ADVANTAGES AND DISADVANTAGES VERSUS SPARK-IGNITION ENGINES

Diesel engines are often perceived to be much more efficient than gasoline/petrol engines of the same power, resulting in lower fuel consumption than gasoline engines. A common margin is 40% more miles per gallon for an efficient turbodiesel over a gasoline engine. However, most of this "improvement" is because the diesel fuel itself has more energy per gallon than gasoline, not because of significantly greater efficiencies of the diesel cycle. The diesel cycle and the higher compression ratio is indeed helpful in raising efficiency, but diesel fuel [[4]] contains approximately 30% more energy per unit volume than gasoline [[5]], and this is the crucial factor in creating the impression of significantly greater efficiency of diesels.

Naturally aspirated diesel engines are more massive than gasoline/petrol engines of the same power for two reasons; the first is that it takes a larger capacity diesel engine than a gasoline engine to produce the same power. This is essentially because the diesel cannot operate as quickly - the "rev limit" is lower - because getting the fuel-air mixture into a diesel engine is more difficult than a gasoline engine [6]. The second reason is that a diesel engine must be stronger to withstand the higher combustion pressures needed for ignition.

Yet it is this same build quality that has allowed some enthusiasts to acquire significant power increases withturbocharged engines through fairly simple and inexpensive modifications. A gasoline engine of similar size cannot put out a comparable power increase without extensive alterations because the stock components would not be able to withstand the higher stresses placed upon them. Since a diesel engine is already built to withstand higher levels of stress, it makes an ideal candidate for performance tuning with little expense. However it should be said that any modification that raises the amount of fuel and air put through a diesel engine will increase its operating temperature which will reduce its life and service interval requirements. These things are issues with newer, lighter, "high performance" diesel engines which aren't "overbuilt" to the degree of older engines and are being pushed to provide greater power in smaller engines.

The addition of a turbocharger or supercharger to the engine (see turbodiesel) greatly assists in increasingfuel economy and power output. Boost pressures can be higher on diesels than gasoline engines, and the higher compression ratio allows a diesel engine to be more efficient than a comparable spark ignition engine. Although the calorific value [[7]] of the fuel is slightly lower at 45.3 megajoules [[8]] per kilogram to gasoline at 45.8 MJ/kg, diesel fuel is much heavier and fuel is sold by volume, so diesel contains more energy per litre or gallon.

The recent development of biofuel [[9]] alternatives to fossil fuels has unleashed the ability to produce a net-sum of zero emissions of CO2, as it is re-absorbed into plants and then comes full circle, being used to produce the fuel.

Diesel engines produce very little carbon monoxide as they burn the fuel in excess air except when under full load, at which point a full stochiometric [[10]] quantity of fuel is injected per cycle. However, they can produce black soot from their exhaust, consisting of unburned carbon compounds. This is often caused by worn injectors, which do not atomize the fuel sufficiently, or a faulty engine management system which allows more fuel to be injected than can be burned with the available air. Particles of the size normally called PM10 (particles of 10 micrometres or smaller) have been implicated in health problems, especially in cities. Modern diesel engines catch the soot in a particle filter, which when saturated is automatically regenerated by burning the particles. Other problems associated with the exhaust gases (nitrogen oxide, sulfurous fumes) can be mitigated with further investment and equipment; some diesel cars now have catalytic converters in the exhaust.

The lack of an electrical ignition [[11]] system greatly improves the reliability. The high durability of a diesel engine is also due to its overbuilt nature (see above) as well as the diesel's combustion cycle, which creates less-violent changes in pressure when compared to a spark-ignition engine, a benefit that is magnified by the lower rotating speeds in diesels. Diesel fuel is a better lubricant than gasoline so is less harmful to the oil film on piston rings and cylinder bores; it is routine for diesel engines to cover 250,000 miles or more without a rebuild.

Unfortunately, due to the greater compression force required and the increased weight of the stronger components, starting a diesel engine is a harder task. More torque is required to push the engine through compression.

Either an electrical starter or an air start system is used to start the engine turning. On large engines, pre-lubrication and slow turning of an engine, as well as heating, are required to minimize the possibility of damaging the engine during initial start-up and running. Some smaller military diesels can be started with an explosive cartridge that provides the extra power required to get the machine turning. In the past, Caterpillar and John Deere used a small gasoline "pony" motor in their tractors to start the primary diesel motor. The pony motor heated the diesel to aid in ignition and utilized a small clutch and transmission to actually spin up the diesel engine. Even more unusual was an International Harvester design in which the diesel motor had its own carburetor and ignition system, and started on gasoline. Once warmed up, the operator moved two

levers to switch the motor to diesel operation, and work could begin. These engines had very complex cylinder heads (with their own gasoline combustion chambers) and in general were vulnerable to expensive damage if special care was not taken (especially in letting the engine cool before turning it off).

Aircraft, Airship, Hovercraft and Light Engine

Based on the opposed piston two stroke principle used by Junkers, Rolls-Royce, Napier and Coventry Climax, a recent addition to the diesel family of engines is from the Dair.co.uk. This is designed to be light weight, affordable and powerful the horizontally opposed aircraft engine replacement. The advent of a liquid cooled 100hp twin cylinder, four piston twin stroke diesel by Diesel Air Limited in the United Kingdom is sure to send waves through the light engine community. Called a "Dair-100" this revolutionary powerplant is new to the market and is designed to run on both diesel and A1 jet fuel.

One company now is producing the powerplant for use. Successful test flights and use in the The Airship Technologies AT-10 airship first flew with DAIR-100 engines on 28th March 2002. With a displacement of 1810 cc the Dair is the first of a number of aluminium diesel aircraft engines up to 600 horsepower (450 kW) that have a comparable power to weight ratio comparable with modern petrol engines.

Automobile racing

Although the weight and lower output of a diesel engine tend to keep them away from automotive racing applications, there are many diesels being raced in classes that call for them, mainly in truck racing, as well in types of racing where these drawbacks are less severe, such as land speed record racing. Diesel engined dragsters even exist, despite the diesel's drawbacks being central to performance in this sport. In 1952,Cummins Diesel won the pole at the Indianapolis 500 race with a supercharged 3 liter diesel car, relying on torque and fuel efficiency to overcome weight and low peak power, and led most of the race until the badly situated air intake of the car swallowed enough debris from the track to disable the car.

Recently, there had been a renewed interest in racing with diesel engine and the VAG is one of the best example. Their DAKAR rally entrants for 2005 and 2006 are powered by their own line of TDI engines. Meanwhile, the five time Le Mans winner Audi R8 race car was replaced by the R10 in Le Mans 2006 and 2007, which is powered by a 650 hp (485 kW) and 1100 N•m (810 lbf•ft) V12 TDI Common Rail diesel engine. That car won the race in both years, the first such accomplishment for a diesel car.

Source : http://engineering.wikia.com/wiki/Diesel_engine