Australian Academy of Technological Sciences & Engineering
1975-2025

REPORT SUMMARY

Fortescue

FULL REPORT
atse.org.au/diesel

Decarbonising diesel industries

Transition technologies and policy pathways for diesel reduction in Australian mining, freight and agriculture, fisheries and forestry

AUGUST 2025

Australian Academy of Technological Sciences & Engineering

Executive summary

Diesel fuel is the dominant energy source powering Australia's mining, freight, agriculture, fisheries and forestry sectors. It supports critical machinery, transport vehicles and infrastructure essential to the nation's economy and exports. However, this widespread reliance on diesel comes with significant environmental, health, economic and strategic risks.

Diesel combustion contributes approximately 17% of Australia's total carbon emissions, posing a major obstacle to meeting the country's climate targets of a 43% reduction by 2030 and net zero emissions by 2050. Australia imports nearly 29 billion litres of diesel annually, reflecting a heavy dependence on international fuel markets and diminishing domestic refining capacity.

Despite these clear challenges, current policy settings inadvertently support diesel use by subsidising fossil fuel consumption. This delays critical investment and adoption of cleaner technologies.

Decarbonisation of diesel-dependent sectors requires a diversified technology approach.

Biofuels can be used as drop-in replacements in existing diesel engines without major modifications. This compatibility enables rapid emissions reductions, especially in remote areas and freight operations where infrastructure constraints limit electrification or hydrogen adoption.

Electrification can be used to replace diesel engines with electric vehicles and power stationary equipment with renewable energy sources. While urban freight and certain mining equipment are amenable to electrification, longer-distance freight and some heavy machinery face challenges related to battery range and charging infrastructure.

Green hydrogen produced from renewable electrolysis holds promise for heavy-duty applications in mining, freight and agriculture. Hydrogen fuel cells deliver zero tailpipe emissions and longer operating ranges than batteries, making them attractive for long-distance transport and off-grid mining operations.

Recommendations

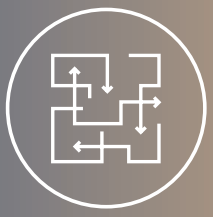
1

Conduct a national technical and economic assessment of decarbonisation pathways, and evaluate how prepared key sub-sectors are for the transition.

2

Review the financial incentives supporting diesel use.

3



Develop a coordinated future diesel strategy that includes a quantitative assessment of demand and supply across alternative energy scenarios.

4

Invest in comprehensive infrastructure to support the clean energy transition.

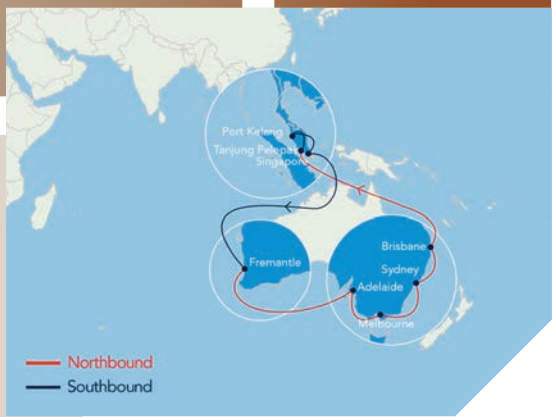
5

Provide targeted support across the technology maturity spectrum.

CASE STUDY

In 2022, a container ship powered by 500 metric tons of biofuel completed a 42-day rotation from Brisbane to South-East Asia and several key Australian ports. The trial was completed by global shipping and logistics company ANL in partnership with the Woolworths group, with the support of the Queensland Government.

Image source: statedevelopment.qld.gov.au/news-and-events/queensland-welcomes-home-successful-biofuel-shipping-trial



The case for action

Environment

The widespread use of diesel in Australian industry presents significant environmental, economic and public health risks. Diesel combustion contributes substantially to national emissions, comprising approximately 17% of Australia's total carbon emissions annually. Reducing diesel use presents as a critical opportunity for reaching Australia's emissions targets.

Health

Diesel engine exhaust is a significant source of air pollution and presents well-established health risks. Non-road diesel engines represent the largest unregulated air pollution source in Australia and emit more particulate matter than all on-road vehicles combined. Electrification, hydrogen and biofuels emit fewer pollutants and greenhouse gases than diesel. Given the regulatory obligations on employers and the well-documented health risks of diesel exhaust exposure, companies in diesel-intensive sectors have a strong incentive to reduce their reliance on diesel where practical.

National security

Australia's heavy reliance on imported diesel undermines both its fuel security and its capacity for energy independence. Over the past two decades, the number of operational crude oil refineries in Australia has declined from 12 to just two, significantly reducing the country's domestic refining capability. In 2022-23, Australia imported approximately 29 billion litres of diesel, at a cost to the national economy of $33 billion. This high dependency creates a strategic national vulnerability. As an island nation, Australia's fuel supplies are delivered through a small number of maritime ports, making them susceptible to disruption from geopolitical instability, trade conflicts, natural disasters and global market volatility.


Biofuel


Electrification

Hydrogen

Diesel alternatives

As Australia's heavy industry sectors consider pathways toward decarbonisation, several alternative fuels and technologies have emerged as potential replacements for diesel: biofuels, electrification and hydrogen.

Biofuel
Advanced biofuels are compatible with existing petroleum infrastructure and engines, and are produced from non-food feedstocks such as woody biomass or waste materials like cooking oils and animal tallow. By using by-products and other waste, advanced biofuels help decarbonise fuel use by replacing diesel without competing with food production.

Electrification
Electrification of diesel-fuelled industry involves replacing diesel-powered systems with electric alternatives such as electric vehicles, battery energy storage systems and microgrids that are powered by renewable sources such as solar or wind. These systems reduce fossil fuel reliance and enable cleaner on-site power generation in remote or off-grid locations. By enabling direct integration with renewable energy, electrification supports both national and global net-zero emission strategies.

Hydrogen
Hydrogen, due to its high energy density, presents opportunities for large-scale heavy industry applications. Hydrogen fuel cells are more energy-efficient than diesel engines and emit only water as a by-product.

Each has its own level of technical maturity, infrastructure requirements and suitability across different use cases. There is no linear or one size fits all approach: a strategically diverse and well-coordinated set of technology approaches is therefore required.

CASE STUDY

In partnership with Liebherr, Fortescue is deploying zero emission machines including electric excavators and cutting-edge battery haul trucks. The haul trucks will be fitted with a power system developed by Fortescue Zero, marking a significant step toward decarbonising mining.

Image source:donau3fm.de/liebherr-unterzeichnet-groessten-auftrag-der-unternehmensgeschichte-983689/

Interconnected barriers

While diesel replacement technologies are advancing, widespread adoption is being slowed by technological, policy, regulatory and economic barriers. Addressing these barriers is critical to achieving Australia's decarbonisation goals in mining, agriculture and freight.

Cost
Key concerns include high upfront capital costs, high costs to replace or retrofit diesel equipment, and the ongoing price gap between diesel and low-emissions alternatives. Upfront costs place a heavy financial burden on businesses, especially small and medium size operators. High capital costs of first-of-a-kind deployments deter most companies from taking on the investment risk. A lack of transparent, Australia-specific cost and performance data across electrification, hydrogen and biofuel options further complicates investment decisions.

Infrastructure
Australia's vast geography, low population density and long-distance freight corridors require a tightly coordinated rollout of vehicles, fuel supply, and refuelling and recharging infrastructure. Without coordinated planning and investment, these technologies will not be able to scale.

Policy
A patchwork arrangement across the Commonwealth, and state and territory governments, provides little confidence that current policies support long-term investments in alternatives to diesel. At a national scale, the Fuel Tax Credit Scheme is a major disincentive to diesel substitution for Australian industry, acting as a subsidy on the use of a significant fossil fuel and one of the top 20 expenses in the federal budget, costing the country almost $11 billion every year. An ineffective Research and Development Tax Incentive, lack of targeted new technology incentives and inadequate emissions cost signals contribute to a policy environment that does not provide strong support for heavy industry to move away from diesel.

Technology
Current technology barriers include: energy density limitations of diesel alternatives, which are required to operate at high power outputs over long duty cycles, making performance constraints a key issue; weight of battery systems in electric vehicles affecting freight and mining payloads; and storage and transportation of compressed hydrogen over long distances.

Lack of infrastructure – **a technological barrier** – is both a result of and a contributor to limited market demand – **an economic barrier** – which in turn is shaped by unclear or insufficient regulatory signals – **a policy barrier**.

Solutions

PHASING OUT OR REFORMING THE FUEL TAX CREDIT SCHEME would remove the market distortions that favour diesel and discourage investment in low-emissions alternatives. Experts consulted consistently identified the FTCS as one of the most significant economic barriers to the transition away from diesel.

REFORM OF THE SAFEGUARD MECHANISM could broaden the scheme to cover significantly more facilities, including many reliant on diesel, providing a price incentive for industrial evolution across emissions-intensive sectors.

INCENTIVES TO SUPPORT INDUSTRIES facing higher upfront costs and operational challenges associated with the shift away from diesel could come in the form of tax incentives, direct grants and accelerated depreciation allowances. At the state level, early-stage grant funding, public-private partnerships and streamlined regulatory approvals are critical for enabling timely deployment of clean infrastructure.

STRENGTHENING GRID CAPACITY would help meet demand for high-capacity charging infrastructure and firmed renewable power from electrification. Regional and remote areas would need to be prioritised for upgrades to enable high-power charging and all-electric industrial operations.

SUPPORTING R&D AT ALL LEVELS OF TECHNOLOGICAL READINESS is a key enabler for the discovery, development and move into commercial use of the next generation of low-emissions technologies and innovations.

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This report summary provides an overview of recommendations and findings on the decarbonisation of diesel industries. Read the full report on the ATSE website.

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