



Clean Air Emissions Vehicles

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“Here. Everything’s Better”

Since 1905



HEB Transportation

- ◆ Primary operation is to transport various goods for sale at over 300 retail locations throughout Texas and Mexico. This is accomplished by utilizing (400) plus power units, over (2,000) trailers, and support by numerous personnel located at (5) logistic centers, also know as Retail Support Centers in San Antonio, Houston, Corpus Christi, Weslaco, and Waco.



HEB's Standardized Fleet

- ◆ Over 400 Sterling tractors with Caterpillar engines.
- ◆ Tractors are purchased annually for both growth, and replacement on a (5) year life cycle
- ◆ LNG Fleet is currently based and operated out of the Houston Retail Support Center
- ◆ Of the (92) tractors domiciled in Houston, (54) have been converted to dual fuel, and additional tractors are in the process of being converted at the local Caterpillar Dealer



Why We Decided to Use Alternative Fuel

- ◆ Positive impact on the environment and air quality
- ◆ HEB has a strong reputation of community service
- ◆ Lessen our dependence on foreign oil
- ◆ LNG is produced in large quantities in our operating area; Southeast Texas. Currently we receive fuel from Willis Texas, about 52 miles from the terminal.
- ◆ Preparing for the future, and it was the right thing to do...



HEB's Past Experience with Alternative Fueled Tractors

- ◆ 1988 - HEB ran a pilot fired compressed natural gas vehicle between Corpus and San Antonio \$55,000
- ◆ 1994 price for an LNG powered tractor from Volvo with a Detroit Diesel spark ignited gas engine and LNG tanks: \$186,000
- ◆ October 95 price for LNG powered tractor from Volvo with Cummins spark ignited gas engine and LNG tanks: \$144,000
- ◆ November 95 price for LNG powered tractor from Volvo with Cummins spark ignited gas engine and LNG tanks: \$126,000
- ◆ May 99 price for LNG powered STERLING tractor with Caterpillar LNG engine and diesel fuel fallback capability with dual LNG tanks (\$120,000)



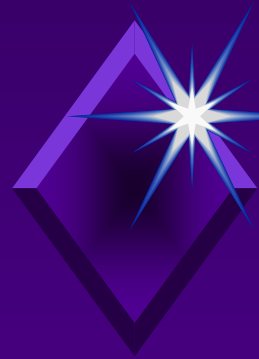






The Way it Works

- ◆ Dual fuel engines operate on LNG and Diesel (90% LNG , 10% Diesel)
- ◆ Unlike spark ignited engines, LNG in dual fuel engines is ignited by a small amount of diesel fuel under heat and compression
 - ◆ Diesel ignites @ 450 degrees F
 - ◆ LNG ignites @ 900 degrees F
 - ◆ You need diesel combustion to ignite LNG
- ◆ Modified manifold with six gas injectors, an additional piggyback engine control monitor (ECM), cold side turbo waste gate, and LNG tank



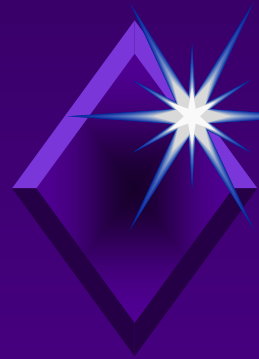
Caterpillar C-12 Diesel Engine After Conversion





Why Dual Fuel?

- ◆ Dual fuel engines are reliable; no spark plugs needed
- ◆ Engines can run in either dual fuel mode or diesel with no noticeable transition (fall back capability)
- ◆ Minimal modification / ease of conversion (2 days)
- ◆ Known effect on residual value of tractors
- ◆ Reduced oil changes

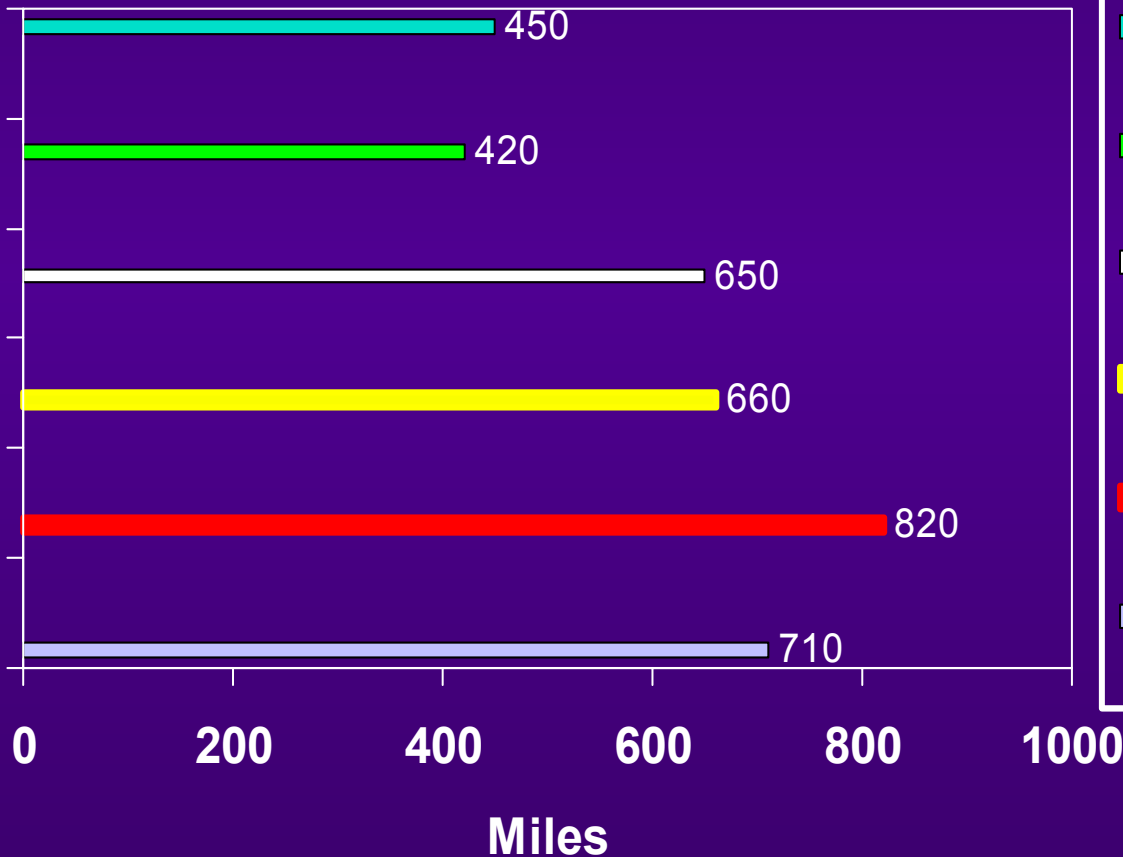


Positive Environmental Facts:

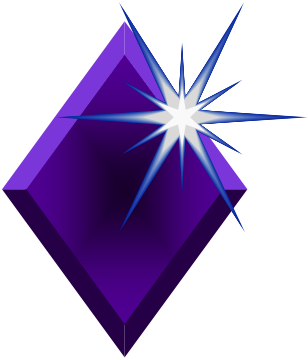
- ◆ One converted HEB tractor equals a NO_x reduction of 1,300 lbs per year
- ◆ This reduction is equivalent to removing 63 cars from the road per year
- ◆ Greater reduction in emission for you money is realized by converting Class 8 Tractors than smaller vehicles
- ◆ Greater Environmental benefit by operating within and around the Houston non attainment area
- ◆ HEB is a corporate citizen doing its part for air quality in Texas



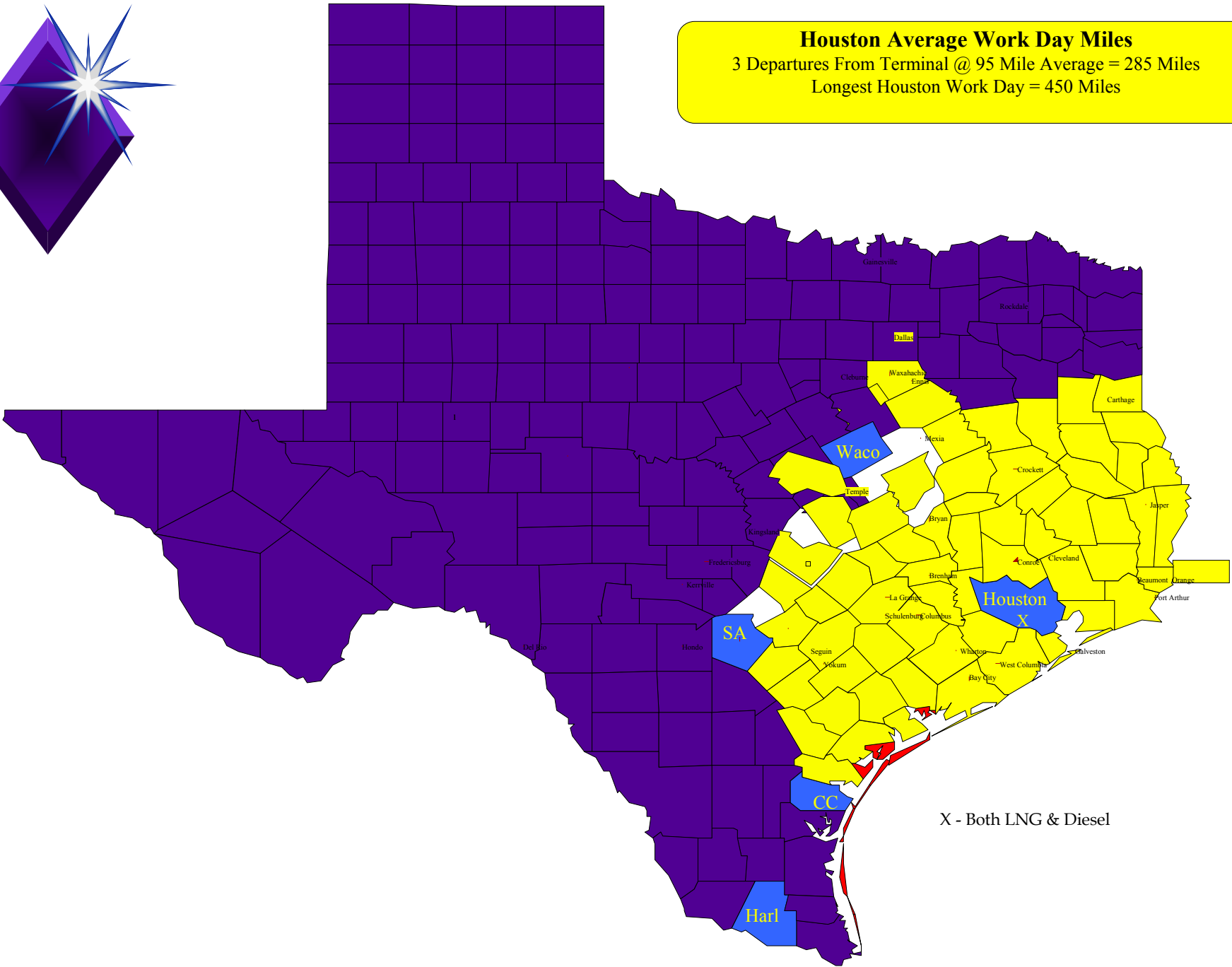
Tractor Fuel Range



- Longest Total HRSC Driving Day
- Maximum LNG Range Single Tank
- Overall Fuel Total Including Diesel Reserve Single
- Maximum LNG Range Dual LNG Tanks
- Overall Fuel Total Including Dual LNG Tanks
- Standard HEB Diesel Fuel Range



Houston Average Work Day Miles
3 Departures From Terminal @ 95 Mile Average = 285 Miles
Longest Houston Work Day = 450 Miles



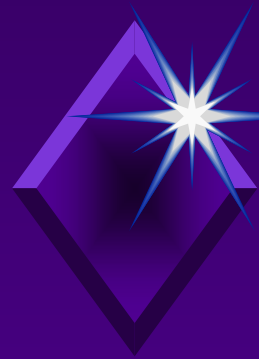
X - Both LNG & Diesel



Vehicle Specification

◆ **Tractor Specifications**

- ◆ Sterling / Ford with customized options
- ◆ Caterpillar C-12 engine with 2100 RPM and 350 HP
- ◆ C.A.P. lowest cost problem free conversion
 - ◆ Diesel fallback capability if LNG is not available
- ◆ Special frame and wheel base length
- ◆ Special Pre-drilling of frame for future LNG tank brackets
- ◆ Specific diesel tank size and location to match with future LNG conversion
- ◆ Frame mounted accessories placed so that they are already in position for LNG conversion
- ◆ Straight drive transmission and differential ratio to match 2100 RPM engine and 60 - 70 miles per hour road speeds



Facility Installation - Shop Conversion Cost & Training

\$ 610,000 Fueling Site – includes:

- 2 LNG Cryogenic tanks with capacity of 18,800 gallons, concrete pad, secondary containment, 2 dispensers and canopy

\$ 185,000 Maintenance Shop Conversion

- Infrared Methane Sensors, Air Evacuation System, Down Spouts for both Methane & Exhaust, and modified lights and electrical systems

\$ 14,200 Training

- 130 Drivers @ 4.5 hours each
- 10 Maintenance Tech's @ 11 hours each
- 4 Management @ 20 hours each



Obstacles That Had to be Overcome

- ◆ Resistance to change
- ◆ Driver concerns: Power, Torque, Reliability, Safety
- ◆ City, State, County, Fire and OSHA regulation concerning LNG
 - ◆ Regulatory agencies are not familiar with LNG
 - ◆ Each agency has its own regulations, and there are conflicting statements on installation procedures
- ◆ Overall SAFETY: Extensive training, shop conversion, methane detectors
- ◆ Delays, On-Road issues
- ◆ Partners fueling a cryogenic liquid that is at -250 degrees
- ◆ Requires two fueling operations
- ◆ The (C-12) Caterpillar engine and CAP Conversion are relatively new on the market
- ◆ 790 lbs. additional weight to equipment



What we have experienced

- ◆ LNG System upgrades
 - ◆ Gas Injectors (redesign dependability from 25,000 miles to 200,000)
 - ◆ Early Head gaskets failures (upgrade to a larger heat exchanger)
 - ◆ Filtration (added last chance filter to inlet on the manifold)
 - ◆ Engine Wiring harness (added a shielded to prevent interference of sensor signals to the ECU)
 - ◆ ECU (product evolution , made water proof)
 - ◆ Turbo Air By-pass Valves .. TAB (Upgraded TAB to a larger model for increased capacity and faster acting when dumping boost pressure)
 - ◆ Shut off Solenoid Valve .. SOV (Turns fuel off and on to the fuel rail to determine defects , supplies engine with fuel , electrical shut off valve)
 - ◆ Relocated fuel management module for technician friendly service
 - ◆ Redesign coalescing filter element with a centering locater to ensure element stays attached to housing
 - ◆ Fueling Station Upgrades (added a higher capacity dispensing pump, 13000 gallon vertical storage tank, JC Carter fueling nozzle vs Parker .



Tank Experiences

- ◆ LNG Vehicle tank
 - ◆ Added 2nd tank for longer travel
 - ◆ Changed rigid piping to steel flexible lines
 - ◆ Redesign plumbing to reduce leaks (hand flow valves, vent valves)
 - ◆ New relief valves (230 & 350 psi)
 - ◆ Increased ID on fuel lines to heat exchanger to improve fuel flow
 - ◆ Upgrade economizer from adjustable to non adjustable (fixed setting)
 - ◆ Upgraded 2 psi check valves with a stronger spring and a steel ball to eliminate the ball valve sticking open / closed.
 - ◆ Designed a on-site field re-vac to re-establish vacuum without removing tank. (reducing tractor down time)
(establish vacuum is @ 1.0 micron)



Successes

- ◆ Drivers were won over by the increase in power and reduced noise in the cab
- ◆ Technicians view conversions as an added modification to the basic diesel engine. Like going to an electronically controlled engine
- ◆ Have experienced longer than planned oil change intervals
- ◆ Recognized by State of Texas as clean air leader for 1997
- ◆ Received the 1999 Clean Cities National Partner Award
- ◆ Received 2003 Clean Air Leader award from Houston-Galveston Area Council
- ◆ Public approval for clean air efforts
- ◆ Both drivers and technicians feel comfortable handling the fueling and driving of the tractor

and Cleaner



Serving More Texans Better ^ Every Day

