

Truck Stop Electrification (TSE)

Background

Several governments, including the US, Canada, and Alberta, are looking at potential solutions to address the problem of heavy duty diesel, long haul vehicle idling – which has been identified as a major source of GHG emissions, as well as, criteria air contaminants, such as, NO_x, CO, PM and VOCs. NRCan's Office of Energy Efficiency has found that many vehicles idle up to 65% of their operation time.

What Is TSE?

Truck Stop Electrification (TSE) technology is essentially the provision of electrical power outlets at truck stop locations. There are two types of TSE systems. The stand-alone system is owned and operated by the truck stop, and each parking stall is equipped to provide heating, ventilation and air conditioning (HVAC) to the cab via a hose attached to the window. The only equipment required by the truck is a window template. For the onboard or shore power systems, vehicles must be equipped with TSE equipment, including power systems that convert 12V DC into 120V AC for all onboard systems. For long duration or overnight stops, TSE equipped trucks are simply plugged into the local electric utility, just as recreational vehicles are plugged in at RV parks. Power flow is activated and deactivated by a swipe card reading mechanism. On-board vehicle systems that can run off the provided electricity include fuel heaters, cab heaters, air conditioning, and appliances (microwave, TV, etc.) built into the truck cab.



Current Status

The US Departments of Energy and Environment have been funding a significant amount of research and economic feasibility analysis into the concept of establishing a TSE network on the United State's interstate highway system.

Companies currently providing TSE systems include Idle Aire Technologies, Phillips, and Xantrex. Volvo is presently offering an AC power system in a recent model of class 8 tractors - the Volvo 770. No other heavy-duty diesel vehicle manufacturer is presently offering this option. For details about companies currently offering TSE systems please see:

<http://www.epa.gov/otaq/smartway/idlingtechnologies.htm>

There are currently more than 30 TSE stations in the United States. For example, the Petro Stopping Centre in Bucksville, Alabama, is equipped with TSE for all 81 parking stalls for long-haul trucks. A window adapter costs \$10, while the service costs \$1.25 to \$1.50 per hour and is paid with a credit card via a touch screen. New York State is currently conducting a TSE pilot project along the NY State Thruway. TSE units will be installed at four Travel Plazas as part of the project. If successful, the TSE project will expand to other Thruway Travel Plazas throughout NY State.

Pilot programs related to TSE are also being conducted by certain companies. For example, Schneider National equipped its truck fleet cabs with auxiliary coolers and heaters. They found that when the coolers were used during warm weather conditions, idling decreased from 19% of the operation time to 15%; however this had no noticeable effect on total fuel efficiency. When heaters were used, idling decreased from 22% of the time to 9%, and fuel efficiency improved by 2%. Caterpillar is currently testing generator that provide power when the engine is off. Espar Heating is currently testing combined cab heating and cooling; they also have engine preheaters.

Further research by the Advanced Vehicle Testing Activity group, which is part of the US Department of Energy, will examine cab insulation and load reduction.

Estimated Emission Reduction Potential

Research conducted by the Argonne National Laboratory, funded by the US Department of Energy, has indicated that on average, long haul trucks idle 6 hours/day and 1,830 hours/year. A single long haul truck idling for 1,830 hours/year, according to the Argonne National Laboratory, wastes a million US gallons of diesel fuel per year; and emits 220 pounds of NO_x, 380 pounds of CO and over 20 tons of CO₂. Of note, the Edison Institute has indicated that average idling time is closer to 2,500 hours/year. It is likely that the idling times and thus emission levels are higher for Canadian long haul trucks due to our harsher climate.

The following data, developed by the Argonne National Laboratory, draws a comparison of idling emissions to TSE emissions (based on the average US electrical power mix).

Emissions of Pollutants (grams/hour)

| Technology | THC | CO | NO_x | PM | CO₂ |
|-------------------|------------|-----------|-----------------------|-----------|-----------------------|
| Idling | 12.6 | 94.6 | 56.7 | 2.57 | 10,397 |
| Electrification | 0.054 | 0.481 | 6.04 | 0.035 | 3,014 |

Economics/Feasibility

The Edison Institute has estimated infrastructure installation costs at about \$2,500/spot. It is believed that TSE facilities would only be economical on the most heavily traveled highways (e.g. TransCanada Highway).

Anticipated payback times for TSE are as follows:

| Type | Cost \$ | Yrs @ 1000 hrs | Yrs @ 3000 hrs | Yrs @ 5000 hrs |
|-------------|----------------------|-----------------------|-----------------------|-----------------------|
| TSE | \$1700 + \$2500/spot | 3.8 | 1.3 | 0.76 |