3. Fischer-Tropsch Diesel

3.1 Introduction

Fischer-Tropsch diesel (FTD) is a synthetic fuel produced from the conversion of natural gas into a diesel fuel. The fuel thus formed is superior to crude-oil based diesel in certain ways, principally the high cetane number and the zero sulfur content. It is also known as GTL diesel, where the acronym refers to “gas to liquid” conversion. Gas to liquid fuels conversion is of relevance to Australia, because of the large natural gas deposits in the north-west shelf.

This study is required to use Australian data where available. At the time of writing SASOL-Chevron was not in a position to submit emissions data that would be applicable to its production of FTD and the use of FTD in Australia. It is recommended that a separate study be undertaken when that data becomes available

3.2 Results

3.2.1 Greenhouse gas emissions

Figure 3.1 depicts the greenhouse gas emissions estimated for diesel fuels. These are shown as emissions on an energy basis, as emissions on a per tonne-km basis for trucks, and on a per passenger-km basis for buses. We have used data from Apelbaum Consulting Group (1997) for the passenger task and the freight task in Australia and taken the mean energy intensity for the Australian freight task to be 1.2 MJ/tonne-km (Apelbaum Consulting Group, 1997: p.118), and the energy intensity of buses to be 1.06 MJ/passenger-km (Apelbaum Consulting Group, 1997: p.116).

The extra processing required to make synthetic diesel means that the exbodied emissions of greenhouse gases are greater from FTD than from LSD, even though there are lower tailpipe emissions.

3.2.2 Particulate matter emissions

Figure 3.2 depicts the particulate matter (PM10) emissions estimated for diesel fuels. These are shown as emissions on an energy basis, as emissions on a per tonne-km basis for trucks, and on a per passenger-km basis for buses using the same energy intensities previously noted. Particulate emissions of FTD are markedly lower than those of LSD.

3.2.3 Emissions of oxides of nitrogen

Figure 3.3 depicts the oxides of nitrogen (NOx) emissions estimated for diesel fuels. These are shown as emissions on an energy basis, as emissions on a per tonne-km basis for trucks, and on a per passenger-km basis for buses using the same energy intensities previously noted.

The upstream processing required to produce FTD means that its NOx emissions are greater than those of LSD, even though the tailpipe emissions are lower.

3.2.4 Emissions of hydrocarbons

Figure 3.4 depicts the emissions of non-methanic hydrocarbon (HC) estimated for diesel fuels. These are shown as emissions on an energy basis, as emissions on a per tonne-km basis for trucks, and on a per passenger-km basis for buses using the same energy intensities previously noted.

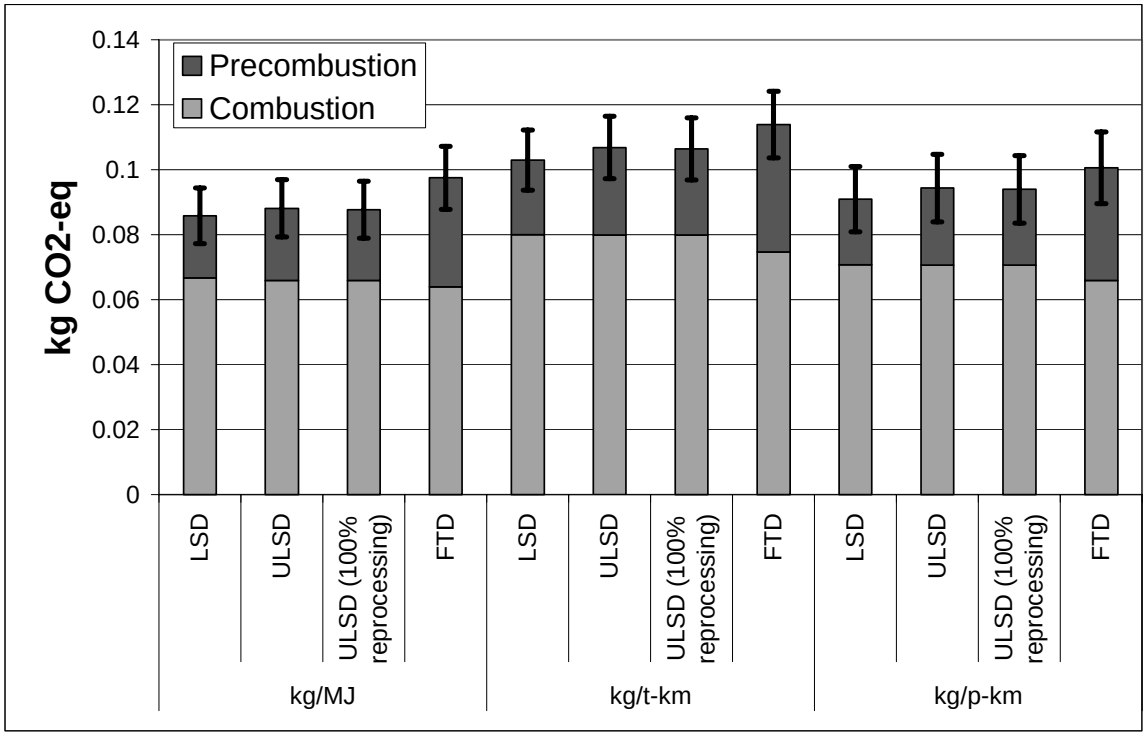

Figure 3.1
Exbodied emissions of greenhouse gases for diesel fuels, low sulfur diesel (LSD), ultra low sulfur diesel (ULSD) and Fischer-Tropsch diesel (FTD) per unit energy and per unit distance.

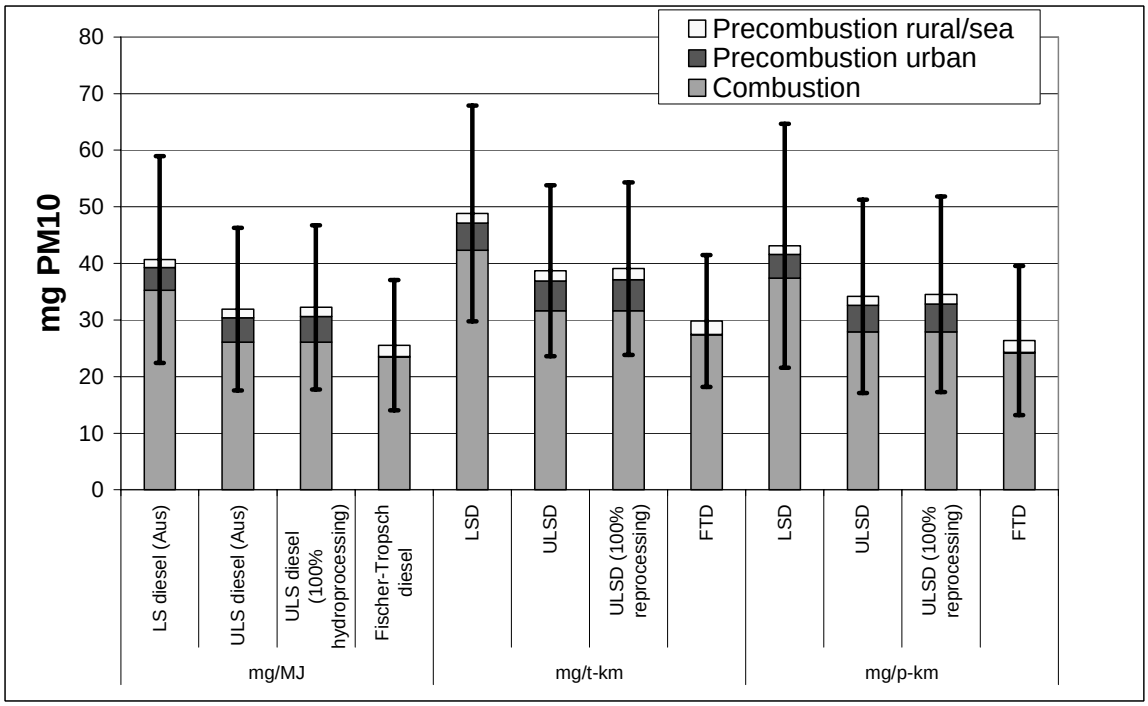

Figure 3.2
Exbodied emissions of particulate matter for diesel fuels, low sulfur diesel (LSD), ultra low sulfur diesel (ULSD) and Fischer-Tropsch diesel (FTD) per unit energy and per unit distance.

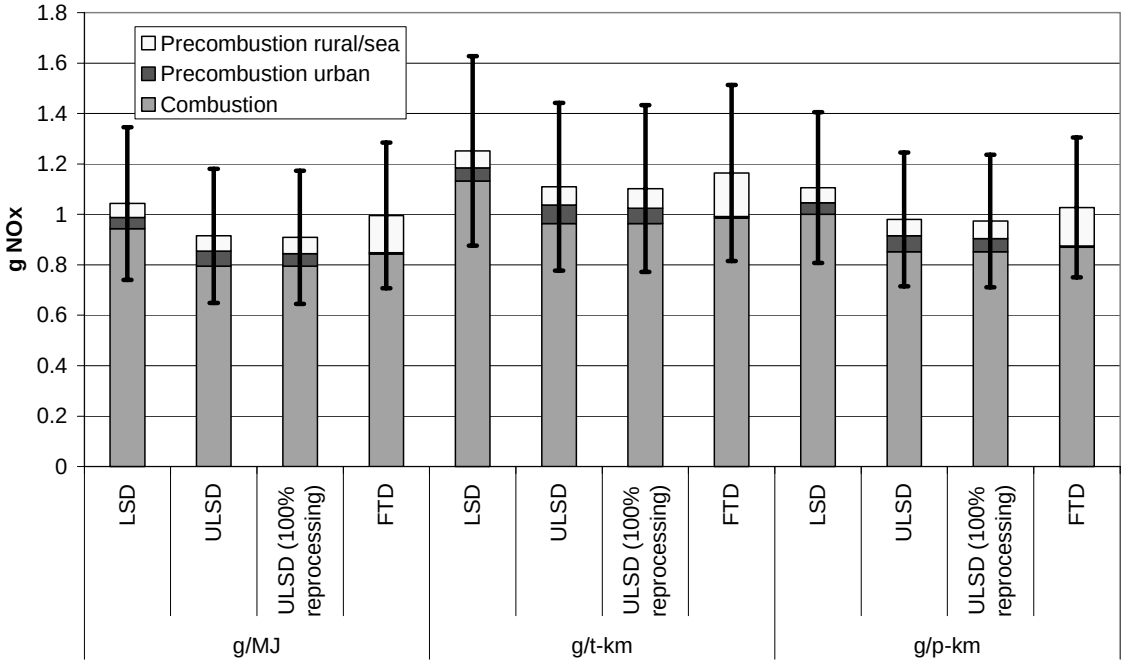

Figure 3.3
Exbodied emissions of oxides of nitrogen for diesel fuels, low sulfur diesel (LSD), ultra low sulfur diesel (ULSD) and Fischer-Tropsch diesel (FTD) per unit energy and per unit distance.

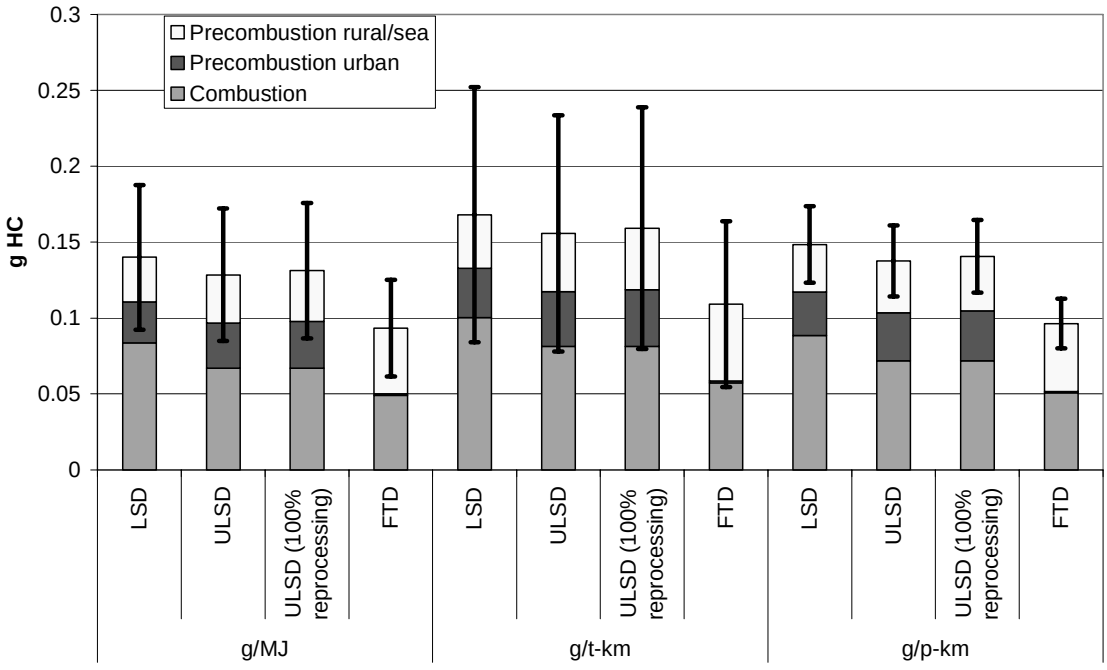

Figure 3.4
Exbodied emissions of hydrocarbons for diesel fuels, low sulfur diesel (LSD), ultra low sulfur diesel (ULSD) and Fischer-Tropsch diesel (FTD) per unit energy and per unit distance.

3.3 Viability and Functionality

FT diesel has the same viability and functionality as diesel fuel.

3.4 Health Issues

FT diesel is an extremely low sulfur diesel, with sulfur content less than 10ppm. The health benefits, when compared to the low sulfur diesel reference fuel will be at least those of ultra low sulfur diesel (ULS). There are claims that there are 20% reductions in aromatics from the tailpipes of vehicles using such extremely low sulfur diesel fuels.

FT diesel upstream emissions of both particulates and HC are substantially less than for LSD. FT diesel tailpipe emissions of both particulates and HC are marginally less than for LSD.

3.5 Environmental Impact and Benefits

Greene (1999) comprehensively reviews the environmental issues involved with GTL fuels. The environmental impacts are the same as those for diesel fuel, with the benefit of lower air pollutant emissions and increased resource security through a lowered dependence on imported oil. An FTD plant does not produce undesirable co-products, unlike a refinery, which produces heavy fuel oil and coke.

ESD issues

Gas to liquids conversion is based on the use of natural gas, which is a fossil fuel. The current concern over climate change highlights the burning of fossil fuels as one of the main causes. Examined from the ESD perspective of equity, efficiency and ecological integrity, even if one argues that the fossil fuel economy is economically efficient, it is more difficult to argue that it encourages equity or ecological integrity. Climate change and global warming pose threats to inter-generational equity.

Sustainability

FTD is made from natural gas. Australian known reserves of natural gas are estimated to last for the next 90 years, ensuring a sustainable, indigenous supply of natural gas as the feedstock for the FTD.

Groundwater contamination

FT diesel does not require the transport of crude oil. Environmental damage from any liquid hydrocarbon can occur, especially from leaks at refuelling depots that may contaminate groundwater supplies.

3.6 ADR Compliance

Ultra low sulfur fuel is being introduced specifically to enable Euro4 fuel specifications to be met. The ADR have been based on this fuel. There should thus be no potential for an even lower sulfur fuel such as FT diesel to compromise vehicles' compliance with gazetted ADR standards.

3.7 Summary

The advantages of FT diesel are:

- FT diesel contains virtually no sulfur or aromatics. In a properly tuned engine this is expected to lead to lower particle exhaust emissions.
- The absence of sulfur means that oxidation catalysts and particulate traps will operate at maximum efficiency.
- The existing diesel infrastructure can be used, unchanged, for Fischer-Tropsch Diesel.
- FT diesel can be used in existing diesel engines.

- Diesel is one of the safest of the automotive fuels.
- An FT plant does not produce any of the less desirable co-products from a refinery, such as heavy fuel oil or coke.
- Provided an FT plant uses an oxygen feed, it produces a pure CO_2 stream that provides an option for the collection and sequestration of CO_2.

The disadvantages of FT diesel are:

- Diesel exhaust (including FT diesel exhaust) is treated by the US EPA as an air toxic.
- Because of the extra processing energy, FT diesel produces more exbodied greenhouse gases than any of the conventional or alternative fuels studied in this report.

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