate credits (with a cash value) that can be traded or used to offset future requirements to improve air quality.

Figure 3 (U.S. EPA 2004b) illustrates areas of the U.S. that are designated by the EPA to be in non-attainment of NAAQS for the pollutants of primary concern to truck idling; these are ground-level ozone and particulate matter < 2.5 micrometers in diameter (PM_{2.5}). These areas offer relatively more immediate incentives to draw early-stage public and private investment in stationary TSE facilities. It can be observed that, compared to many other parts of the country, Iowa is located in an area with relatively few problems in this regard.

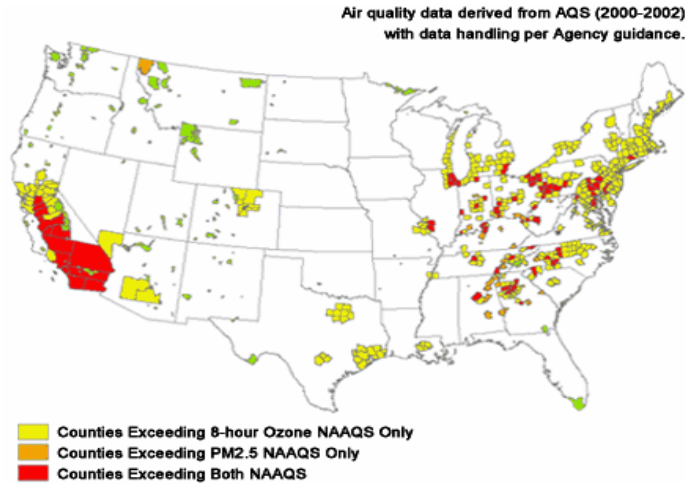


Figure 3. Areas of non-attainment in the U.S.

Figure 4 displays 2003 summary values from air quality monitors in Iowa, expressed as percentages of the NAAQS. Measured values that are within 90% of the respective NAAQS for either ozone or PM2.5 are highlighted in grey. The corresponding values, identified from an EPA website (U.S. EPA 2004c), are listed in Table 2. It can be observed that of the areas along an interstate corridor (with sufficient parking demand to support a TSE facility), the Quad Cities region is closest to exceeding NAAQS criteria.

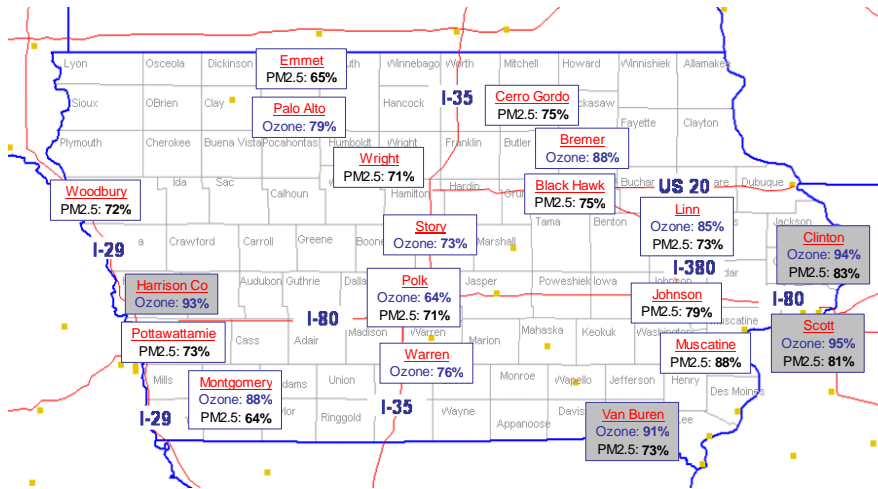


Figure 4. Iowa air quality values relative to NAAQS—2003

Table 2. Summary values in Iowa—ozone and PM 2.5

Location	Ozone 2003 summary value	% of NAAQS 0.08 ppm (8-hour average)	Location	PM 2.5 2003 summary value	% of NAAQS 15.0 µg/m³ (annual mean)
Scott	0.076	95%	Muscatine	13.2	88%
Clinton	0.075	94%	Clinton	12.4	83%
Harrison	0.074	93%	Scott	12.1	81%
Van Buren	0.073	91%	Johnson	11.8	79%
Montgomery	0.070	88%	Black Hawk	11.3	75%
Bremer	0.070	88%	Cerro Gordo	11.2	75%
Linn	0.068	85%	Linn	11.0	73%
Palo Alto	0.063	79%	Pottawattamie	11.0	73%
Warren	0.061	76%	Van Buren	10.9	73%
Story	0.058	73%	Woodbury	10.8	72%
Polk	0.051	64%	Polk	10.7	71%
			Wright	10.6	71%
			Emmet	9.7	65%
			Montgomery	9.6	64%

Cost of Alternatives

To date, air quality and energy efficiency have been the primary factors driving idle reduction. Air quality is generally a public policy (i.e., government) issue; energy efficiency is primarily a voluntary business concern justified primarily by operational fuel savings. With the exception of some of the less-than-fully-functioning options, most of the technologies available today are still viewed by truck owners as either not, or only marginally, worth the costs based on fuel savings alone. Current pricing has yet to motivate widespread adoption of fully functioning idle reduction technologies useful for ozone reduction.

Insights gathered from the industry workshops reported by the U.S. DOE (Slezak 2004) indicate that owners will require a two-year maximum payback and will likely base decisions solely on fuel costs, and that “the strongest interest is for combined heating/cooling/electrical systems with cooling or heating alone a distant second.” A fully installed cost of between \$3,000 and \$4,000 (not including operating costs) for a fully functioning system was indicated as an acceptable crossover value that would motivate truck owners to adopt mobile technologies in 2003. When the workshops were conducted, on-highway diesel prices averaged \$1.51/gallon; as of December 2004, prices were \$2.07/gallon, implying that the target value may now have risen by 41% (to between \$4,100 and \$5,500, with an average of \$4,800).

Known technologies that are currently available to provide fully functioning HVAC and electricity for appliances are listed on an EPA website (U.S. EPA 2004d). These include auxiliary power units that average roughly \$7,000/truck (varying between \$6,000 and \$8,000) and a 12 % federal excise tax of \$840, which implies a total average of approximately \$7,840. Full service TSE is known to cost approximately \$18,000/parking space, and commercial shorepower is known to cost approximately

\$6,000/parking space and require a \$3,000 truck-mounted inverter/electric HVAC package to be fully functioning.

According to Argonne (Gaines, Stodolsky, and Vyas 2000), the energy needed to operate a typical APU is approximately 18% of the fuel consumed by idling, indicating a cost of about \$0.37 per hour at \$2.07/gallon. The two TSE options require a fee to truck owners of \$1.25/hour for full service (\$1.50 without a fleet discount) and \$0.75/hour for shorepower. Table 3 compares approximate system costs and paybacks for each, based on 2,000 hours of use per year and disregarding qualitative issues relating to reliability or accessibility. Current APUs generally appear to have the shortest rate of payback when taking subsidized (infrastructure) costs into consideration. Because they also require a less-fixed capital requirement, it is likely that they will also evolve toward lower cost (technologically) at a faster rate.

Table 3. Approximate system costs for known alternatives

	Full service TSE	Shorepower	APU
System investments			
Parking space equipment	\$18,000	\$6,000	\$0
Truck mounted equipment	\$10	\$3,000	\$7,840
<i>Total system investment:</i>	<i>\$18,010</i>	<i>\$9,000</i>	<i>\$7,840</i>
Operational savings			
Fuel savings	\$4,140	\$4,140	\$4,140
Less: operating costs	(\$2,400)	(\$1,500)	(\$745)
<i>Net annual savings:</i>	<i>\$1,740</i>	<i>\$2,640</i>	<i>\$3,395</i>
<i>Simple payback (years):</i>	<i>10.4</i>	<i>3.4</i>	<i>2.3</i>

Other Situational Factors Regarding TSE in Iowa

In regard to implementing a practical demonstration of shorepower TSE in Iowa, other situational factors were discovered that should also to be taken into consideration. These include the following:

1. Commercial parameters for known TSE platforms (IdleAire, Shurepower, and AirPower) are significantly dependent upon government funding to support installation; air quality issues are the primary factor driving government support. Iowa is in attainment of the truck idling air quality standards and, as such, is likely to be a low priority in national competitions for federal funding to support early-stage TSE deployments.
2. Federal highway funding for transportation projects that help non-attainment areas meet air quality standards is allocated to states through the Congestion Mitigation and Air Quality Improvement program. Because Iowa is in attainment, a base allocation is distributed through the Iowa Clean Air Attainment Program (ICAAP); this fund is relatively smaller and less restricted than in states with non-attainment areas. In FY 2005, ICAAP awarded \$4.7 million, primarily to municipal road and transit projects, that reduce congestion-related idling across several modes, including trucks and passenger vehicles (Iowa Department of Transportation 2002a).

CONCLUSIONS

An underlying purpose of this project was to establish a position for Iowa in advancing idle reduction technologies. Our initial focus anticipated the development of a market-responsive pilot demonstration of stationary shorepower within the state. After further review, however, we have concluded that Iowa's contribution to idle reduction could more cost effectively be served by refocusing toward facilitating the adoption of mobile technologies by Iowa-based fleets and owners, particularly those that operate in out-of-state non-attainment areas.

In evaluating the situation for a shorepower demonstration, we determined that Iowa is generally a net provider of trucks that operate in other states, and that the trucks that do stop in the state are more likely to engage in short-duration idling than in long-duration idling. We estimate that almost two-thirds of the idling by trucks equipped with sleeper berths that results from fuel sold in Iowa occurs at locations other than at commercial truck stops and public rest areas in the state.

At the same time, Iowa is currently in attainment of all air quality standards relevant to truck idling, and ranks just below average (30th) in terms of projected truck parking demand. From a national perspective, the focus of out-of-state public and private resources to support stationary TSE facilities is more likely to be targeted to other areas of the country that have higher traffic and more urgent air quality concerns. This implies that a stationary demonstration in Iowa would be largely dependent on limited state or local resources at the expense of other road and transit projects (that also generate idle reduction benefits).

At the same time, sites in Iowa that could support a practical stationary facility are currently limited to a relatively expensive full-service option. The developer of the system has expressed a strategy that will eventually transition it to less expensive shorepower as a larger number of compatible trucks enter the market. In this regard, a significant share of the installation costs of an early stage demonstration facility could end up funding equipment that will likely become obsolete before the end of its useful life. Delaying an Iowa-based demonstration until the future, however, could potentially offset the added costs of the full-service HVAC components altogether.

When taking subsidized costs into account, existing mobile technologies already appear to demonstrate the lowest combined investment, shortest payback, and highest function in terms of addressing short-term and other idling that occurs beyond off-duty periods at commercial truck stops. The mobility of these approaches would allow Iowa-based fleets to better meet compliance in existing non-attainment areas when necessary.

Mobile technologies also reduce the need to introduce third party operating margins into the solution, and provide a relatively more fluid approach for advancing early-stage technologies. A 50-space full-service TSE facility would lock in a significant share of limited state funding to a single method, with no regulatory requirement or reliable indication of fleet acceptance. The same level of funding could be used to evaluate a variety of alternatives that could be improved incrementally based on fleet-driven experimentation and recommendations.

Because Iowa is currently under minimal pressure to do so at this time, we recommended that the state wait and see whether unsubsidized TSE concepts prove successful in other states or become less expensive, or whether more mobile alternatives emerge to service idle reduction across broader geographic and functional contexts. Our goals during the interim are to facilitate and monitor pilot demonstrations of new or emerging technologies with emphasis on fleet mobility and gaining a better understanding of the situational requirements encountered by drivers.

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