Idle Reduction Technology: Fleet Preferences Survey

Prepared for
New York State Energy Research and Development Authority

Prepared by
The American Transportation Research Institute

February 2006

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ABSTRACT
With the growing number of regulatory and financial incentive initiatives aimed at commercial vehicle idling, the American Transportation Research Institute (ATRI), in partnership with the U.S. Department of Energy Clean Cities Program and the New York State Energy Research and Development Authority (NYSERDA), conducted a national survey to gather information on the extent of idling and use of idle reduction technologies among trucking companies.

The survey was distributed through a variety of sources. Overall, the survey participants provided data on more than 55,000 trucks and provided a fairly comprehensive profile of idling and the use of idle reduction technologies. While the response rate restricts the ability to consider the results to be representative of trucking companies, in general, the results tend to be fairly consistent with previous studies.

Sleeper cabs were reported to idle an average of 28 hours per week which equates to 1,456 hours annually. Day cabs were reported to idle an average of 6 hours per week which equates to 312 hours annually.

Thirty-six percent (36%) of respondents with sleeper cabs currently use on-board idle reduction technologies (technologies which provide power for heaters, air conditioners, and/or in-cab appliances while eliminating main engine idling). These technologies were reported to be used an average of 29 hours per week or 1,508 hours annually.

The most prevalent on-board technology was direct-fired heaters which were used by 32 percent of respondents with sleeper cabs. Battery-powered air conditioners were used by 24 percent of respondents with sleeper cabs while auxiliary power units/generator sets were used by 12 percent of respondents with sleeper cabs.

Direct-fired heaters were reported to be the least expensive on-board technology to purchase ($888) and annually maintain ($110). Battery-powered air conditioners were the next least expensive technology to purchase ($4,300) and annually maintain ($200) followed by auxiliary power units/generator sets ($7,750 to purchase). Based on the reported average capital cost for each type of equipment installed, respondents have already spent nearly $8.8 million on these technologies.

Forty percent (40%) of respondents with sleeper cabs indicated being likely to use battery-powered air conditioners over the next five years. Direct-fired heaters and auxiliary power units/generator sets were each expected to be used by 28 percent of respondents with sleeper cabs over the next five years. Based on the reported average capital cost for each type of equipment, respondents are expected to spend nearly $56 million on on-board idle reduction technologies over the next five years.

ACKNOWLEDGEMENTS
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Section 1 Introduction

The idling of commercial vehicles is receiving unprecedented attention throughout the nation. Currently, more than 30 states, counties or cities have adopted regulations limiting the amount of time a commercial vehicle can idle.[1] In response to the number of different idling regulations being adopted, the U. S. Environmental Protection Agency (EPA) has initiated an effort to develop a model idling law in order to bring uniformity and consistency to commercial vehicle idling regulations.[2] In addition, the State of California has established the nation's first regulation requiring additional emission controls while idling diesel engines and auxiliary power units (APU).[3]

Several national and state incentive programs seek to reduce commercial vehicle idling to decrease emissions and fuel consumption. Federally-funded demonstration projects administered by the EPA and the U. S. Department of Energy (DOE) are helping to advance the deployment of idle reduction technologies.[4,5] Additionally, a cooperative western state initiative is attempting to leverage funds to deploy idle reduction technologies across a broader region.[6] These programs are helping to deploy mobile, on-board idle reduction technologies as well as stationary truck stop electrification technologies.

With the growing number of regulatory and financial incentive initiatives aimed at commercial vehicle idling, the American Transportation Research Institute (ATRI) set out to better understand the extent of idling during truck operations and what, if any, actions fleets are taking to reduce idling. While previous studies and surveys have provided valuable information on truck idling and the use of idle reduction technologies, continuing advancements warrant further study of the use of these technologies. To accomplish this, ATRI, in partnership with the DOE's Clean Cities Program and the New York State Energy Research and Development Authority, conducted a national survey to gather additional information on idling and use of idle reduction technologies among trucking companies.

Section 2 Survey Development

In early 2005, ATRI initiated a survey development process by reviewing studies, surveys and articles focusing on truck idling and the use of idling reduction technologies. (See Appendix A for additional background information.) Based on this review, a preliminary idle reduction technology survey was developed. As part of the survey development process, a survey advisory group was formed. This group consisted of a broad range of stakeholders interested in the topic of truck idling and included representation from trucking and truck stop trade associations, a truck and engine manufacturer, an idle reduction technology vendor, public utilities, DOE, and an academic advisor. A preliminary survey was distributed to the survey advisory group and a conference call was held in April 2005 to refine the preliminary survey.

Based on input from the initial conference call, written comments and follow-up conversations, revisions to the preliminary survey were made and a second conference call was held in May 2005. Once again input was received from interested parties and modifications to the revised survey were made. Following additional input, a draft final survey was developed in June 2005 and pre-tested on the motor carrier members of ATRI's Research Advisory Committee. Based on feedback from this pre-test, final revisions to the survey were made.

Section 3 Survey Distribution

The final survey was distributed through several sources. Initially, in July 2005, the survey was faxed to a random sample of 3,000 motor carriers drawn from the American Trucking Associations' (ATA) North American Truck Fleet Directory. In August 2005, the survey was posted on-line and noticed through *Truckline*, a news blast from the American Trucking Associations, as well as through the membership notification systems of targeted state trucking associations. In September 2005, two more notices were posted in *Truckline*. The survey was also e-mailed to the membership of ATA's Environmental Policy Committee. The data collection effort was completed in early October 2005.

Overall, the survey participants provided data on more than 55,000 trucks; however, the response rate was significantly lower than expected. It appears this can be attributed somewhat to the extent of information requested from respondents. When notices were posted on *Truckline* and sent out by the state trucking associations, numerous hits to the on-line survey occurred but very few surveys were completed. It is believed the majority of potential respondents were unwilling to take the time and/or provide the level of detail requested and chose not to complete the survey.

Nonetheless, the information provided by those who did complete the survey provides a fairly comprehensive profile of the extent of idling and the use of idle reduction technologies among those respondents. While the lack of responses restricts the ability to consider the results to be representative of trucking companies, in general, the results tend to be consistent with previous studies. When viewed relative to previous studies, it appears this survey helps advance the understanding of the extent of idling and the use of idle reduction technologies among trucking companies.

Section 4 Survey Results

4.1 Company Profile

Types of Carriers

As shown in Table 1, the majority of survey respondents were comprised of truckload carriers (55%), specialized carriers (19%) and less-than-truckload carriers (13%). Compared to the distribution of carriers submitting annual reports to the U.S. Department of Transportation, ATRI's survey tends to slightly over-represent the truckload, less-than-truckload and bulk haulers while under-representing tank, household goods and specialized carriers.

Table 1. Distribution by Type of Carrier

Category	DOT (1)	ATRI Survey
Truckload	50%	55%
Less-than-Truckload	10%	13%
Refrigerator	6%	6%
Tank	6%	--
Bulk Hauler	4%	6%
Household Goods	4%	--
Other Specialized	21%	19%

(1) U.S. Department of Transportation, Motor Carrier Annual Reports, 2002. (Carriers with annual revenues below $3 million do not report.)

Figure 1 shows nearly half the respondents were Class 1 carriers with annual revenues greater than $10 million (48%). Class 3 carriers with annual revenues less than $3 million were the next largest category (29%) followed by Class 2 carriers with annual revenues from $3-$10 million (23%).

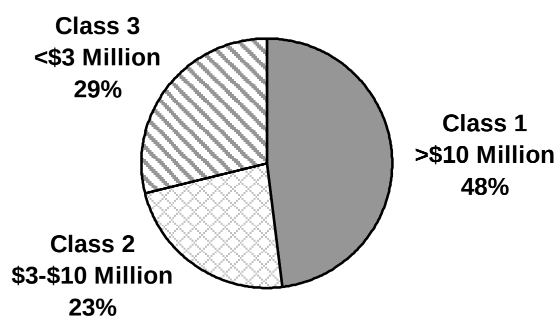

Figure 1
Distribution by Annual Revenue

Number and Age of Trucks

The total number of trucks operated by survey respondents exceeded 55,000. Sleeper cabs accounted for 75 percent of all trucks reported with day cabs comprising the other 25 percent. Sleeper cabs were operated exclusively by 35 percent of carriers while day cabs were operated exclusively by 19 percent of carriers. Forty-five percent (45%) of carriers operated both sleeper and day cabs.

Compared to the 2002 Vehicle Inventory and Use Survey (VIUS) administered by the U.S. Census Bureau, the number of sleeper cabs captured by the ATRI survey represents approximately 6 percent of the 2002 VIUS national estimate for sleeper cabs while day cabs represents less than 1 percent of national day cabs.

As shown in Table 2, the reported age distribution of sleeper cabs and day cabs was quite different. While 69 percent of sleeper cabs were 4 years old or less, only 35 percent of day cabs fell into this category. The largest percentages of day cabs were found in the following age categories: 2 years old or less (23%), 5 to 6 years old (22%), and 7 to 8 years old (18%). Vehicle age was not reported for a large percentage of both sleeper cabs (28%) and day cabs (17%).

Table 2. Age Distribution of Trucks by Category

	ATRI Survey	
	Day Cabs	**Sleeper Cabs**
2 years old or less	**23%**	**42%**
3 to 4 years old	**12%**	**27%**
5 to 6 years old	**22%**	**2%**
7 to 8 years old	**18%**	**0%**
9 to 10 years old	**7%**	**0%**
Greater than 10 years old	**1%**	**0%**
Not Reported	**17%**	**28%**

Types of Truck Purchases and Length of Ownership

When survey respondents were asked whether they purchase trucks new or on the secondary market, 64 percent indicated they purchase new sleeper cabs while 55 percent purchase new day cabs. The type of purchase was not reported for a large percentage of carriers operating day cabs (30%). For respondents who purchased trucks on the secondary market, the average age of the truck at time of purchase was 3.6 years for sleeper cabs and 5.6 years for day cabs.

Length of ownership for the different categories of vehicles was also explored. As shown in Table 3, the largest percentage of respondents kept sleeper cabs for 5-7 years (36%) with the average length of ownership being nearly 7 years. The length of ownership for day cabs was equally distributed among the 5-7 years, 8-10 years and more than 10 years categories (27% each). The average length of ownership for day cabs was 9.5 years.

Table 3. Length of Vehicle Ownership

	ATRI Survey	
	Day Cabs	Sleeper Cabs
Less than 5 years	5%	28%
5-7 years	27%	36%
8-10 years	27%	24%
More than 10 years	27%	12%
Not Reported	14%	--
Average (years)	9.5	6.9

Annual Mileage and Driving Distance

Differences in average annual mileage were found among sleeper cabs and day cabs. As shown in Table 4, more than 90 percent of sleeper cabs traveled 100,000 to 199,999 miles annually. In contrast, 80 percent of day cabs traveled less than 130,000 miles annually.

Table 4. Average Annual Mileage

	ATRI Survey	
	Day Cabs	Sleeper Cabs
Less than 50,000 miles	21%	0%
50,000 to 99,999 miles	26%	2%
100,000 to 129,999 miles	36%	58%
130,000 to 149,999 miles	5%	23%
150,000 to 199,999 miles	1%	10%
200,000 to 249,999 miles	1%	3%
250,000 miles or more	4%	4%
Not Reported	6%	0%

Survey respondents were asked how far drivers of sleeper cabs generally travel between off-duty periods. While the intent of this question was to determine how far solo drivers of sleeper cabs generally travel over a typical shift, some responses appear to include either drivers who return home after a shift or are team drivers. Consequently, responses ranged from 0 to 3,000 miles with an average distance of 604 miles.

When the data was reanalyzed to remove potential return home and team drivers, an average distance of 480 miles was reported. This analysis was done by framing the responses within the parameters of greater than 200 miles but less than 750 miles per driving shift. These distances represent conservative estimates of distances drivers would be able to travel and either return home during the shift or maximize allowable driving hours.

Travel times collected by ATRI for five major freight corridors as part of a Federal Highway Administration-sponsored project averaged 54 miles per hour.[7] Over an eleven-hour driving shift, nearly 600 miles could be traveled at this speed. This distance falls within the average per shift travel distance reported in the ATRI survey of 480 – 604 miles.

Types of Routes and Areas of Operations

Figure 2 indicates that sleeper cabs generally travel the same route, location-to-location less frequently than day cabs. The same percentage (40%) of sleeper cabs traveled the same route more than 75 percent of the time as traveled the same route 25 percent of the time or less. Sixty-five percent (65%) of day cabs traveled the same route more than 75 percent of the time while 20 percent traveled the same route 25 percent of the time or less.

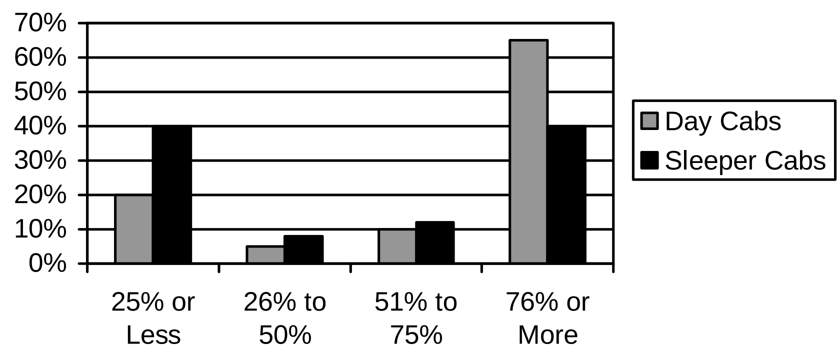

Figure 2
Percentage of Trips Traveling Same Route

Figure 3 shows the percentage of respondents by primary areas of operation. Several carriers operate in more than one of the areas shown. Carriers with operations in the area including Illinois, Indiana, Ohio, Wisconsin and Michigan comprised the largest percentage of survey respondents (29%). Carriers with operations in all states and with operations in states along the Atlantic coast from Florida to New York comprised the second largest percentage of respondents (26%).

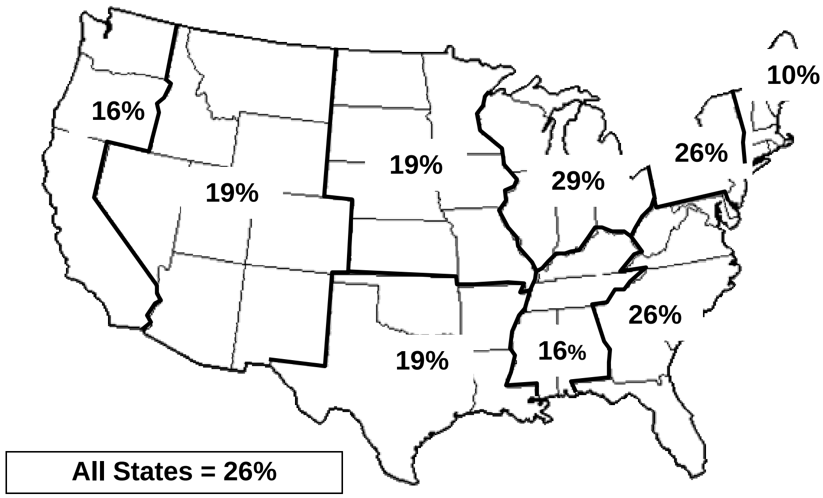

Figure 3
Distribution of Survey Respondents

4.2 Awareness of Idling

Just over half (52%) the respondents indicated electronic monitoring of the amount of time spent idling. A variety of systems were listed as being used to conduct this monitoring. Sleeper cabs were reported to idle an average of 28 hours per week, equating to 1,456 hours annually. Day cabs were reported to idle an average of 6 hours per week which equates to 312 hours per year.

In comparison, previous studies have estimated annual long-haul truck idling to range from 1,700 - 1,830 hour per truck.[8,9] Although it is unclear why ATRI's survey found lower idling times, one possible explanation could be the increased use of idle reduction systems, especially automatic engine shutdown devices and direct-fired heaters, among survey respondents.

The average cost of idling was estimated at $3.00 per hour. At the time the survey was administered, August through early October of 2005, diesel prices had reached historically high levels prior to and after Hurricane Katrina affected the U.S. refining and distribution capacity. (Average U.S. retail prices ranged from $2.35 - $3.14/gallon). It appears the estimated cost of idling corresponds somewhat to the average retail price of diesel during the time the survey was administered.

For 2005, U.S. retail diesel fuel prices averaged $2.40 per gallon. Assuming the cost of idling corresponds to the per gallon retail price of diesel fuel, an estimate of the average annual per truck cost of idling for 2005 would equal $3,494 for sleeper cabs and $749 for day cabs.

As shown in Table 5, the idling of sleeper cabs was reported to occur primarily at three locations: truck stops (33%), rest stops (21%), and at the loading/unloading location (20%). Day cabs were reported to idle primarily at the loading/unloading location (57%) or while in traffic (19%).

Table 5. Percentage Idling by Location

Location	ATRI Survey	
	Day Cabs	Sleeper Cabs
Truck Stops	3%	33%
Rest Stops	5%	21%
Loading/Unloading	57%	20%
In Traffic	19%	10%
Along the Roadside	2%	2%
Other	14%	13%

The percentage of time spent idling to conduct various activities is shown in Table 6. As some of these activities may occur at the same time, i.e., heating the cab and warming the engine, the totals do not equal 100 percent. For sleeper cabs, cooling (40%) and heating (32%) the cab were reported to require the highest percentage of idling. Idling while stopped in traffic (10%) was reported to require the third highest percentage of sleeper cab idling. For day cabs, the same three activities were listed as requiring the highest percentage of idling, although the order was somewhat different: cooling the cab (36%), stopped in traffic (24%), and heating the cab (20%).

Table 6. Time Idling by Activity

	ATRI Survey	
	Day Cabs	Sleeper Cabs
Cooling the Cab	36%	40%
Heating the Cab	20%	32%
Stopped In Traffic	24%	10%
Powering Auxiliary Equipment	5%	4%
Warming the Engine	9%	4%
Powering In-Cab Appliances	0%	2%
Other	9%	4%

Totals not equal to 100%

The types of in-cab appliances being used by drivers were also explored. As shown in Table 7, communications equipment, such as CB radios (90%) and cell phones (84%) were the most common in-cab appliances. Entertainment devices, including televisions (61%), stereos (58%), DVD/CD players (42%) and computers (39%), were generally the second most common category of in-cab appliances. Kitchen-type appliances, such as refrigerators (58%), microwaves (29%), and coffee makers (23%), were generally the third most common category of in-cab appliances. Cab comfort devices, such as lamps (45%), electric blankets (23%), electric air conditioners (10%), and electric heaters (3%), generally comprised the final category. When asked to identify the power source for these in-cab appliances, 12-volt battery power was cited by the majority of respondents.

Table 7. Types of In-Cab Appliances

	ATRI Survey
CB Radio	90%
Cell Phone	84%
Television	61%
Refrigerator	58%
Stereo	58%
Lamps	45%
DVD or VCR Player	42%
Computer	39%
Microwave	29%
Coffee Maker	23%
Electric Blanket	23%
Electric Air Conditioner	10%
Electric Heater	3%
Other	10%

4.3 Impacts of Regulations

Thirty percent (30%) of respondents indicated they have experienced some enforcement of city or state laws limiting vehicle idling. New York and New Jersey were listed most frequently as areas where enforcement has occurred. For those experiencing enforcement, little to no business impacts were noted.

According to the Philadelphia Inquirer, the greatest numbers of citations for violating idling laws were issued in New York City, New York State, New Jersey, Washington, D.C., and Philadelphia.[10]

Should laws limiting idling become more prevalent, respondents indicated having alternative power sources for air conditioning and heating were equally important and more important than for electric power alone.

4.4 Current Use of Idle Reduction Technologies

Fifty-five percent (55%) of respondents indicated their company has policies limiting vehicle idling. Establishing maximum idling times either through company policy and/or by programming automatic engine shutdown devices were the most common policies listed.

Thirty-two percent (32%) of respondents indicated they provide incentives to drivers to reduce idling. The most frequent types of incentives mentioned were bonuses or pay-based programs.

Fifty-five percent (55%) of respondents indicated they use automatic engine shutdown devices to limit engine idling. As shown in Table 8, over 40,000 trucks were equipped with shutdown devices.

Thirty-six percent (36%) of respondents with sleeper cabs indicated they currently use on-board idle reduction technologies (technologies which provide power for heaters, air conditioners, and/or in-cab appliances while eliminating main engine idling). These technologies were reported to be used an average of 29 hours per week. The most prevalent on-board technology was direct-fired heaters which were used by 32 percent of respondents with sleeper cabs and equipped on more than 8,000 trucks. Auxiliary power units/generator sets were used by 12 percent of respondents with sleeper cabs and equipped on 155 trucks. Battery-powered air conditioners were used by 24 percent of respondents with sleeper cabs and equipped on 92 trucks.

Table 8. Current Use of Selected Idle Reduction Systems

	Percent of Sleeper Cab Respondents	# of Trucks	Percentage of Total Sleeper Cabs
Automatic Engine Shutdown (1)	**55%**	**40,701**	**74%**
Direct-fired Heaters	**32%**	**8,110**	**19%**
APU/Generator Sets	**12%**	**155**	**0.4%**
Battery-powered A/C	**24%**	**92**	**0.2%**

(1) Percentages for Automatic Engine Shutdown are based on total trucks (sleeper + day cabs) rather than sleeper cabs only.

In comparison, the EPA's SmartWay Transport Partnership currently has 2004 idling reduction data for approximately 70,000 long haul trucks. Of these trucks, (assuming all are equipped with sleeper berths):

- Approximately 1,400 trucks (or 2.0 %) use direct-fired heaters;
- Approximately 36 trucks (or 0.05 %) use APUs; and
- Approximately 13 trucks (or 0.02 %) use battery-powered HVAC systems.

It should be noted that some ATRI survey respondents may be participants in the SmartWay Transport Partnership, consequently some data may overlap. In addition, the timing of the data collection is not the same, with EPA data collected through 2004 while ATRI's data was collected in 2005.

When asked to identify the general locations on-board idling reduction technologies were being used, rest stops were identified by 92 percent of those using these technologies, truck stops by 85 percent, loading/unloading by 62 percent, roadside by 31 percent, and other locations by 15 percent. The use of these technologies may occur at several locations; therefore, the percentages do not total 100 percent.

Overall, 81 percent of those using on-board idling reduction technologies were either satisfied or very satisfied with the technologies. All of the respondents using direct-fired heaters were either satisfied or very satisfied, while 67 percent of respondents using auxiliary power units/generator sets or battery-powered air conditioners were either satisfied or very satisfied.

As shown in Table 9, the average capital and maintenance costs for on-board technologies varied. Direct-fired heaters were reported to be the least expensive on-board technology to purchase ($888) and annually maintain ($110). Battery-powered air conditioners were the next least expensive technology to purchase ($4,300) and annually maintain ($200) followed by auxiliary power units/generator sets ($7,750 to purchase). Annual maintenance costs for auxiliary power units/generator sets were not adequately reported.

Table 9. Average Capital and Maintenance Costs of On-Board Idle Reduction Technologies

	Capital Cost	Annual Maintenance Costs
Direct-fired heaters	**$888**	**$110**
Battery-powered A/C	**$4,300**	**$200**
APU/Gen Set	**$7,750**	**NA**

NA = Data not available

Based on the reported average capital cost for each type of equipment installed, respondents have spent nearly $8.8 million to equip more than 8,000 trucks with on-board idle reduction technologies.

Information about the use of off-board technologies (technologies which supply cab comfort services from a stationary electrical power source while eliminating main engine idling) was also requested. However, responses to the off-board technology questions were not sufficient to develop meaningful data regarding the use of these systems.

4.5 Future Use of Idle Reduction Technologies

Respondents were asked what benefits were envisioned from the use of idle reduction technologies. Fuel savings was mentioned most often followed by less engine wear and less pollution.

As shown in Table 10, when asked how likely respondents would be to purchase idle reduction technologies if the payback period was two years, 26 percent of respondents indicated being likely or very likely to purchase idle reduction technologies. When incentives to offset half the purchase price of idle reduction technologies were added to a two-year payback period, 48 percent of respondents indicated being likely or very likely to purchase idle reduction technologies.

Table 10. Likelihood of Purchasing Idle Reduction Technologies

	Not Very Likely	Not Likely	Uncertain	Likely	Very Likely	No Response
A 2-year payback period	**23%**	**10%**	**29%**	**16%**	**10%**	**13%**
A 2-year payback period & incentives to offset half the purchase price	**16%**	**0%**	**23%**	**16%**	**32%**	**13%**

When asked how much respondents would be willing to pay per truck for idling reduction technologies, responses ranged from $0 to $7,500 with an average of $2,165. Compared to the average capital costs shown above, with the exception of direct-fired heaters, the cost of on-board idle reduction technologies is higher than the average price respondents were willing to pay. Twenty-nine percent (29%) of responses indicated a willingness to rent or lease idle reduction technologies.

4.6 Idle Reduction Technology Outlook

As shown in Table 11, 40% of respondents with sleeper cabs indicated they are likely to use battery-powered air conditioners over the next 2-5 years, equipping more than 10,000 trucks. Direct-fired heaters are expected to be used by 28 percent of respondents with sleeper cabs over the next 1-5 years, equipping more than 10,000 trucks. Auxiliary power units/generator sets are expected to be used by 28 percent of respondents with sleeper cabs over the next 1-4 years, equipping nearly 100 trucks.

Table 11. Likely Use of Selected Idle Reduction Technologies

	Percent of Sleeper Cab Respondents	# of Trucks	Timeframe (years)
Battery-powered A/C	**40%**	**10,606**	**2-5**
Direct-fired Heaters	**28%**	**10,555**	**1-5**
APU/Gen Set Systems	**28%**	**99**	**1-4**

Based on the reported average capital cost for each type of equipment, respondents are expected to spend nearly $56 million equipping over 10,000 trucks with on-board idle reduction technologies over the next 5 years.

By comparison, EPA's SmartWay Transport Partnership data projects 15,000 new direct-fired heaters, 6,660 new auxiliary power units/generator sets and 177 new battery-powered HVAC systems to be purchased by participating carrier companies from 2004 to 2007. EPA estimates these purchases will cost nearly $64 million.

Section 5 Conclusion

Based on results of a national survey among trucking companies, sleeper cabs were reported to idle an average of 28 hours per week, equating to 1,456 hours annually. Day cabs were reported to idle an average of 6 hours per week which equates to 312 hours per year. The reported average idle time for sleeper cabs was 14 – 20 percent lower than estimates contained in previous studies. This may reflect higher use of idle reduction systems, especially automatic shutdown devices and direct-fired heaters, among the survey respondents.

The average cost of idling was estimated at $3.00 per hour. This estimate corresponds somewhat to the average retail price of diesel during the time the survey was administered, which ranged from $2.35 to $3.14 per gallon. Based on the 2005 average retail price of diesel fuel ($2.40/gallon), sleeper cab operators spent an average of $3,494 in 2005 to idle a truck while day cab operators spent an average of $749.

The idling of sleeper cabs was reported to occur primarily at three locations: truck stops (33%), rest stops (21%), and at the loading/unloading location (20%). Communications equipment was the most common category of in-cab appliance, followed by entertainment devices, kitchen-type appliances and cab comfort devices. Twelve-volt battery power was identified as the primary power source for in-cab appliances.

Fifty-five percent (55%) of respondents indicated the use of automatic engine shutdown devices to limit engine idling on over 40,000 trucks.

Thirty-six percent (36%) of respondents with sleeper cabs currently use on-board idle reduction technologies (technologies which provide power for heaters, air conditioners, and/or in-cab appliances while eliminating main engine idling). These technologies were reported to be used an average of 29 hours per week or 1,508 hours annually. This figure is fairly consistent with the average idle time reported by respondents operating sleeper cabs.

The most prevalent on-board technology was direct-fired heaters which were used by 32 percent of respondents with sleeper cabs. Battery-powered air conditioners were used by 24 percent of respondents with sleeper cabs while auxiliary power units/generator sets were used by 12 percent of respondents with sleeper cabs.

Overall, 81 percent of those using on-board idling reduction technologies were either satisfied or very satisfied with on-board idle reduction technologies. All of the respondents using direct-fired heaters were either satisfied or very satisfied, while 67 percent of respondents using auxiliary power units/generator sets or battery-powered air conditioners were either satisfied or very satisfied.

Direct-fired heaters were reported to be the least expensive on-board technology to purchase ($888) and annually maintain ($110). Battery-powered air conditioners were the next least expensive technology to purchase ($4,300) and annually maintain ($200) followed by auxiliary power units/generator sets ($7,750 to purchase). Based on the reported average capital cost for each type of equipment installed, respondents have already spent nearly $8.8 million on these technologies.

When asked how much respondents would be willing to pay per truck for idling reduction technologies, responses ranged from $0 to $7,500 with an average of $2,165. Compared to the average capital costs reported, with the exception of direct-fired heaters, the cost of on-board idle reduction technologies is higher than the average price respondents were willing to pay.

When asked how likely respondents would be to purchase idle reduction technologies if the payback period was two years, 26 percent of respondents indicated being likely or very likely to purchase idle reduction technologies. When incentives to offset half the purchase price of idle reduction technologies were added to a two-year payback period, 48 percent of respondents indicated they would be likely or very likely to purchase idle reduction technologies.

Forty percent (40%) of respondents with sleeper cabs indicated being likely to use battery-powered air conditioners over the next five years. Direct-fired heaters and auxiliary power units/generator sets were each expected to be used by 28 percent of respondents with sleeper cabs over the next five years. Based on the reported average capital cost for each type of equipment, respondents are expected to spend nearly $56 million on on-board idle reduction technologies over the next five years.

As the cost of fuel and, consequently, idling has increased, trucking companies appear to be investing more in idle reduction technologies. In general, users seem to be satisfied with the performance of these technologies, although costs appear to be higher than most are willing to pay. Nonetheless, the use of idle reduction technologies is expected to expand. When growth projections associated with the U.S. trucking industry are considered, a 70% increase in the volume of goods moved from 1998 to 2020, the demand for idle reduction technologies should continue to increase well into the future.[11]

Appendix A

Background on Selected Idling Studies & Initiatives

Several previous studies and surveys have focused on truck idling and the use of idle reduction technologies. One of the initial studies, conducted by DOE, established that a typical intercity tractor-trailer idles an estimated 1,830 hours each year when parked overnight at truck stops.[12]

In 2001, results were published of a pilot survey of line-haul drivers conducted at four locations in Northern California to learn more about truck driver attitudes towards idling, APUs and truck auxiliary power usage.[13] The findings of this pilot survey indicated:

- Line-haul truck drivers in California require an average of 4-6 kilowatts of power for a stereo, a CB radio, a light, a refrigerator, and the climate control found in the average truck; and

- The majority of truck drivers are receptive to idling alternatives and two-thirds of truck drivers surveyed reported they would support a program to reduce idling.

The pilot survey was followed-up with a nationwide survey conducted at six different locations in January 2003.[14] This follow-up survey sought to learn about idling and idle reduction technologies throughout the U.S. Both the pilot and nationwide survey polled truck drivers at either truck stops or rest areas. The nationwide survey indicated that:

- Line-haul truck engines are idled for an average of 34 percent of total engine run time, roughly 1,700 hours per truck annually;

- Approximately 10 percent of drivers reported idling 10 percent or less of engine run time, while another 10 percent reported idling over 54 percent of engine run time;

- The mean annual fuel used during idle was estimated to be about 1,600 gallons per year; and

- An estimated 25 percent of drivers consumed over 2,300 gallons of fuel during idle and 10 percent of drivers consumed over 3,400 gallons per year.

In early 2003, draft final results from a survey of the Technology & Maintenance Council (TMC) of the American Trucking Associations (ATA) were released. The survey polled TMC fleet members (as opposed to drivers under the pilot and nationwide surveys) and focused on fleet characteristics and idle reduction technologies. Among the conclusions of this survey:

It is apparent from the analysis of the survey results that a large number of fleets don't think they have a need. They already automatically reduce idle by having the engines shut themselves down. It is the drivers who have needs. Other things which are apparent are that cost is the biggest barrier to implementation of auxiliary "driver comfort" devices and elimination of the FET and/or a tax credit would help overcome that. The majority of those who have tried the various devices have been satisfied, implying that it is not the technology that needs enhancement (except for reducing its cost) but other "needs" that must be explored.[15]

Beyond these survey efforts, a significant advancement in idle reduction technology took place in June 2003 with the first commercial deployment of an advanced truck stop electrification system.[16] The expansion of this system to numerous locations throughout the U.S. has heightened awareness of truck idling and brought new financial resources as well. In addition to this system, other on-board and off-board technologies are available, or are in the early stages of commercial development, which can be used to reduce idling.[17]

More recently, the Energy Policy Act of 2005 authorizes appropriations of $94.5 million for EPA's SmartWay Transport Program to support deployment of idle reduction technologies and energy conservation technologies from 2006 to 2009. The Act also authorizes $350 million under a National Grant and Loan Program for fleets to work on projects to reduce long-duration idling. While funding is only authorized, efforts to appropriate funding to support these idle reduction programs can be expected to continue.

Appendix B Endnotes

[1] American Transportation Research Institute/American Trucking Associations. *Compendium of Idling Regulations*. www.atri-online.org/research/results/idling_chart.pdf. December 2005.

[2] *See* www.epa.gov/otaq/smartway/idle-state.htm.

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[4] U. S. Environmental Protection Agency. *SmartWay Transport Partnership Homepage*. www.epa.gov/otaq/smartway. December 2005.

[5] U. S. Department of Energy. *National Idle Reduction Network News*. FreedomCar & Vehicle Technology Program. www.eere.energy.gov/vehiclesandfuels/resources/fcvt_national_idling.shtml. November 2005.

[6] West Coast Collaborative Homepage. www.westcoastdiesel.org. November 2005.

[7] American Transportation Research Institute. *Freight Performance Measures, Phase Three: August 2005 Data Analysis of Five Significant Freight Corridors*. August 2005.

[8] Lutsey, N. P., C. J. Brodrick, D. Sperling, C. Olgesby. *Heavy-Duty Truck Idling Characteristics –Results from a Nationwide Truck Survey*, Transportation Research Board 2004 Annual Meeting CD-ROM, 2004.

[9] Stodolsky, F., L. Gaines & A. Vyas, *Analysis of Technology Options to Reduce the Fuel Consumption of Idling Trucks.* Center for Transportation Research, Energy Systems Division, Argonne National Lab, June 2000.

[10] Philadelphia Inquirer, *Penalties are Few for Idling Diesel Engines*. (August 30, 2005)

[11] U.S. Department of Transportation, Federal Highway Administration, *The Freight Story: A National Perspective on Enhancing Freight Transportation* (November 2002).

[12] Stodolsky, F., L. Gaines & A. Vyas, *Analysis of Technology Options to Reduce the Fuel Consumption of Idling Trucks.* Center for Transportation Research, Energy Systems Division, Argonne National Lab, June 2000.

[13] Brodrick, C. J., N. P. Lutsey, Q. A. Keen, D. I. Rubins, J. P. Wallace, H. A. Dwyer & S. W. Gouse. *Truck Idling Trends: Results of a Pilot Survey in Northern California*, Society of Automotive Engineers 2001-01-2828, 2001.

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[15] Suski, V. & R. Braswell, *Idle Reduction Technology Need Assessment*, Technology & Maintenance Council/American Trucking Associations, National Renewable Energy Laboratory, Draft Final Report, February 2003.

[16] IdleAire Technologies Corporation Homepage. www.idleair.com. December, 2005.

[17] Idle Reduction Technologies Homepage. SmartWay Transport Partnership, U.S. Environmental Protection Agency. www.epa.gov/otaq/smartway/ idlingtechnologies.htm#truck.