ElecComm Power Services

Working Toward Sustainability

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Overview

ElecComm Power Services is a company that provides temporary generator and power solutions to all of New England and New York. ElecComm Power Services was formed in 2006, when GE sold its Power division. When this occurred, two former GE employees reached out to ElecComm Corporation, an underground utility company. Together they were able to create a power services division called ElecComm Power Services. ElecComm Power Services was able to retain a majority of GE's technicians and clients.

Today ElecComm Power Services continues to grow and diversify their business to new opportunities and fields in the power and utility industry. The Company continues to grow and realizes that it must streamline and reevaluate some of its operating procedures and philosophies. After numerous meetings with ElecComm's owners, they requested that we investigate the following areas to increase the Company's Sustainability:

- The excessive fuel consumption of the technician's trucks while monitoring the generators and the alternative heating and cooling needs the technician will require while the engine is off.
- Strategic satellite locations for storing generators to decrease travel time of technicians to get the generator and return to jobsite. This will increase technician efficiency and decrease fuel consumption.
- Feasibility of using waste oil as an alternative fuel for heating the Companies maintenance bays through a waste oil boiler and the possibility of selling excess waste oil to surrounding warehouses and maintenance shops.

On the Job Site

Once a generator has been delivered to the jobsite, the technician works along with their customer in order to make the proper electrical connections and start generating electricity. Once the unit is online there is paper work and other tasks that must be completed by the technician. Since this is a field

service position, the vehicle is used for transportation, as well as an office and shelter. Jobsite paper work needs to be completed, generator maintenance records need to be updated, fuel delivery must be arranged, and relief personnel need to be notified, along with many other tasks that are taken care of at the job site.

Inside the truck a power supply for cell phones and laptops are necessary for the technician to complete their work. Currently the trucks are equipped with power inverters that convert the 12 volt battery supply to the 120 volts necessary to operate the office equipment. In order to maintain battery power the engine must be running.

In addition to idling the trucks for power, they are also run to provide comfort conditions, such as heat, air conditioning and a radio which makes the job more enjoyable. During the rain and snowy seasons, the truck cab is the only place the technician has to escape the weather. Running the engine allows them to dry off and warm up while listening to the radio and completing their paper work.

Fleet Fuel Consumption from Idling

ElecComm Power Services is an around the clock operation that has technicians on the road 24 hours a day 7 days a week. On the low end scale, ElecComm's fleet of trucks idle an average 40 hours per week. The Chevrolet 2500 pickup truck with its VB 6.0 liter engine consumes approximately .58 gallons per hour of gasoline while idling. This amounts to each truck wasting a minimum of 23 gallons of gasoline each week from just sitting at the job site. The average price for a gallon of 87 octane gasoline in the greater Boston area is $2.69. This amounts to $3,300 worth of gasoline that each truck uses in a year to provide the generator technicians with heat, air conditioning and electricity. With ten trucks in the fleet, ElecComm is spending over $30,000 each year on fuel that is essentially producing no work. Not only is this a waste of natural resources but it is increasing the maintenance cost of the vehicles and is producing large quantities of unnecessary Green House Gas Emissions.

Alternative Energy Sources

While running the trucks engine is a simple and convenient solution, it is very wasteful and produces unnecessary pollution. ElecComm Power Services is in the business of producing electricity and has existing useable power outlets on all of their equipment. With a generator already running at each site, one can take

advantage of the free available power and eliminate the necessity of idling the trucks engine. For a relatively small initial cost, each truck can be modified and operated using power supplied by the generator. With the mechanical knowledge of the technicians, these modifications can be made in house without voiding the warranty of the fleet vehicles.

The first step would be to incorporate a 120 volt power supply to the truck. All of the generators are equipped with standard 120 volt 20 amp power outlets. Weather proof enclosures and cables can be purchased at any marine or local automotive store. For ease of installation and operation it is recommended that the receptacle be installed on the passenger side, rear cargo compartment as indicated in Figure 1. From here a hole can be drilled to lead up to the cab. Another hole will need to be drilled through the cab floor, which will bring power inside the truck. The holes can be made weather tight using a flexible waterproof silicone such as Permatex PX 82180 or any similar product. A junction box will need to be installed behind the back seat (see Figure 2) in order to distribute power inside the truck, as well as the engine compartment. From the junction box one cable will be run under the carpet to the center console where an outlet will be installed to supply power for the technician's equipment. The proposed location for the installation is shown in Figure 2. This simple wiring will eliminate the inverter and the need to idle the vehicles engine for power.


Figure 2

Another reason for running the engine is to maintain battery power while using the trucks accessories such as the radio, interior lights, defroster and blower. An alternative to running the engine would be to permanently install a 120 volt battery tender in the engine compartment. It is recommended to use a product similar to the Deltran Power Tender Plus (DEL-021-0157-1). This model is weather proof, shock and vibration resistant, lightweight and designed for permanent installation. With a 12 volt 5 amp power output, this unit will maintain a fully charged battery while running every accessory built into the truck. This unit can be installed directly behind the trucks battery on the passenger side front quarter panel as indicated in Figure 3.

Power for the battery tender will be supplied from the junction box that is installed behind the back seat. A second power cable from the junction box will be routed through the hole drilled in the truck floor, along the underside of the

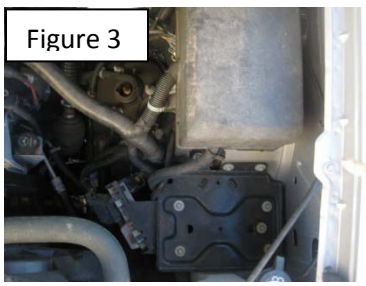


Figure 3

truck and up to the battery tender. To eliminate the possibility of failure due to moisture, dirt or road salt, it is recommended that the tender be hard wired without the use of a plug. The 12 volt power outlet cables are connected to the battery terminals with the use of an in line fuse.

The fuse provides reverse polarity protection, which will prevent damage to the generator or any electronic component plugged into the center console outlet. This system can remain connected to the battery while driving the vehicle with adverse effects. The technician now has the ability to run any accessory in the truck including a laptop and phone charger without having to run the truck engine.

In every gas or diesel powered vehicle, heat is generated by combustion in the engine. That heat is absorbed by the engine coolant and is circulated using a pump driven by a pulley on the engine. The coolant passes through a heat exchanger where heat is transferred to the driver's compartment using a fan. To eliminate running the engine for heat and coolant circulation an Espar Hydronic 4 coolant heater (see Figure 4) should be installed. The heater is compatible with all Chevrolet 2500 pickups and is available from any local Thermo King supplier. There is a box system available which is designed to protect the equipment from all types of weather and road debris. With external dimensions of 6 x 9 x 4 inches, the Hydronic 4 kit can easily be installed in the spare battery location shown in Figure 3.

Figure 4

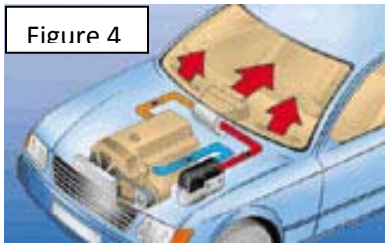
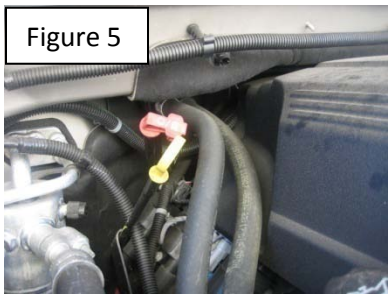


Figure 5



The Hydronic 4 kit is a gasoline fired heater capable of maintaining the engine coolant at temperatures between 149 and 176 degrees Fahrenheit. During normal operation the heater will consume between .05 and .11 gallons per hour of gasoline which is over 80% less fuel consumed by running the engine. Since the heater runs on its own fuel and the trucks 12 volt power supply, it can be run completely independent of the truck engine which makes it both fuel and power efficient. Espar offers a 12 volt Box Truck Kit (CA-2257-55) that comes complete with the heater, main wiring harness, on/off switch, fuel pickup pipe, fuel line and fittings required for installation. It however does not include coolant hoses or fitting necessary to complete the installation but these items can be purchased at most local plumbing or automotive stores.

No permanent modifications to the vehicle are necessary for this installation. The coolant can be supplied to the heater by installing the supplied fitting into one of the freeze plugs located on the engine

block. The return line from the heater should be located as far away from the freeze plug as possible to ensure good heat distribution. The recommended location is somewhere near the heater core supply line as indicated in Figure 5.

Once installed, the unit is automatically controlled by an on/off switch that is located inside the vehicle. A flame sensor, temperature regulator and overheat sensor are some of the safety features which make the Hydronic 4 a safe and dependable alternative to running the engine.

Fuel Project Savings and Costs

If this system is installed by the ElecComm Technicians, the cost of the project would be approximately $1550 per truck, plus labor. According to a representative from Mass Truck Refrigeration Services the first truck installation would take approximately 10 hours. Once the initial process is worked out, the remaining trucks could possibly be completed in as little as 5 or 6 hours.

For installation to be completed by an authorized Thermo King distributor at $85 per hour, the cost of installation per truck would be around $540. This would bring the total system cost to approximately $2090 per truck.

Although the initial cost of this package is high, the conservative payback period is between seven and ten months depending on who completes the installation. By reducing fuel consumption from .58 to .08 gallons per hour at idle, the low end fuel savings will be $54 per week. In addition to fuel savings, ElecComm will generate less Green House Gas Emissions and will extend the service life of their fleet vehicles.

Satellite Storage Locations

ElecComm Power Services is located in Hyde Park, Massachusetts. One of the major expenses to the company is the cost of fuel for the trucks to transport the generators to different locations. They roughly spend $50,000 a year in fuel transferring these portable generators. On average, their trucks get 8-10 miles per gallon of gasoline when towing.

Some of the suggestions that were given to ElecComm were to look for satellite storage locations, install fleet management systems in their trucks, perform periodic maintenance on their

trucks, educate their drivers on simple ways help improve their fuel economy, and also employ a system which has employees working close to where they live.

As of now ElecComm does most of their driving throughout Massachusetts and parts of New York and Connecticut. With their shop located in Hyde Park, they spend a significant amount of their revenue on gas for transportation of generators to work sites. By investing in a satellite storage facility, this could help in reducing the amount they have to travel loaded (towing the generator). Picking a location like Springfield, MA would place them in an area which could support the western part of the state along with providing easy access to both New York and Connecticut. The trucks average mileage is about 16 mpg unloaded, and about 10 mpg loaded. They could rent a storage unit in Springfield located about 80 miles from Boston for roughly about $100 a month. With the current gas prices at an average of $2.65 a gallon it would cost them about $13.25 one way ($26.50 back and forth) unloaded, or $21.20 ($42.40 back and forth) loaded. Only a few trips out west a month loaded would pay for the storage.

Last year they did a lot of their business west of Rt. 495. With traveling roughly 400 times back and forth out west loaded it costs them about $17,000 a year in gas. If they had a storage unit in the area they could reduce their fuel costs. If driving out west unloaded it would only cost them about $11,000 a year. With the rental and cost of the storage unit, ElecComm could save about $5,000 a year in gas. If gas prices continue to increase like they did a year ago, which most likely they will, an even greater savings would occur. This approach could not only save them money but it would also help them in reducing greenhouse gas emissions.

The way a vehicle is driven and maintained affects operating costs, fuel economy, and greenhouse gas emissions. A few actions in these areas can yield significant savings. By educating drivers one can teach them how to be more efficient on the road and drive fewer miles. Speeding, coupled with rapid acceleration and deceleration, for instance can significantly increase fuel consumption. Idling is another way in which fuel consumption is increased. Idling uses more fuel than restarting the engine. Improving vehicle maintenance is a way to help increase fuel efficiency. Regular oil changes, proper tire inflation, and other preventative maintenance practices can increase fuel economy. A dirty air filter can reduce fuel efficiency by 10%, causing higher emissions. Incorporating new technology can also help in fuel savings. Routing software, GPS systems and fuel management software can increase efficiency. New products allow for real time monitoring and data collection that can increase safety, reduce idling, cut fuel consumption, and decrease emissions. Fuel inefficiencies are often caused by the way a vehicle is

being driven or as a result of poor journey planning. Tracking provides companies with the tools to be able to manage & control fuel consumption using real time alerting features and historic journey data.

More complex tracking systems can provide a 'Driver Training System.' These systems still monitor vehicles movements and provide the data one would expect from a tracking system but also provide much more advanced features. These systems obtain data from the vehicle, such as engine revs and MPG (miles per gallon) performance. The system is able to use this data to understand how the vehicle is being driven. The system will then prompt the driver using a simple in-cab interface to adjust their driving style to be more fuel efficient.

Waste Oil Heating

ElecComm is currently using an industrial grade furnace, rated for 250,000 BTU/hour, burning #2 fuel oil. This furnace is used solely to provide heat during the winter months in their double bay shop. After an initial walk through of the shop, and gaining an understanding of what they do, it became clear that a waste oil furnace should be strongly considered. ElecComm currently has 25 generators ranging in size from 20 kilowatts, all the way up to 1 megawatt.

The goal of the waste oil furnace is to supplement or possibly eliminate the cost of home heating oil by burning the waste oil of the 2S generators. Right now this waste oil is being stored on site in two collection tanks, one 800 gallon tank and one 600 gallon tank, to be picked up and recycled by Clean Harbors. Both of these waste tanks were full during our tour along with their current 300 gallon #2 fuel oil tanks. For a small company looking to save costs, this was a waste that we were confident could be corrected.

To determine if a waste oil furnace would in fact be cost effective we needed to find out how often these generators were getting oil changes, how much oil was in each of the generators and how often employees were actually at the shop versus on the road. While this company seems to have a strong culture, they are very profit oriented at this point and cannot afford to implement change that would be cost effective. With the help of ElecComm we were able to put together the following numbers seen in Figure 6. The numbers in this table are 2008 totals and indicate the size of each generator, how often it is serviced during the year and each generators total waste oil production.

FIGURE 1

Generator #	Size	Oil Qty	Service per year	Gallons Waste Oil Per Year
GU-1	320KW	12	10	120
GU-2	320KW	12	6	72
GU-3	320KW	12	7	84
GU-4	68KW	4	8	32
GU-5	640KW	45	10	450
GU-6	55KW	4	7	28
GU-7	60KW	4	9	36
GU-8	200KW	9	7	63
GU-9	200KW	9	12	108
GU-10	200KW	9	8	72
GU-11	125KW	6.6	7	46.2
GU-12	500KW	40	6	240
GU-13	68KW	4	6	24
GU-14	240KW	12	8	96
GU-15	68KW	4	7	28
GU-16	320KW	12	5	60
GU-17	60KW	4	7	28
GU-18	125KW	6.6	4	26.4
GU-19	100KW	6.6	7	46.2
GU-20	20KW	3	5	15
GU-21	56KW	3	6	18
GU-22	56KW	3	10	30
GU-23	100KW	6.6	5	33
GU-24	1MW	75	8	600
GU-25	320KW	12	7	84

The total waste oil per year was found to be 2439.8 gallons. This is the first number needed to determine if a waste oil furnace is the right choice. Next, we found that the shop occupied an average of 40 hours per week (160 a month) and that the heating season is 6 months long. This gave us a total of 960 hours (160*6) of heating needed each season. With ElecComm's current boiler setup they burn an average of 2 gallons of oil an hour. This means ElecComm requires 1920 gallons of #2 fuel oil to be burned each winter. This is approximately 520 gallons less than the total waste oil collected each year. It was now time to find a waste oil burner that can put out the same amount of heat while burning the same amount of fuel.

Clean Burn Energy Systems CB-2500 Waste Oil Furnace

There are many options when looking into a waste oil furnace. Old burners can be converted to burn waste oil, used systems can be purchased, and new systems can have price differences in the thousands depending on size and brand. The unit that was decided on is the Clean Burn CB-2500 Waste Oil Furnace System. Clean Burn Energy Systems is a worldwide leader in the production and sales of these furnaces, and most importantly this unit has the specs required for this site. 250,000 BTU/hour, and burns a maximum of 1.7 gallons per hour.

The CB-2500 is more expensive upfront than many of the other furnaces researched, however, the payback will be seen in the efficiency and the minimum amount of maintenance needed on this furnace. Efficiency in waste oil furnaces is determined by outlet stack temperatures because of the constant change in BTU value while burning different types of fuel. If there is a cooler stack temperature, this is a clear indication of more heat being used to warm the room, and less heat exhausted to the outdoors. The C8-2500 average stack temperature, during constant operation is 650 degrees. Compare that to 900 degrees, which is seen in many of the simple blast tube furnaces and one can see the difference in heat exchanger efficiency.

Clean Burn is able to do this by increasing the amount of heated surface area that the cool air comes in contact before leaving the furnace, as seen in Figure 2. After the combustion gases leave the initial combustion chamber, the gases are drawn into a series of tubes. These tubes redirect the combustion gases twice. The cool outside air from the room is drawn into the furnace to pass the outside of these tubes, picking up heat. In the common blast tube design seen below there is a single pass of combustion gas which does not give the cooler outside air enough time to pick up the heat, or the hot gases enough time to give up the heat which is now being wasted up the stack.

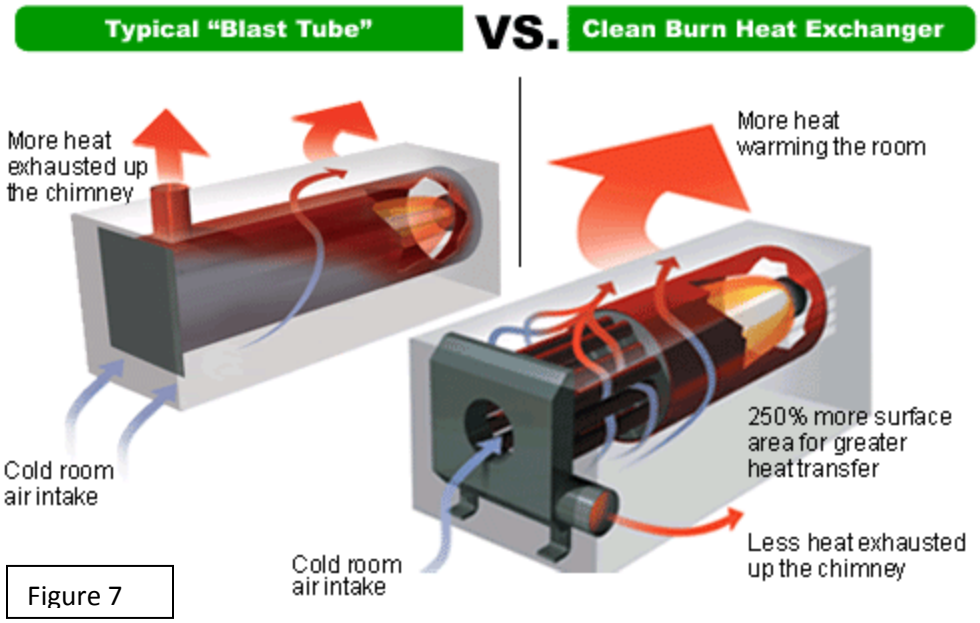


Figure 7

Maintenance for this furnace is minimal outside of a seasonal cleaning, every 1000 hours. The pump and furnace internals are made of steel, not plastics and composites, and these metals are swedged together not welded. Swedged metals in a combustion chamber are not susceptible to cracking and failing and the tubes are able to expand and contract with temperature changes. Reliability is a key element in ElecComm's success with their customer. They are a small company that do not have the time, money, or man power to worry about the heating system and why it isn't working. Just as they need to be there for their customer, they need a furnace that will be there for them when needed.

Fostering Sustainable Behavior

Current behavior	*Expected behavior*	*Barriers*	*Benefits*	*Strategies*
Leave Truck Engine Idling while on job site	**Plug truck into generator and shut off the truck engine**	**Differs from way it is currently done**	**Reduce fuel consumption and carbon foot print**	**Educate benefits to company's bottom line and benefit to the environment**
Leave generators at one central location	**Set up satellite locations**	**Finding location that is cost beneficial**	**Reduce fuel costs** **Reduce Greenhouse Gas emissions**	**Employee deployment based on where they live**
Reuse of waste oil for shop heating	**Collection of waste oil**	**Initial cost of boiler**	**Reduce heating bills** **Reuse of oil** **Reduce waste costs**	**Purchase a high quality unit** **Proper location of unit**
Fleet management system	**Adhere to recommended maintenance schedule**	**Initial cost of system**	**Improve gas mileage** **Track employee driving**	**Properly use system to its full potential**

Cost & Benefit Analysis

Waste Oil Environmental Implications

The use of a waste oil furnace immediately reduces ElecComm's carbon footprint by eliminating the need to burn any access fossil fuel. The fuel they will be burning is 100% recycled fuel from the generators. Burning waste oil also eliminates the chance of the oil getting into the watershed. This is the major reason that waste oil furnaces have been supported by the EPA for the use of onsite heating. By eliminating Clean Harbors, ElecComm can follow the oil from cradle to grave. There is no longer a chance of spillage during transportation or pumping by Clean Harbors.

Waste Oil Project Cost and Savings

The total project cost is quoted at $10,904. This cost was for equipment, installation, permitting (state and fire department), piping, foundation, and all electrical connections. The only thing not included on the quote is routine maintenance. The average price of home heating oil today, December 1, 2009, in Boston MA is $2.75 a gallon. This would indicate a 2009-2010 winter heating bill of

approximately $5,280. These numbers offer a two year payback with enormous savings from that point on, as the price of fossil fuels continues to rise. The potential for even more savings seems to be in the future, as more and more states are offering tax credits to companies that burn their waste oil.

Recommendations

The recommendations due to the current winter season and the nature of ElecComm Power Services business for immediate positive financial and environmental gain are the following:

- For the trucks install: the 120 V receptacle to receive generator power, Deltran Power Tender Plus, and the Hydronic heater.
- Satellite locations: investigate strategic locations for the current weather season and equipment deployment areas where land can be leased or agreements can be work out with customers.
- Waste oil: the tanks required are already in place, waste oil is abundant, a location has been designated to install the furnace and there is no current installation of a furnace that would disrupt heating, so this project can be completed at ElecComm's convenience without heat interruption.
- Implement strategies outlined to enable the required behavioral changes for employees.

Incorporating these initiatives immediately will provide immediate truck and heating fuel savings due to the current cold weather conditions and the nature of the 24/7 business. Due to the small number of employees these initiatives will be easy to institute and track with both minimal cost and time involvement for management. Employee buy in will be high, as overall creature comfort and environment will improve in the trucks where devices and heat can be run without concern for draining batteries and engine failure. The environment in the shop will improve where heat can be supplied consistently now that a waste product is now being utilized to supply heat and not the expensive # 2 fuel oil.

It was our pleasure to be able to work with you on this evaluation and we would be available to assist with ElecComm's implementation of these initiatives and any other support required.