

Case Study:

Biodiesel - Adelaide Metro Buses



Since 2005, Adelaide Metro has used biodiesel blends in its diesel bus fleet.

The desire to reduce greenhouse gas emissions and diesel fuel consumption while maintaining an efficient public transport system initiated a study of the environmental and economic benefits of biodiesel.

In 2002, a six month trial of a bus using a 20% biodiesel blend (B20), travelling over 25,000km, found the vehicle's performance comparable to that on 100% petroleum diesel. Exhaust emission tests found reductions of more than 50% in particulates, 75% in carbon monoxide, 14% in methane and 1% in carbon dioxide.

In February 2005, following further successful testing, the Minister for Transport announced that all Adelaide Metro diesel buses would operate on 5% biodiesel (B5) and move progressively to B20.

What influenced Adelaide Metro's decision to use biodiesel?

The use of B5 was estimated to replace approximately four million litres of 100% petroleum diesel annually (also including the train network), resulting in a net reduction of

10,000 tonnes of carbon dioxide (CO₂) – or emissions from 700 households per annum.

Australian Fuel Quality Standards requirements for B5 to meet conventional automotive diesel fuel standards meant that no special service requirements or engine manufacturer approvals were necessary.



B20, for all but the oldest vehicles in the fleet, was the recommended limit set by the engine manufacturers for protection of components and consequently warranties.

Further information:

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As it reduced greenhouse gas emissions relative to B5, Adelaide Metro supported the shift to B20.

Initially all diesel buses operated on B5. A contracted service provider representing two thirds of the diesel fleet has progressively moved to B20.

The remaining diesel fleet continues to operate on B5 due to contractor preference and agreements with fuel suppliers, however Adelaide Metro now gives preference to the use of B20 in its tender documentation for future operator bids.

Vehicle Service and Maintenance

Where the quality of the fuel is assured, no additional maintenance requirements were identified. Poor quality fuel did lead to fuel pump issues and fuel filters were required to be changed where reductions in engine power were observed.

As such, fuel filters required monitoring for an initial period after converting to biodiesel to determine the need for early replacement. After this time, manufacturers' prescribed maintenance intervals were sufficient for biodiesel.

Rubber fuel components (hoses, seals, gaskets) did not need to be replaced before converting buses to B20, as any resultant leakage was going to be slow to develop, and would normally be identified during routine maintenance checks.

Newer vehicles were usually already compatible; a number of older vehicles may have had non-compatible components replaced during their lifetime.

Biodiesel qualities

Due to the hydrophilic (water loving) nature of biodiesel, B20 fuel storage requires more

frequent monitoring for quality as it deteriorates more rapidly than does B5 or automotive diesel fuel.

Fuel quality (*viscosity, water <0.050% no visible sediment or suspended matter, bacteria, density, filter blocking tendency, flashpoint, mould count, glycerine, oxidation stability and cold filter plugging*) is the most critical factor in successfully using biodiesel.

The only failures that occurred during the initial trials were attributed to poor-quality fuel.

Adelaide Metro has found that the level of fuel consumption depends on the feedstock source of the fuel. Fuel consumption is higher on vegetable oil-based biodiesel than tallow-based biodiesel, due to its lower energy content.



However, biodiesel contains a mixture of feedstock and variations in fuel consumption fall within the tolerance of other factors, for example, use of air conditioning, driver habits or idle times.

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Adelaide Metro is conscious of procuring sustainably produced alternative fuels which do not contribute to land clearing or degradation.

Success?

There was no noticeable difference in the bus fleets' fuel consumption or cost by shifting to B5 and B20, indicating that biodiesel blends are competitive with automotive diesel and can bring about cost-effective environmental gains.

Testing demonstrated B20 has lower greenhouse gas, carbon monoxide, and particulate matter tailpipe emissions compared to automotive diesel, however it has slightly higher NOx levels in comparison.

In South Australia, most biodiesel is sourced from waste animal fats and is therefore an excellent substitute to automotive diesel sourced from oil.

There have been no occupational health, safety and welfare issues arising from the use of biodiesel fuels in buses.

The ability to revert to petroleum diesel without any modifications when supplies of biodiesel are low is valuable.

Adelaide Metro's initial trials concluded that the use of B20 in public transport diesel buses did not, and should not cause any future issues or concerns, as long as the quality of the fuel is to standard. This remains the case.

Under current engineering specifications of Adelaide Metro buses, blends greater than B20 may cause operational difficulties and won't be actively pursued until manufacturers release vehicle models designed for operating on higher ratios of biodiesel.

Next Steps

Adelaide Metro is currently trialling a series-configuration diesel-electric hybrid bus. This is also running on B20.

The benefits of the hybrid system are lower fuel consumption, emissions and noise. The trial will measure these benefits on a city loop route, where the short distances and frequent stopping are most suitable for the hybrid's regenerative braking system.

A second hybrid with a parallel-configuration will arrive in late 2013, allowing for comparison, and the trials will include monitoring the performance of both buses on a mix of trip types.

7836025 (4/9/13)

See Also:

- [Transport Fuels: Biodiesel – \(B5, B20 and B100\)](#)
- [Case Study: Ecodriving](#)
- [Case Study: Alternative Fuels](#)
- [Case Study: Fleet Efficiency](#)
- [Case Study: Electric and Hybrid Vehicles](#)

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