Each issue, QTLC is bringing you a deep dive into a promising decarbonisation pathway for low-emission freight. In this issue, we take a look at Renewable Diesel (RD).

Introducing: Renewable Diesel

Hydrogen and batteries may be soaking up a lot of industry attention at the moment, but there is one alternative energy source with untapped promise: Renewable Diesel. The name might first appear contradictory but RD has been decades in the making, leveraging advances in science and refining technology that are radically reshaping the global biofuel industry.

Biofuels 1.01

Biofuels are produced using biomass as a substitute for fossil fuels. Biomass feedstocks come from a range of organic sources including palm oil, soya, corn or other agricultural crops. 'Next generation' biofuels are also derived from used cooking oil, waste animal fats (or 'tallow'), fast-growing algae, sugar cane byproducts, forestry residues and even municipal rubbish. Broadly speaking, this biomass is chemically transformed into a type of hydrocarbon that can then be mixed into the existing fuel supply chain.

Irrespective of the feedstock, biofuels hold one major advantage over fossil fuels: they *can* be a net zero energy source over their full lifecycle. Whereas the stored carbon in fossil fuels is drilled, refined, combusted and then released into the atmosphere in a one-way process, biofuel production reabsorbs carbon from the atmosphere in a cyclic process. In effect, growing the biomass can remove much of the carbon released when biofuels are burned.

The RD Step Change

Biofuels are often called 'drop in' fuels: they work within the existing energy system instead of replacing it. For example, biodiesel and ethanol can already be blended at low levels into diesel and petrol (2% and 5% respectively) under existing fuel quality standards, without additional labelling. Higher blends are also available from some fuel suppliers, and most diesel engines can handle up to 20% biodiesel (i.e. B20). Higher concentrations require some engine and fuel system modifications, so only some OEMs uphold warranty on engines using higher blend ratios, making uptake beyond B20 more difficult.

Here, Renewable Diesel is rewriting the biofuel rulebook. Despite using many of the same feedstocks as biodiesel, RD is refined to be not just blend-able with conventional diesel but chemically identical to it. Specific refining methods vary (for the full chemistry lesson, see here) but this technical breakthrough means that not only can RD *reduce* diesel consumption, it can actually *replace* it.

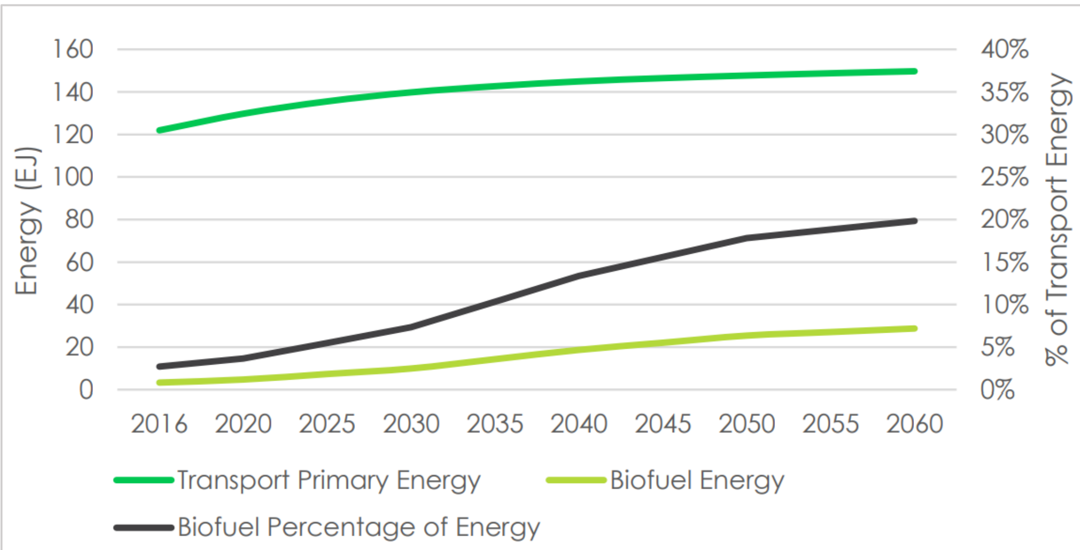
The fact it can be used in all trucks and is not dependent on new truck sales means RD's potential benefit is significant; in theory, any fleet running diesel vehicles can go out tomorrow, purchase commercial quantities of RD and start operating at net zero emissions immediately. One study found that blending just 2% of RD into Australia's heavy vehicle fuel mix would be equivalent to removing 29,000 rigid trucks from the road. For ease of adoption and operational compatibility, RD may well be the lowest resistance pathway for reducing freight emissions.

Sound too good to be true?

Going Green, Spending Green

Switching to RD comes at a cost – a big cost. Anecdotally, one litre of HVO renewable diesel can retail anywhere between AU$3-4 which would effectively double the typical fleet's fuel bill. Economies of scale in RD production may moderate these costs in future but are unlikely to reach parity with fossil diesel any time soon. Biodiesel's experience appears to bear this out; despite decades of production investment, biodiesel remains almost a dollar more expensive than conventional diesel and actually rose by up to 160% in 2022.

The cost premium is partly due to Australia's undeveloped RD market. Domestic production of renewable diesel is effectively nil, with almost all broader biofuel production facilities closing or ramping down since their 2014 peak. Biofuels – of any type – constitute less than 0.1% of Australia's diesel mix while globally they accounted for just 170 gigalitres in 2022, roughly 3.5% of total transport energy demand.

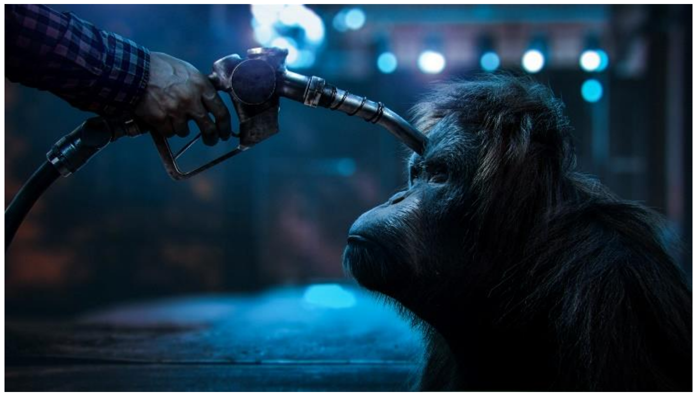


OPEC & IEA projections, CEFC & ARENA, 2019

The Biofuel Backlash

Like all biofuels, RD is only as sustainable as the feedstock it is produced from. Here, the food-vs-fuel debate has damaged the viability and reputation of many crop-based feedstocks (e.g. soy, corn, canola). The challenge for the world's agricultural zones to simultaneously support global food supply and an increasing demand for biofuel feedstocks will remain an intractable problem.

Even more damaging has been the sustainability backlash against feedstocks that do more environmental damage than good. Land use change is a significant driver of climate change with some studies finding that demand for raw biofuel inputs are driving unsustainable farming practices or outright deforestation (e.g. cutting down rainforest for palm oil plantations). Where such land use changes result in a net *increase* in carbon emissions, the sustainability benefits of using the resultant biofuels are largely null and void.



'Not in my tank', T&E, 2023

Global Cause, Domestic Effect

Global developments in the biofuels market present both opportunities and challenges. For example, RD is booming in the USA. Driven by generous government incentives and regulations (particularly in California), RD uptake has surged by 285% to roughly 927 million gallons (2021), accounting for all growth in US biomass-based diesel over the preceding 5 years. The EU is also prioritising biofuels (like RD) in its Renewable Energy Directive. By 2030, renewable fuels must make up 14% of transport energy in European member states and a further proposal would see a specific 5.5% target introduced for 'advanced biofuels'.

Furthermore, renewable diesel will not be the only sector clamouring for sustainable biomass. Hard-to-abate sectors in industry and transport have few immediate alternatives for cutting sectoral emissions. For example, Sustainable Aviation Fuel (SAF) requires similar feedstocks to RD (albeit refined to a different standard) and 'Jet Zero' commitments abroad and in Australia could squeeze out RD volume for road freight. In July, the International Maritime Organization committed to 5-10% uptake of 'zero or near-zero' fuels in global shipping by 2030.

With no binding local commitments, there is limited incentive for RD producers to set up in Australia or for global suppliers to redirect volume here. Ironically, as a major producer of biofuel feedstocks (canola, tallow, agricultural residues) Australia is already exporting the ingredients for RD even while a local production industry struggles to gain a foothold. One estimate suggests Australia would need a 40-fold increase in domestic production just to keep pace with global projections.

Despite the challenges, there is still local demand building outside the transport sector. For example, Australian crane operator Marr Contracting is pressing ahead with renewable diesel despite the costs, partnering with Lendlease to import commercial quantities of RD for use on landmark construction sites. In comments that may resonate with many freight operators, Marr's has "looked at the alternatives and believe this is the most sustainable fuel source currently available for the work that we are doing."

The Path Ahead

On paper, RD *should* be the ideal 'drop in' transition solution to reduce emissions from freight. It has lower adaptation costs than battery electric vehicles, none of their operational constraints (weight penalty, driving range) and more proven fuel performance than hydrogen. In reality, for RD to be a viable, scalable net zero pathway for Australian freight, costs not only need to drop fast, they must drop *faster* than other zero emission technologies.

As at 2023, this looks unlikely with battery costs plummeting, hydrogen attracting major subsidies, and existing RD volume gobbled up by growing demand in other sectors or markets. The high ongoing fuel bills for RD will not be a cost-effective pathway for most conventional fleets.

This may not be true for all freight applications, however. Specialist freight vehicles, long-distance heavy haulage, mass/volume-constrained trucks, niche plant and equipment are all unlikely to find electric or hydrogen replacements in the near term. Until they do, reducing emissions from these sub-sectors will necessarily rely on 'drop in' solutions, like RD. If supply constraints persist, there is a strong argument for 'safeguarding' RD for the parts of the freight sector with no decarbonisation alternative.

For fleets that do have aggressive net zero targets and generous fuel budgets, RD is likely a good 'quick win'. If commercial volumes can be secured from the global market, RD effectively offers a 'business-as-usual' solution, with zero changes to operations and up to a 100% cut in Scope 1 emissions (i.e. if 100% RD is used). However, even if supply can be secured, the costs will likely eclipse conventional diesel for the foreseeable future.

For many freight fleets, renewable diesel may be the perfect technical solution to reduce emissions – just not yet the right financial one.