Converting Diesel Engines to Dual Fuel
The Pros and Cons of Common Gas Engine Types

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Back Ground A Dual Fuel diesel engine (traditionally) is a diesel engine that has been fitted with additional devices allowing it to utilize natural gas as a supplemental fuel. This engine type is a true diesel and requires some level of diesel for operation, for ignition of the gas fuel. This engine type has been available to industry since the 1930's. Its use was almost exclusively for power generation where the fuel supply was a pipeline source. Its availability was almost exclusively through the Original Equipment Manufacturer (OEM). The dual fuel engine type has a number of quality attributes. A primary benefit is that of fuel flexibility, operating with cleaner cheaper natural gas when available and on diesel alone when necessary. Many hundreds of these engines were employed in the US during the rurual electrification period. After grid power became economical many of these engines were discarded. With uncertainties in power availability, emissions and the current price of diesel, dual fuel engines are gaining a new popularity.

Conventional Options A single primary option to the dual fuel engine type is that of spark ignited gas. While this can be a good option and sometimes the best option, this is not always the case. OEM companies making only diesel or spark ignited engines will virtually always explain that for gas a spark ignited engine is the best method. But of course, why would they say anything different, they don't sell dual fuel. Besides its good for sales to replace their diesel engines in the field with new spark gas engines.

What is good about Spark Ignited Engines

- There is no need for diesel fuel storage.
- The engines have only one fuel system to maintain.
- They are purpose built with optimized cam timing and a piston compression ratio that best balances efficiency, emissions and power with a specific fuel.
- Most (all non lean burn) can readily utilize catalytic converters on the exhaust to accomplish quite good emission levels.
- OEM product support. (converting a small diesel engine to spark ignited gas is generally not economically viable)

What is not so good about them

- It is common understanding that spark ignited engines don't have the same power density. It makes sense then that they will have a larger price tag for the equal power (bigger engine for the same rating).
- Spark ignited engines have a different cam timing than diesels so generally they will have higher exhaust gas temperatures. Combined high temperatures with the dry gas fuel causes significantly higher valve seat wear rates.
- Spark systems have come a long way in durability but they are far from maintenance free. Many engines have fairly short plug life and while there are plugs special built to last longer they are expensive. Spark plug life can range from 600 hours to 1500 maybe 2500, longer if conditions are good and special plugs are used. (When visiting a ASME ICE conference in New Orleans I listened to a speaker explain the most current advances to spark plug life. I asked him what the best most durable igniter system was?, he smiled and said, "a diesel injector".)
- Spark ignited engines have limits to fuel content, temperatures and power capacity. Combustion knock is a operational limiting factor that ruins spark plugs. Timing adjustment can help.

What is good about Dual Fuel Engines _ Well first I will say that not all dual fuel systems are created equal. Ourselves here at ECI have systems with different attributes but in general the following will be true.

- Keep your diesel engine, convert it and run with gas
- Fuel flexibility, if gas is interrupted full diesel operation is available instantly while generating power.
- Full original power capacity (in one form or another, it is system dependent).
- Diesel cam timing keeps exhaust cooler and provides better scavenging, contributes to higher power density and longer valve life.
- Higher compression ratio, better efficiency, nearly all dual fuel engines have better efficiency than spark gas.
- Diesel ignition, this is a huge one. You will have very long service intervals with the ignition system (same as normal diesel injector service). Lean burn combustion capacity, far beyond any spark ignition system, contributes to reduced misfire, better efficiency, higher power density, reduced Nox emissions. Diesel pilot fuel provides lubrication to valves and rings, when combined with clean gas,

maintenance service intervals are longer than strait diesel not shorter like spark gas.

- Exhaust emissions, specifically Nitrogen oxides, CO2 and particulates are significantly reduced.
- Fail safe operation, if a problem exists with the gas system full diesel backup is instantly provided.
- No changes should be made to your standard engine warranty (affected by the attitude of local dealer)
- Should be noted that certain aspects of a lean burn spark gas and dual fuel are similar.

What is not good about Dual Fuel? Here again we find differences with different systems.

- Dual fuel engines require diesel for ignition. Run out of diesel and you are not running.
- Higher emissions of CO compared to strait diesel. Similar emissions of CO as spark gas (with out catalytic converter).
- Two fuel systems to maintain. Keep in mind however that diesel fuel ignition is less maintenance than spark systems and that the gas control system is mostly maintenance free.
- Requires the support of additional supplier, not just the OEM. This is why ECI works to secure local distributors to represent their products.
- Engine warranty, if you still have a warranty on your engine, we have seen the attitude of local dealers and distributors who immediately assume that this will void your warranty. This is simply not the case and in the United States there is a law that requires OEM's to maintain their warranty in the presents of aftermarket accessories (stated below). So what is not so good? Just overcoming people with wrong understanding!
- Less oil contaminates leads to longer lasting engine, possibly by a factor of two. Why is this not good? Well this is sort of a little joke but if you are a engine dealer not selling rebuild parts its not funny. You will not sell major engine parts like you would for standard diesel engines.

The Magnuson-Moss Warranty Act (15 U.S.C 2302 (C))

The federal law regulates warranties for the protection of consumers. The essence of the law concerning aftermarket parts is that a manufacturer may not condition a written or implied warranty on the consumers using parts or services which are identified by brand, trade, or corporate name (such as the manufacturer brand) unless the parts or service are provided free of charge. The law means that the use of an aftermarket part alone is not cause for denying the warranty. However, the law's protection does not extend to aftermarket parts in situations where such parts actually caused the damage being claimed under the warranty.