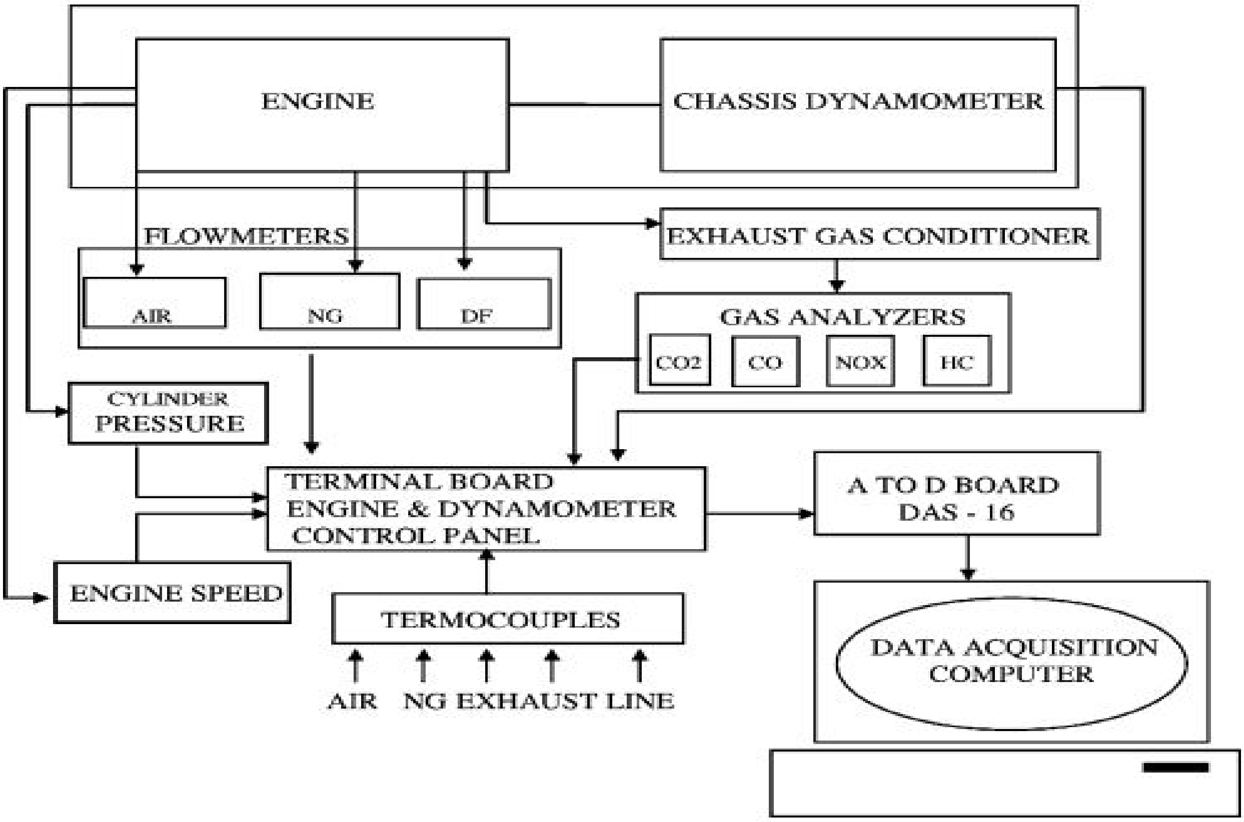
DUAL FUEL ENGINE PERFORMANCE TEST

The engine used in this study is a naturally aspirated, V-8 Deutz FL8 413F four cycle diesel engine.



Experimental Setup

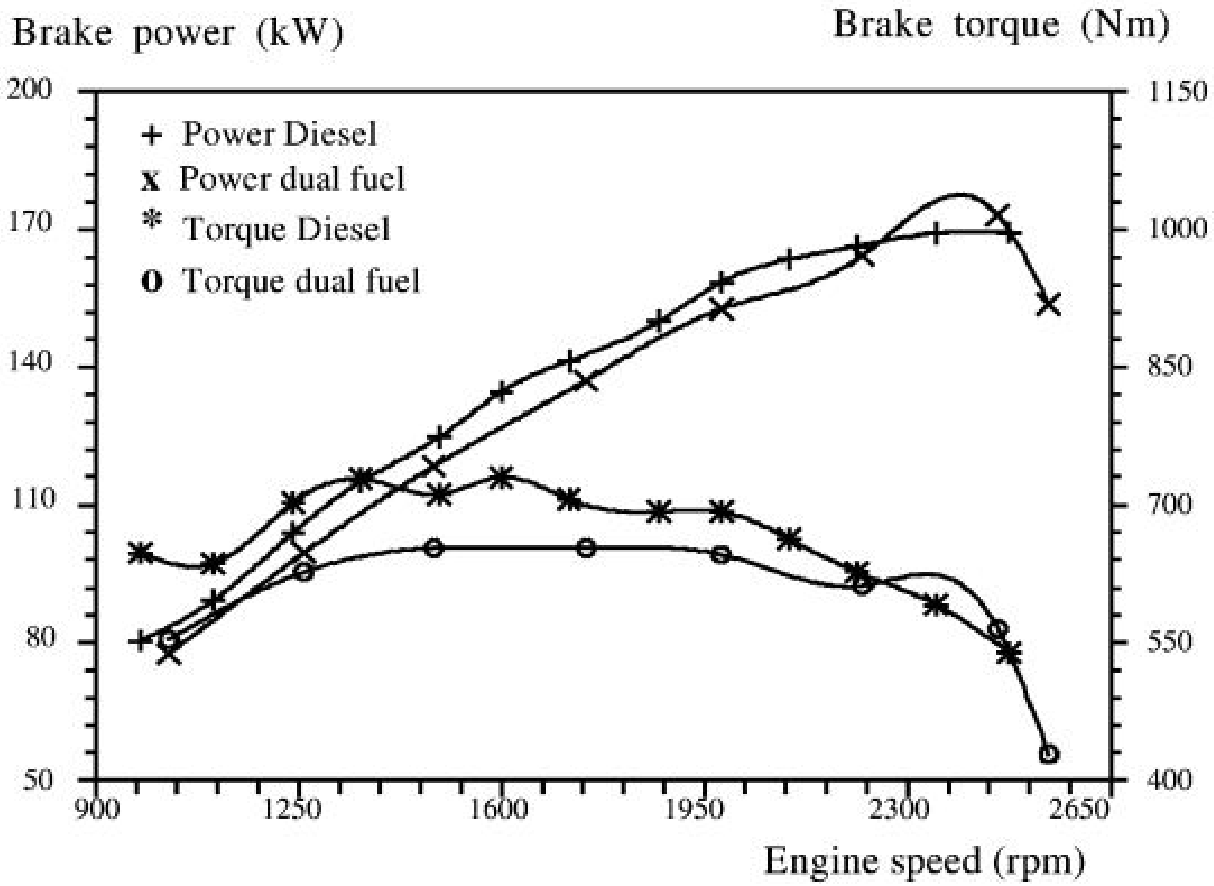
The dual-fuel mode uses compressed natural gas (CNG) as the primary fuel and small quantities of diesel pilot-fuel for ignition. The Engine is equipped with a dual-fuel (combined use of diesel and CNG) DELTEC con-version kit. The kit allowed for engine operation on either 100 % diesel fuel or in a dual-fuel mode. In either case, the engine started and idled on diesel mode. Thus, engine starting and idling characteristics were identical to unmodified engine. In the dual-fuel mode, natural gas is introduced into the intake system, triggered by engine speed. Timing and duration of the pilot injection is performed by an electronically controlled hydraulic DELTEC system. The ratio of diesel pilot to natural gas is controlled by a metering valve, with diesel ratio (ratio of calorific value of diesel fuel to total calorific of fuels entering the combustion chamber) is kept approximately constant over the entire load range with a fixed metering valve position and CNG pressure. The natural gas was introduced into the intake air stream. Gas flow is measured by a fine wire anemometer and controlled using a manual, variable area and fine control needle valve. Engine intake air was filtered and measured with a laminar flow-meter. Diesel fuel flow rate is measured by two volumetric flow-meters, connected to the inlet manifold of the injection pump and to the outlet manifold. The flow-meters are connected by two photodiode cells to a data acquisition system.

The NUOVO-PIGNONE LPS 2000 chassis dynamo-meter engine test (figure 1) was equipped with a digital readout of engine speed, torque and power. A strain gage amplifier was placed in parallel to the dynamometer strain gage and a frequency-to-voltage convector was placed in series with the magnetic pick-up of the engine speed on the dynamometer. These modifications allowed engine speed and torque to appear on the dynamometer digital readout and to be simultaneously recorded by the computer data acquisition system. Therefore, two types of tests were performed in each measuring session, where the emission and performance levels were measured on a chassis dynamometer under steady and unsteady conditions. The compression ratio has been kept unchanged for the two versions engine test.

The evaluation of the specific consumption was based on the experimental results of the brake power and the consumption results under steady conditions. It was taken to be equal to brake power divided by the total injected volume (pilot diesel +natural gas volume in equivalent energetic).

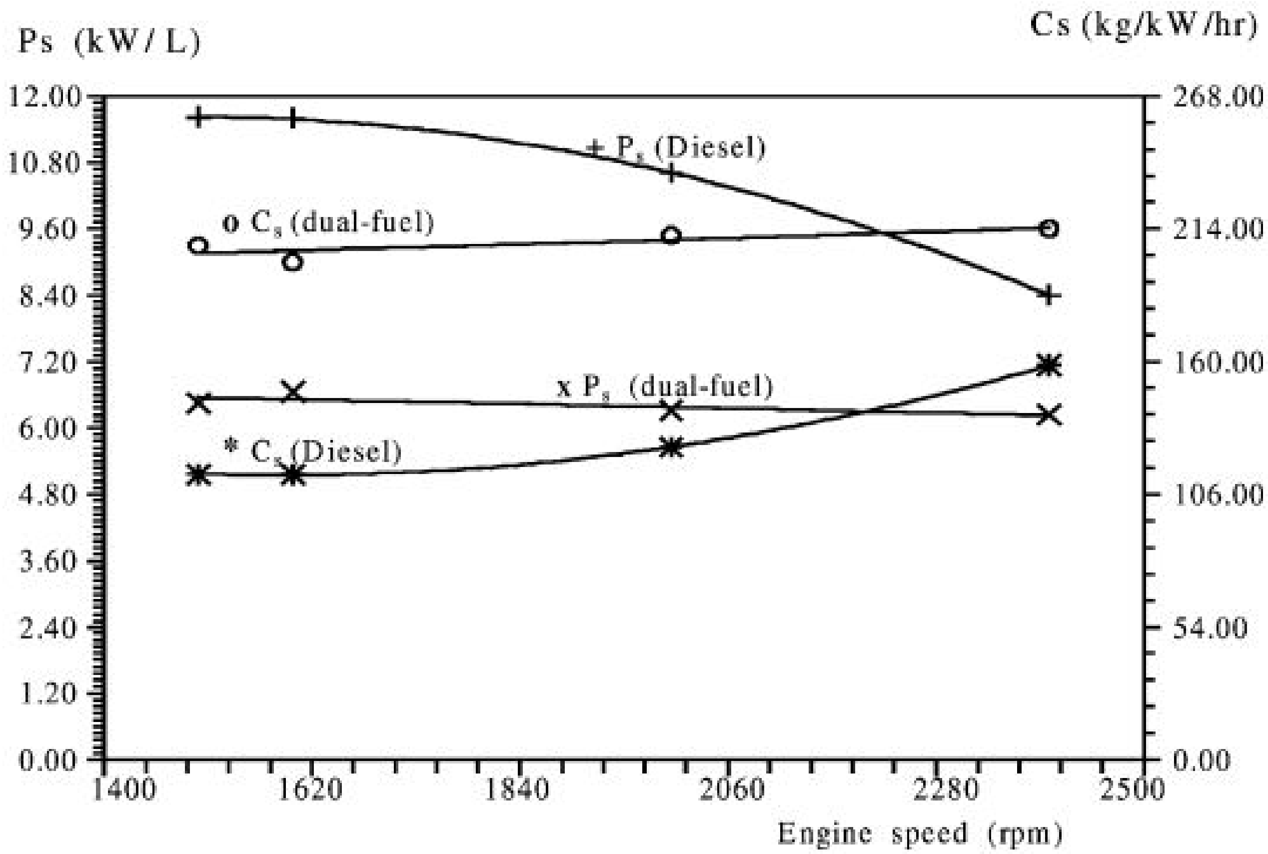
Secondly, as load is decreased, the engine is less efficient using natural gas hence more natural gas must be added to produce the fixed load-speed condition. The increased fuelling then increases the equivalence ratio of the engine. The cylinder gas pressure was measured using a piezo-electric transducer inserted into water cooled adapter and mounted in the main combustion chamber. It is connected to a digital acquisition system (DAS 1401). An incremental shaft encoder was coupled to the engine crank-shaft to trigger the pressure data collection at one-half crank angle increments.

RESULTS



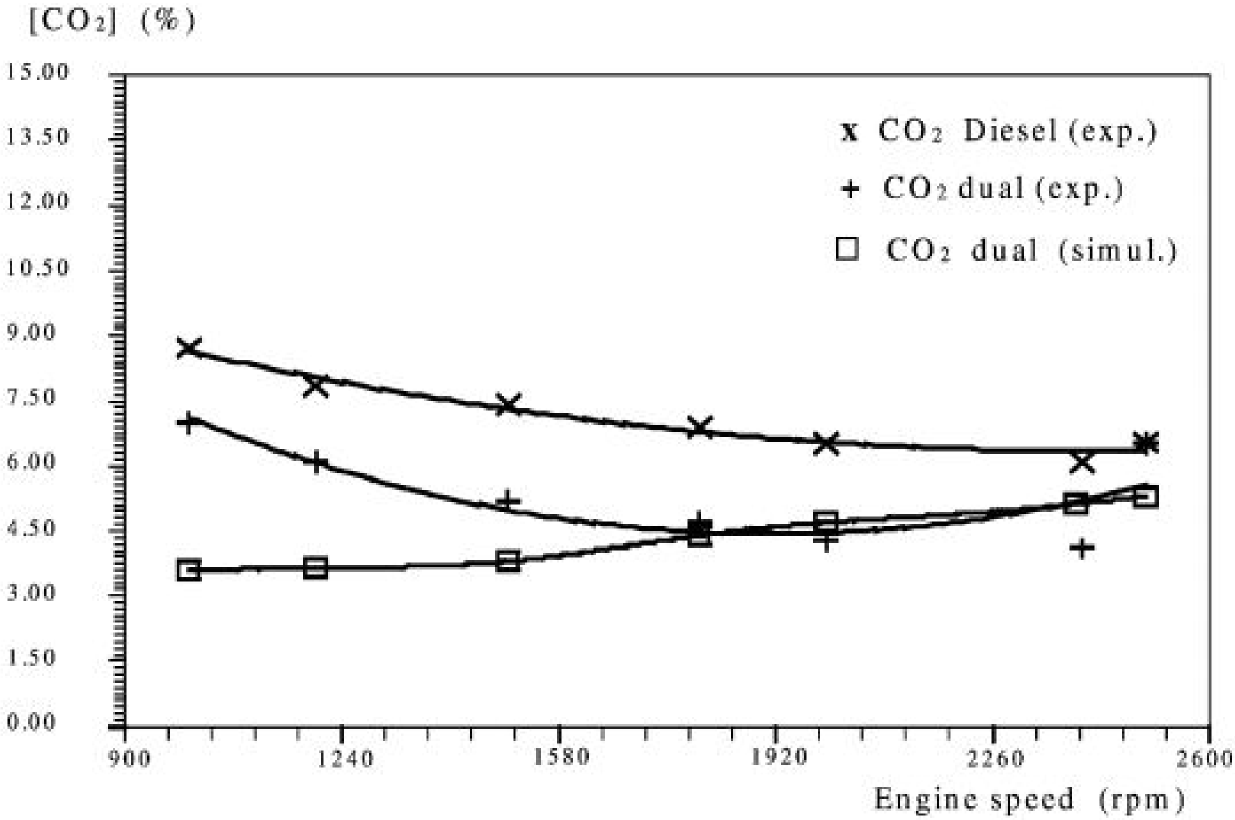
❖The power developed is slightly lower than that of diesel, but gives higher power than diesel at 2500 rpm.

❖The same characteristic can be seen in the case of torque also.



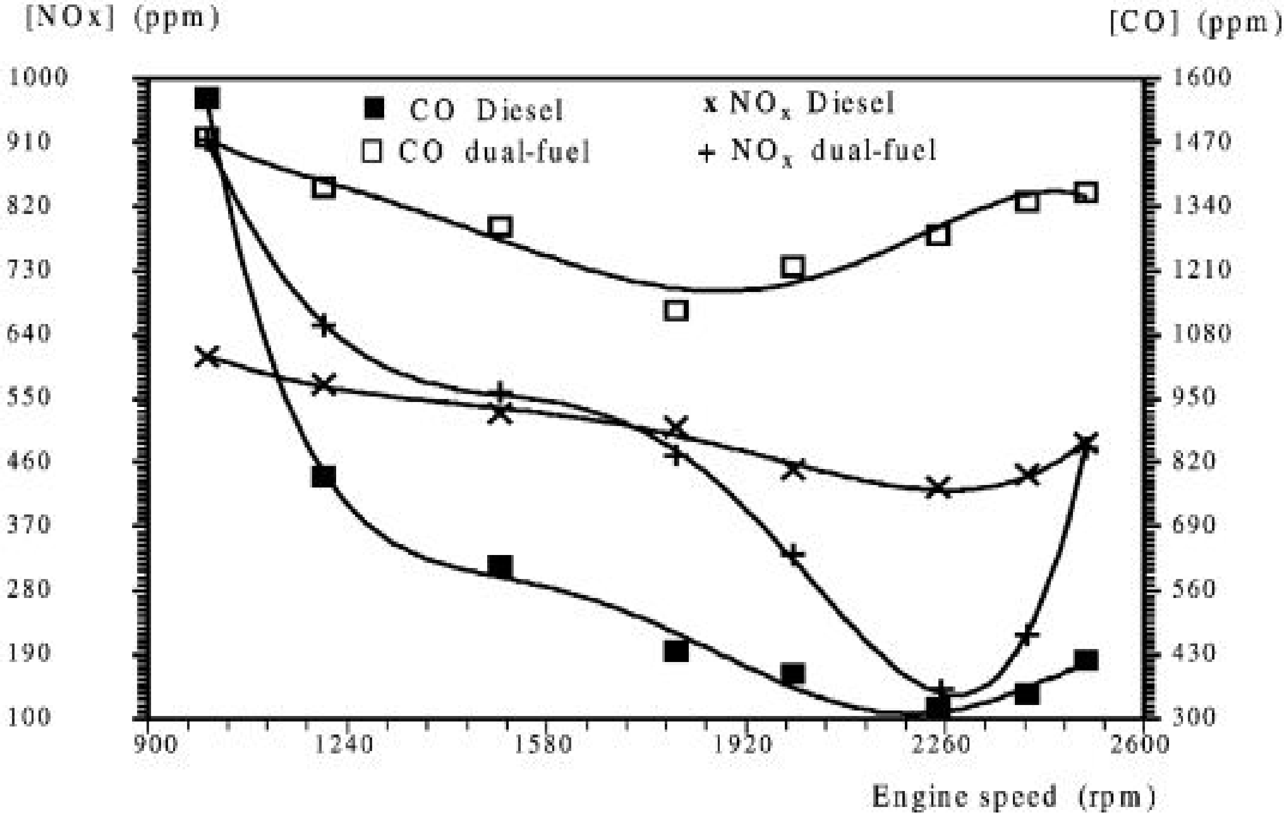
❖ Fuel consumption is high for the Dual fuel engine than the normal diesel engine.

❖ This may be due to the less calorific value of the gas than the diesel.



❖CO_2 emission is high for the diesel.

❖This may be due to the high carbon content of the diesel fuel.



❖CO and NO_x emission is high for the Dual fuel engine.

❖This may be due to the high nitrogen content in the fuel and lack of proper combustion