Department of Climate Change,
Energy, the Environment and Water

NSW Renewable Fuel Strategy

November 2025

NSW GOVERNMENT

Acknowledgment of Country

Department of Climate Change, Energy, the Environment and Water acknowledges the traditional custodians of the land and pays respect to Elders past, present and future.

We recognise Australian Aboriginal and Torres Strait Islander peoples' unique cultural and spiritual relationships to place and their rich contribution to society.

Artist and designer Nikita Ridgeway from Aboriginal design agency – Boss Lady Creative Designs, created the People and Community symbol.

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Minister's foreword

Renewable fuels represent an exciting opportunity to drive emissions reduction and underpin industrial activity in NSW.

A strong renewable fuels industry in NSW offers new economic and job opportunities and improved fuel security, and will accelerate decarbonisation for our hard-to-abate sectors.

This is a win-win-win opportunity.

A win for the planet, a win for jobs, and a win for fuel security.

The NSW Government is already acting to drive down emissions, legislating emissions reduction targets and transforming our energy system.

This will drive significant decarbonisation and enable the shift to electrification for households and light transport.

This transition to a net zero economy creates opportunities for new industries to emerge and thrive, leveraging NSW's natural resources, established industries and highly innovative workforce.

Not only that, it is also vitally important to combat climate change and safeguard our current industrial base.

However, not all sectors can be electrified, which presents challenges in achieving full decarbonisation across the economy.

While we remain committed to hydrogen, other renewable fuels can unlock short-term emissions reduction options for these sectors. They will also play an ongoing role into the future, enabling NSW to meet its 2050 target.

Hon. Penny Sharpe, MLC

Minister for Climate Change, Energy, the Environment, and Heritage

Strategy at a glance

The NSW Renewable Fuel Strategy is a crucial component of the NSW Government's vision for a thriving net zero economy.

Introduction

A renewable fuels sector in NSW will support economic growth, create jobs and enhance energy security while enabling early and meaningful decarbonisation across the state.

The NSW Government has committed to reducing emissions by 50% of 2005 levels by 2030, 70% by 2035 and to be net zero by 2050. The latest projections by the NSW Department of Climate Change, Energy, the Environment and Water (the department) show that further action is needed to meet these targets.

A significant portion of NSW's emissions, around 25 million tonnes (Mt) CO_2e, or 19% of NSW's total emissions[1], are considered hard-to-abate. These sectors face challenges to electrification due to chemical, technical, or practical limitations. Hard-to-abate sectors include:

- manufacturing (steel, cement and chemical production)
- primary industries (mining and agriculture)
- transport (heavy vehicles, maritime, aviation and rail).

Renewable fuels such as sustainable aviation fuel (SAF), renewable diesel, biomethane and hydrogen are needed to decarbonise our hard-to-abate sectors. They can serve as a bridge to electrification or a longer-term decarbonisation solution.

A strong renewable fuels sector in NSW delivers benefits that go beyond decarbonisation. It can support the creation of new industries in the region, bolster fuel security for the state, and underpin the future success of existing industries in a net zero economy. The bioenergy sector alone has the potential to provide over 26,000 jobs across Australia by the 2030s.[2]

This strategy outlines the NSW Government's commitment to accelerating the production and uptake of affordable renewable fuels where barriers are delaying adoption. It builds on the NSW Hydrogen Strategy, recognising hydrogen's critical role in establishing scaled supply of fuels produced through renewable electricity. It also provides the opportunity that biogenic fuels bring for short-term abatement due to their higher commercial readiness.

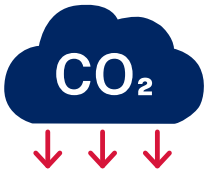
As an emerging industry, renewable fuels are not yet cost-competitive with fossil fuels or produced at the scale required to fully decarbonise our hard-to-abate sectors. Unless renewable fuels are available at a reasonable cost and sufficient scale, there is a risk that hard-to-abate sectors will fall behind others in the transition to net zero.

The strategy and its actions are guided by key principles, including sustainability, circular economy, collaboration and cost of abatement.

1 Commonwealth DCCEEW, State and territory greenhouse gas inventories [data set], 2022.
2 Australian Renewable Energy Agency (ARENA), Australia's bioenergy roadmap, 2021.

Objectives

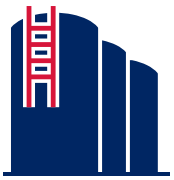
The NSW Government is committed to fostering a thriving renewable fuels sector that supports economic growth, creates jobs and enhances energy security across the state. A strong renewable fuels industry in NSW can accelerate a low carbon transition that benefits NSW communities.



Contribute to NSW's emissions reduction targets

Support decarbonisation in hard-to-abate sectors

Drive economic development in regional NSW



Improve fuel security

Targets

2035

Renewable fuels contribute **2.5%** to emissions reduction of NSW hard-to-abate sectors (baseline FY2024)

15% of industrial gas use is renewable

$1bn of economic investment in regional NSW

10 PJ of renewable fuel produced

Key strategy actions

Expand the Renewable Fuel Scheme

Expand Renewable Fuel Scheme support to biomethane

Invest in renewable fuel production

Support commercial-scale production from emerging technologies and build supply chain assets

Support biohubs

Accelerate production of biomethane at existing facilities with feedstock and capability

Fund renewable diesel trials

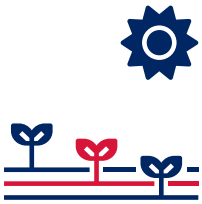
Undertake trials in transport, construction, mining, and agriculture sectors

Deliver studies on commodity markets

Evaluate the economic potential and demand outlook for new commodities

Fund research and innovation

Boost efficiencies and improve industry capability



Fund biomass crop R&D trials

Partner with primary producers to test and demonstrate biomass opportunities

Facilitate and guide industry through planning approval

Improve access and clarity of approval processes

Renewable fuel disclosure requirements

Develop disclosure requirements for the sale of renewable fuels

Expand GreenPower to renewable fuels

Certify additional renewable fuels and co-products

Purpose of the strategy

Our NSW Renewable Fuel Strategy establishes a strong foundation to enable the next wave of renewable fuel production.

Fuelling the net zero transition for hard-to-abate sectors

To achieve the NSW Government's emissions reduction targets we need a strong renewable fuels industry in NSW to support decarbonisation in hard-to-abate sectors.

Hard-to-abate sectors include:

- manufacturing (steel, cement and chemical production)
- primary industries (mining and agriculture)
- transport (some heavy vehicles, maritime, aviation and rail).

The NSW Government has committed to reducing emissions by 50% of 2005 levels by 2030, 70% by 2035 and net zero by 2050. The latest projections by the department show that without accelerated action, NSW could fall short of our 2030 target by up to 4%, and our 2035 target by up to 8%.[3] This is backed by the Net Zero Commission's initial assessment that NSW will need to accelerate decarbonisation of the energy sector to stay in reach of its emissions targets.[4]

NSW still relies on fossil fuels to power its economy. In 2022-23, fossil fuels accounted for 1,279 petajoules (PJ) of total energy used in NSW. Of these fuels, hard-to-abate activities used 36% (458.5 PJ), contributing around 25 Mt CO_2e, or 19% of NSW total emissions.[5]

Electrification, efficiencies and technological advancements are expected to play a leading role in decarbonising fossil fuel use in many sectors of the economy, and where possible should be considered first. However, more options are needed for hard-to-abate sectors that face commercial or technical challenges to electrifying. Renewable fuels provide an intermediate decarbonisation solution where electrification is not yet available, and can play a longer-term role as energy carriers and feedstocks for industrial processes.

NSW Gas Plan

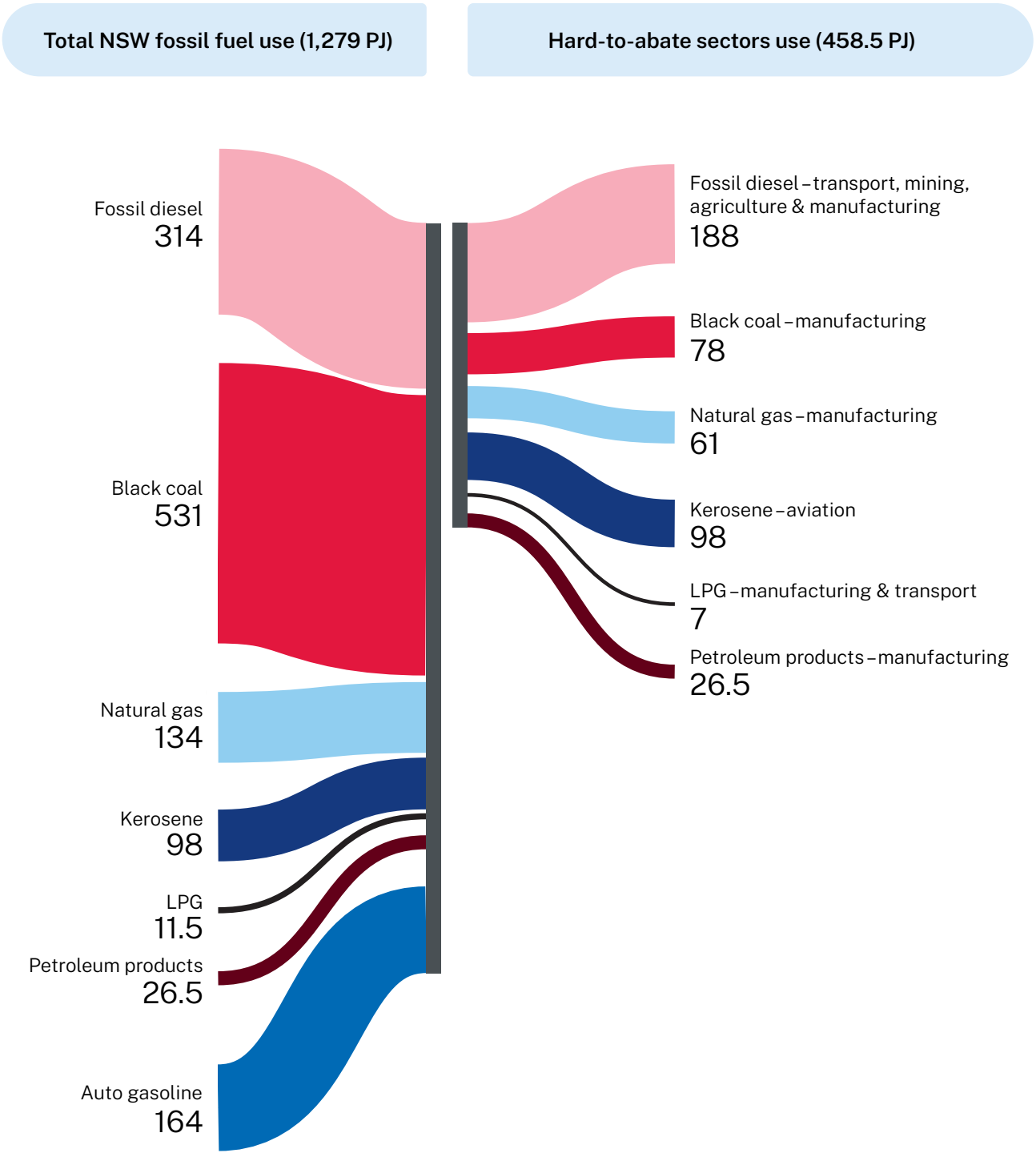
The NSW Government is developing a NSW Gas Plan, which will provide clarity to industry and households on gas decarbonisation. It will complement the NSW Renewable Fuel Strategy and consider setting targets as part of its development.

3 NSW DCCEEW, NSW greenhouse gas emission projections, 2022–2050 [data set], 2024.

4 Net Zero Commission, 2024 annual report, 2024.

5 Commonwealth DCCEEW, State and territory greenhouse gas inventories [data set], 2022.

Figure 1: Fossil fuel consumed by hard-to-abate sectors in NSW (PJ), 2022-23



Source: Commonwealth DCCEEW, Australian Energy Update, 2024

Developing economic opportunities and fuel security

A strong renewable fuels industry in NSW can accelerate an energy transition that not only reduces emissions but also builds fuel security and supports regional economic opportunities. NSW is estimated to use 16,000 million litres of imported oil products each year, which can expose our market to international supply chain shocks. This risk is most acute for diesel and aviation fuel. In 2024, 65% of diesel imports and 70% of aviation fuel imports were sourced from just 3 countries.[6]

The Australian Energy Market Operator (AEMO) forecasts the risk of peak-day gas shortfalls and seasonal supply gaps in NSW from 2028, with annual supply gaps emerging from 2029.[7]

Without additional supply, beyond that currently planned, the east coast gas shortfall is expected to exceed 110 PJ in 2035. NSW production of renewable fuels alone, including biomethane, e-methane or the use of biogas to displace fossil gas use, is expected to bridge over 5% of gas shortfalls on the east coast of Australia.

Building local capability and supporting a domestic renewable fuels industry will also be important to reduce exposure to international supply chain shocks and elevated fuel prices.

The Sustainable Aviation Fuel Prospectus, released by the NSW Department of Primary Industries and Regional Development (DPIRD) in 2024, estimated that domestic SAF production has the potential to contribute $4.8 billion per year to the NSW economy by 2050. Nationally, the sector could support up to 13,000 jobs throughout the SAF supply chain and create 5,000 new high-value jobs to construct and operate the facilities.[8]

New jobs, skills, qualifications, training pathways, technologies and industries will emerge over the next 30 years, particularly in the regions.[9] With feedstock comprising up to 70% of production costs, this represents a significant economic opportunity for Australia's agricultural sector to diversify income streams for farmers and regional communities.[10]

6 Clean Energy Finance Corporation and Deloitte, Refined Ambitions: Exploring Australia's Low Carbon Liquid Fuel Potential, 2025.
7 Australian Energy Market Operator (AEMO), Gas Statement of Opportunities, 2025.
8 ICF International, Developing a SAF industry to decarbonise Australian aviation, 2023.
9 Jobs and Skills Australia, The Clean Energy Generation: workforce needs for a net zero economy, 2023.
10 Clean Energy Finance Corporation and Deloitte, Refined Ambitions: Exploring Australia's Low Carbon Liquid Fuel Potential, 2025.

NSW's strengths for renewable fuel development

NSW has natural technical and industrial advantages to develop renewable fuels.

Diversity of feedstocks

Feedstocks include agricultural waste (residues), seed oil, sewage, and commercial, industrial and municipal organic waste streams. With supportive policies, NSW can potentially produce up to 176 PJ of renewable fuels per year from existing sustainably accessible biogenic feedstocks.[11] Additional feedstocks can be recovered from those currently exported overseas for biofuel production, such as canola and tallow.

Renewable energy potential

NSW's ability to generate abundant renewable energy from solar and wind supports the production of green hydrogen and other e-fuels. The NSW Electricity Infrastructure Roadmap sets out a plan to deliver 12 gigawatts (GW) of additional renewable electricity generation by 2030. To date, 5 Renewable Energy Zones have been declared as designated NSW areas for renewable energy generation.

Large industrial and heavy transport sectors

NSW is home to high-emitting manufacturing operations, including the largest integrated steelworks in Australia at Port Kembla, and ammonia nitrate facility on Kooragang Island. The Kingsford Smith Airport in Sydney accounts for 40% of Australia's demand for conventional jet fuel and a new Western Sydney Airport (Nancy-Bird Walton Airport) is set to open in 2026. These industries provide strong local demand to achieve economies of scale in renewable fuel production.

The Australian aviation industry is leading by example with commitments on SAF:

- Qantas is aiming for 10% SAF by 2030 and approximately 60% by 2050. It has established the $200 million (USD) Australian Sustainable Aviation Fuel Partnership with Airbus.
- Boeing is supporting Wagner Sustainable Fuels to develop Australia's first SAF blending facility.
- Virgin Australia has committed to a target of Net Zero Emissions by 2050. It is already trialling SAF in Australian flights and is partnering with Qatar Airways to deliver a SAF production facility in North Queensland.

11 Modelling for NSW DCCEEW, 2025.

The Country Regional Network links regional NSW to interstate and metropolitan rail systems.

Large workforce

NSW has strong workforce potential for renewable fuel production, particularly in regional NSW, where much of the feedstock originates. This includes employees skilled in professional, scientific and technical services, as well as construction, mining, electricity, gas and waste services.

Existing road, rail and port network

NSW has approximately 6,700 km of operational rail and strategically located ports, such as Port Botany, Port Kembla and the Port of Newcastle. This provides a well–developed existing supply chain to service the renewable fuels industry.

Research and development (R&D) capability

NSW has become a leading hub for R&D, driven by the work of world-class universities, government departments and industry groups. There are 11 universities based in NSW, several of which have renewable fuel-related programs. DPIRD is recognised as a leader in the field of plant, animal and environmental sciences and is leading R&D work on feedstocks.

NSW is also home to the Powerfuels including Hydrogen Network of the Decarbonisation Innovation Hub. This innovation network, supported by NSW Government funding, builds local expertise and accelerates the commercialisation of clean fuel technologies. The network is led by the University of New South Wales in partnership with major NSW universities and has strong industry partnerships.

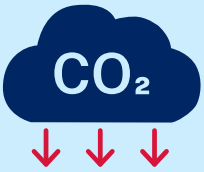
A strategic approach

NSW Government support for a renewable fuels industry addresses barriers to development while considering our priority objectives and principles.

Priority objectives

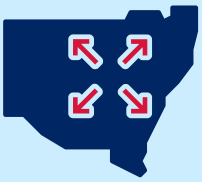
This strategy has 4 priority objectives:

Contribute to NSW's emissions reduction targets



Fossil fuels (coal, oil and gas) currently provide around 90% (1,279 PJ) of primary energy consumed in NSW.[12] Replacing existing fossil fuel use with low emissions alternatives will be critical to decarbonise NSW.

Drive economic development in regional NSW



Regional areas have existing agricultural industries, manufacturing capabilities and infrastructure that are a foundation for renewable fuel supply chains.[14] A renewable fuels industry would benefit new and existing workforces and create economic opportunities for NSW. Our SAF industry alone could be worth $4.8 billion by 2050.[15]

Support decarbonisation in hard-to-abate sectors

Hard-to-abate industries currently account for around 19% of NSW emissions, and this share is expected to rise as other sectors decarbonise more rapidly.[13] Renewable fuels provide short to long-term decarbonisation solutions, as energy, high heat or feedstocks for these industries.

Improve fuel security

NSW uses approximately 16,000 million litres of imported oil products annually.[16] A domestic renewable fuels industry reduces our exposure to international supply chain shocks and elevated fuel prices. It can also help address forecasted long-term gas shortfalls on the east coast of Australia.[17]

12 Commonwealth DCCEEW, Australian Energy Update [data set], 2024.
13 Commonwealth DCCEEW, State and territory greenhouse gas inventories [data set], 2022.
14 Office of the NSW Chief Scientist & Engineer, NSW Power-to-X industry feasibility study, 2023.
15 DPIRD, Sustainable aviation fuel prospectus, 2024.
16 Commonwealth DCCEEW, Australian Petroleum Statistics [data set], 2024.
17 Australian Energy Market Operator (AEMO), Gas Statement of Opportunities, 2025.

Strategy targets

The NSW Government has set clear and achievable targets to drive the next wave of renewable fuel production in the state, guided by our priority objectives. This strategy lays the foundation for an emerging industry, seeding a future market that will deliver scalable growth, innovation, and enduring decarbonisation outcomes.

2035

Renewable fuels contribute **2.5%** to emissions reduction of NSW hard-to-abate sectors (baseline FY2024)

15% of industrial gas use is renewable

$1bn of economic investment in regional NSW

10 PJ of renewable fuel produced

Renewable fuels unlock early decarbonisation along with economic opportunities for regional NSW.

Strategic principles

This strategy and its actions are guided by the following key principles, which will be balanced to achieve optimal outcomes.

Sustainability

Renewable fuels can have varying emissions reduction benefits, depending on the type of feedstock and production method used. Sourcing and using feedstocks for renewable fuel production must not have a detrimental environmental or social impact. Incentives developed through this strategy will ensure that production and use of renewable fuels result in a lifecycle emissions reduction, adhere with environmental standards, and where available, use accredited certification. Renewable fuels should not be sourced from native forest biomaterial and native vegetation, including invasive native species, where there is a risk of incentivising land clearing given the biodiversity and species impacts from habitat loss.

Circular economy

This strategy delivers opportunities for circular economy outcomes, to reduce costs and improve sustainability. A circular economy eliminates waste by maintaining a circular flow of materials, through recovering, retaining or adding to their value. Biogenic fuels can be generated from previous waste streams, including agricultural residues and household food waste, harnessing and circulating the energy and carbon embodied in those materials.

Collaboration and co-investment

The NSW Government will continue to engage with industry, communities and local, state and Commonwealth governments to seek collaboration and co-investment opportunities that develop Australia's renewable fuels industry.

Cost of abatement

NSW Government support will target low-cost, high emissions reduction outcomes, while enabling the development of longer-term technologies for industries with no foreseeable decarbonisation alternative to renewable fuels.

A biomethane facility can help mitigate landfill waste, return nutrients to soil and reduce emissions.

Support for a developing industry

The NSW Renewable Fuel Strategy provides support to develop a thriving renewable fuels industry across 6 focus areas.

Figure 2: Key focus areas for strategy support

Renewable fuels explained

Renewable fuels provide a short-term bridge for decarbonisation where electrification is not yet available, and will be a long-term solution to decarbonise some uses.

The role of renewable fuels

Renewable fuels are used directly as fuel, or feedstock (inputs) in industrial processes. They are generally gaseous or liquid and produced from either:

- sustainable biomass (organic material) such as agriculture and food wastes, known as biogenic fuels, or
- hydrogen generated using renewable electricity and water, known as e-fuels.

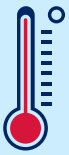
Renewable fuels will play a pivotal role in decarbonising our hard-to-abate sectors. They can provide a short-term decarbonisation option where electrification is not yet available or serve as a long-term solution.

Hard-to-abate sectors rely on high-energy fuels and use industrial processes that are difficult to electrify. This includes extremely high-heat applications and the use of fossil gas as a chemical feedstock. These industries may continue to require gas for operation, including low carbon gases such as biomethane or hydrogen. Aviation, remote power systems, and some heavy transport modes are also projected to remain reliant on liquid fuels such as SAF and renewable diesel for the foreseeable future.[18]

Renewable fuels can be used as a chemical feedstock or for high heat in industrial processes.

18 Department of Infrastructure, Transport, Regional Development, Communications, Sport and the Arts and Commonwealth DCCEEW, Low Carbon Liquid Fuels, A Future Made in Australia: Unlocking Australia's low carbon liquid fuel opportunity consultation paper, 2024.

Table 1: Opportunities for renewable fuel use

High heat	Main industrial sectors:
 Industrial heat can be broadly broken down into low, medium and high heat applications. Many low heat activities can decarbonise using existing electrification technologies. Hard-to-abate activities, however, generally require medium to high temperatures (above 250 °C), for which solutions vary in maturity.	**Ammonia:** Fossil gas is used as energy for steam reforming of methane in catalytic reactors at around 800 °C to produce hydrogen, for conversion to ammonia. Green hydrogen can replace steam methane reforming. **Iron and steel:** Coal is used in this sector in the form of coke to supply process heat. Biomethane and, in the longer term, green hydrogen could replace coal for smelting iron from ore. **Cement and lime:** Very high temperature kilns (up to 1,500 °C) could be fuelled by biomethane or green hydrogen. **Asphalt:** Mixture plants rely heavily on fossil fuels like fossil gas, propane and diesel to heat and dry aggregates, the mineral materials that make up most asphalt. Biomethane could substitute fossil gas.

Chemical feedstock	Main industrial sectors:
 Fossil gas is used as a raw material (feedstock) for creating products such as fertilisers, explosives, plastics and chemicals. As most of these cases require the chemical properties of gas, it cannot be easily substituted with electricity.	**Ammonia:** Almost 60% of fossil gas in ammonia production is used as feedstock. Ammonia can be used to make fertiliser, explosives and cleaning products. Green hydrogen or biomethane could be a substitute. **Methanol:** Methanol is predominantly produced from fossil gas by reforming the gas with steam. It has many uses, including as a fuel for marine vessels. Green hydrogen and captured carbon dioxide can substitute production inputs. **Iron and steel:** Coal is used in this sector in the form of coke as a reactant to convert iron ore into iron and as a source of carbon to create steel. Biomethane and, in the longer term, green hydrogen could replace coal for smelting iron from ore.

Energy density	Main transport sectors:
 The biggest challenge for decarbonising transport is energy density. As the mass of a vehicle and the distance of its journey increases, so too does the energy of the fuel source required to power that vehicle. While battery technology will improve, renewable fuels offer a more immediate, scalable solution ahead of technological advancement.	**Heavy road transport:** Includes use cases in regional and remote areas for very high tonnage, or vehicles with particular duty cycles and charging constraints. **Rail:** Electrified rail is feasible for inter-city and urban areas but is more challenging for rural rail. Diesel locomotives can switch to renewable diesel. Another potential decarbonisation pathway is hydrogen-electric (also known as fuel-cell electric) locomotives. **Aviation:** As technological alternatives to fuel-based propulsion are not currently available, aircraft must have access to large-scale SAF production to decarbonise. It is predicted that NSW will need between 4,000 and 4,300 million litres a year of SAF by 2050.[19] As electric propulsion technologies continue to improve, new types of aircraft may be able to operate some short flights. **Maritime:** Marine vessels are at sea for long periods and require sufficient fuel storage. Renewable diesel, hydrogen, ammonia and methanol are currently the most promising decarbonisation options.

19 DPIRD, Sustainable aviation fuel prospectus, 2024.

Biogenic and e-fuels

Biogenic fuels

When produced sustainably, biomass is a renewable energy source because it comes from organic materials that can be replenished naturally within a relatively short time. Organic materials absorb CO_2 from the air as they grow. When biogenic fuels are used, they release CO_2 back into the air where it can be reabsorbed by plants through photosynthesis, creating a cycle where no new carbon is added to the atmosphere. This differs from fossil fuels which, when combusted, release CO_2 that has been locked up underground for millions of years.

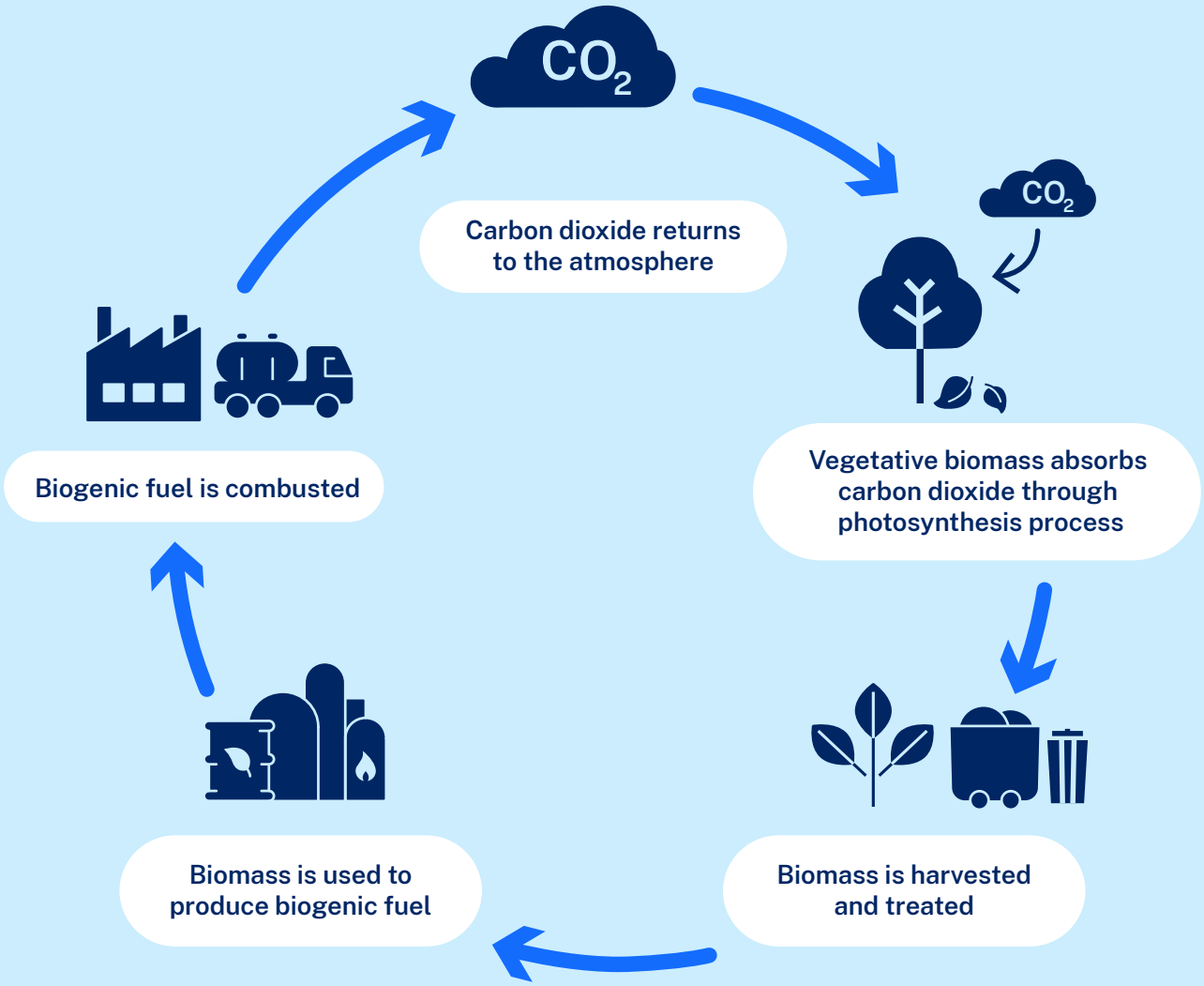
Current practice in Australia involves combusting wastes and residues, taking them to landfill or leaving them to decompose. This decomposition process releases carbon dioxide, nitrous oxide and methane, as well as volatile organic compounds.

The 2021 Australia's Bioenergy Roadmap estimated that NSW has around 553 PJ of biomass that could theoretically be harnessed. However, currently only a portion of this is considered recoverable for use in biogenic fuel production, due to, for example, to distance or competing uses. The NSW Government has undertaken further analysis to identify recoverable feedstock that considers NSW-specific requirements. This analysis has identified that the volume of existing recoverable biomass in NSW represents about 176 PJ of renewable fuel potential.[20]

Even when biogenic fuels are cost-competitive with fossil fuels, modelling shows that there will be insufficient capacity (~38%) to meet fuel demand in NSW hard-to-abate sectors. To enhance these volumes, there is a significant opportunity for growing biomass crops. If grown on marginal land, this would also have co-benefits of ecosystem restoration, soil health improvement and carbon sequestration. Once developed, a local renewable fuels industry also has the potential to secure feedstocks currently exported internationally for renewable fuels production.

20 Modelling for NSW DCCEEW, 2025.

Figure 3: The carbon cycle for biogenic fuel production



The carbon cycle starts when plants convert light energy from the sun and carbon dioxide from the air to carbohydrates and oxygen, via photosynthesis. The carbon is stored in the biomass of vegetation. It can then enter the soil as organic matter as the plant decays or can be released to the atmosphere through respiration by living organisms.

E-fuels

E-fuels, also known as power-to-X fuels, are generally produced from green hydrogen, which is produced by electrolysis using renewable electricity. The green hydrogen is combined with other gases to create feedstocks or alternative fuels. Hydrogen can be combined with nitrogen to produce green ammonia, or combined with carbon dioxide to produce gaseous and liquid fuels. E-fuels currently have a higher cost than biogenic fuels, primarily due to the emerging industry and higher-than-expected production costs.

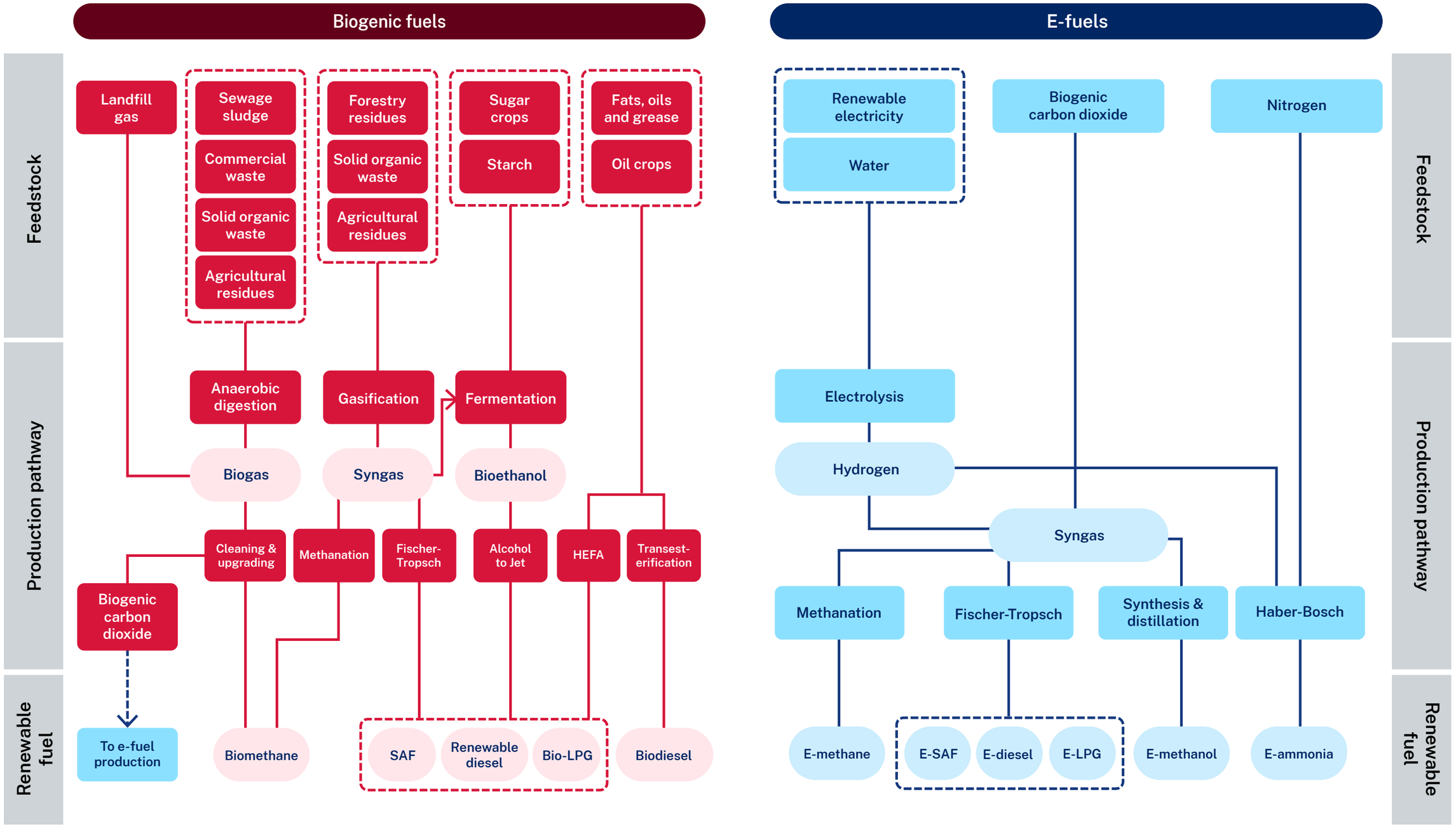
Table 2: Approximate lifecycle emissions reduction potential of green hydrogen and biogenic renewable fuels compared to fossil fuel equivalent.

Fuel	Type	Approximate emissions reduction[21]
Biodiesel	biogenic	38-80 kg CO_2e/GJ (40-85%)
Biomethane	biogenic	33-58 kg CO_2e/GJ (51-90%)
Green hydrogen	e-fuel	55-87 kg CO_2e/GJ (59-93%)
Renewable diesel	biogenic	33-76 kg CO_2e/GJ (35-81%)
SAF	biogenic	24-86 kg CO_2e/GJ (25-91%)

Green hydrogen can be used to refuel heavy road transport.

21 Modelling undertaken for NSW DCCEEW, 2025.

Figure 4: Main biogenic and e-fuel production pathways



Canola seed oil can be a feedstock for producing renewable fuels like SAF, renewable diesel, bio-LPG and biodiesel.

Green hydrogen

Hydrogen is a versatile energy carrier and feedstock. Today, hydrogen for industrial use is primarily produced by reacting fossil gas with steam. The main by-product of this process, known as steam methane reforming, is carbon dioxide.

Green hydrogen is largely produced by splitting water using renewable electricity. This process is known as electrolysis and releases close to zero emissions. Other methods to produce low emissions hydrogen also exist at various stages of development.

Green hydrogen as a fuel

Hydrogen is an energy-dense molecule (by mass). Its energy can be released through combustion or as electricity using fuel cell technology, where the main by-product is water vapour.

Green hydrogen as a feedstock for green commodities

Green hydrogen can be used to produce green steel or ammonia. Ammonia has several downstream applications, including for fertilisers, co-firing to reduce emissions in existing coal plants, long-term energy storage or as a fuel for new applications such as shipping.

Green hydrogen can also be used to produce methanol, synthetic versions of methane, aviation fuel and diesel, or as a reducing agent to replace coal in iron production.

Sustainable Aviation Fuel

Sustainable Aviation Fuel (SAF) is a replacement for fossil-derived conventional jet fuel (kerosene) with a comparable energy density. SAF can be produced through several processes and using a variety of feedstocks, including:

- combining vegetable oils and animal fats with hydrogen through Hydroprocessed Esters and Fatty Acids (HEFA) process
- transforming agricultural residues into ethanol and upgrading this into SAF through Alcohol-to-Jet process
- converting renewable gases into liquid fuels through the Fischer-Tropsch process.

A growing number of pathways certified to industry standards, demonstration flights and fuel off-take agreements are developing both in Australia and overseas.

Renewable diesel

Made through the same production pathways as SAF, renewable diesel is an advanced fuel that is refined to meet fuel quality standards. As it is a 'drop-in fuel', diesel machinery and supply infrastructure can be switched to renewable diesel without performance issues or any need to modify engines.

In February 2025, the Paraffinic Diesel Standard package was approved, enabling the supply of renewable diesel (also known as paraffinic diesel) in Australia.[22] Renewable diesel that complies with the standard can now be supplied at any blend rate.

22 Commonwealth DCCEEW, Fuel Quality Standards (Paraffinic Diesel) Determination 2025.

Some 'drop-in fuels' are close in chemical composition to their fossil fuel equivalents (such as biomethane or renewable diesel) and could be used as a direct replacement in existing assets and infrastructure (such as gas networks or diesel engines). Other types of renewable fuels differ more significantly (such as biodiesel) from their fossil fuel equivalents, but if blended with fossil fuel can be used in existing assets for some emissions reduction benefit.

Drop-in fuels are an attractive option in the short-term to decarbonise existing assets (such as heavy vehicles) with very long lifespans.

Biomethane

Biomethane is produced by upgrading biogas to remove the carbon dioxide and contaminant gases. Biogas is predominantly produced through a biological process known as anaerobic digestion, where microorganisms break down organic material in an oxygen-free environment. The organic material can include wastewater sludge, agricultural waste, food and garden waste, and municipal solid waste at landfill sites.

Biomethane is considered a drop-in fuel as it's indistinguishable from fossil gas. It can replace fossil gas in existing gas networks and equipment without any changes. The cost of production and energy outputs vary significantly, depending on the type of feedstock, production pathway used and scale of individual biomethane projects.

By-products of biomethane production have market value and can be additional revenue streams for developers to make production more economically feasible. These include digestate and biogenic carbon dioxide.

Digestate

Anaerobic digestion to produce biogas also results in a by-product called digestate. Digestate is an organic nutrient-rich material that can be used as a fertiliser and applied on agricultural land instead of chemical fertilisers.

Biogenic carbon dioxide

Carbon dioxide is a by-product of upgrading biogas to biomethane. When carbon dioxide is captured in a closed system, it can be used to create renewable fuels including methanol, dimethyl ether and methane. It is also a valuable product that can be used in food, beverages, and health when purified to industry standards.

Other renewable fuels

Biodiesel

Biodiesel is derived from vegetable oils and waste fats through transesterification. During the manufacturing process, Fatty Acid Methyl Esters (or FAME) are created and blended into the fuel. The FAME has 2 key characteristics: it holds water, and it acts as a 'detergent', cleaning pipework of impurities (although this ultimately ends up in the fuel itself). As a result, biodiesel has a different chemical structure and properties to conventional diesel and renewable diesel. The Australian diesel fuel standards allow up to 5% biodiesel blending in pump fuel. Higher concentrations of biodiesel are available but increase maintenance requirements when used in current infrastructure and engines.

Ethanol

Ethanol is an alcohol produced by fermenting sugars and starches. It's currently produced in NSW and blended between 9 and 10% with regular unleaded petrol to make E10. In April 2024, approximately 72% of service stations in NSW had E10 available at the pump.[23]

E10 produced under Australian conditions has between 2 to 5% lower CO_2 emissions than regular unleaded petrol.[24] While most cars running on unleaded petrol today are compatible with E10, higher blends of ethanol, such as E85, can only be used in cars that have been specifically built or modified to use it.

Ethanol is also an important feedstock used in SAF, renewable diesel and biodiesel production.

Methanol

Methanol can be produced through a biogenic pathway (bio-methanol) or as a derivative of hydrogen (e-methanol). It can serve as a transport fuel substitute suitable for marine vessels, heavy machinery, decentralised power generation in fuel cell or diesel generators and bunker fuel applications. Methanol also has potential as a fuel or energy carrier either for domestic use or export.

Ammonia

Ammonia can be created through a biogenic pathway or as a derivative of green hydrogen. Green ammonia can directly replace conventional ammonia in a range of existing uses, such as in fertiliser for agriculture and mining explosives.

Key emerging markets for green ammonia include use as an energy storage and transportation vector for hydrogen. NSW-produced green ammonia will be sought after by trading partners such as Japan and Korea to help meet their decarbonisation goals.

23 IPART, Monitoring the retail market for E10, 2024.

24 Department of Customer Service, E10 and the Environment, 2025.

Current renewable fuels industry

Efforts are already underway to drive the uptake of renewable fuel locally and internationally. But further government action is needed to accelerate an emerging industry in NSW.

NSW's industry development

Current production

NSW already produces biogenic fuels including ethanol and biodiesel. Ethanol production in NSW has a long history commencing in 1991 at the Manildra Ethanol Plant in Nowra. The facility has the capacity to produce 300 million litres a year from waste wheat starches.

Biodiesel Industries Australia in Maitland has the capacity to produce 20 million litres of biodiesel a year from used cooking oils, through transesterification.[25]

In 2021, Jemena commenced operation of its Western Sydney Green Hydrogen Hub, which produces small quantities of green hydrogen used to trial gas network blending.

In May 2023, Jemena also commenced operation of the first biomethane production facility in Australia, for injection into the gas network. The facility currently produces 95 terajoules (TJ) of biomethane per year.

NSW ports are vital infrastructure hubs for a developing renewable fuels industry.

25 Ecotech Biodiesel, Biodiesel Industries Australia and Just Biodiesel, Position statement, 2024.

Case Study:

Malabar Biomethane Injection Plant

The Malabar Biomethane Injection Plant is a demonstration project located at Sydney Water's Malabar Wastewater Recovery Facility. It was developed by Jemena and co-funded by ARENA. It is the first biomethane production facility operating in Australia to produce biomethane and inject it into a gas network and the first Australian project to receive GreenPower certification.

The project takes the existing biogas being generated from anaerobic digestion of organic waste from the wastewater facility and upgrades it to remove contaminants and produce biomethane.

The biomethane has the identical chemical composition to fossil gas and is therefore compatible with existing infrastructure, appliances and equipment, enabling it to be seamlessly injected into the existing network to displace fossil gas and sold to a retailer.

The plant's current capacity is 95 terajoules (TJ) of biomethane per annum and it has the potential to be scaled up to 200 TJ per annum in the future.

The Malabar Biomethane Injection Plant is the first demonstration project in Australia to produce biomethane and inject it into a gas network.

Hydrogen: status and outlook

The NSW Hydrogen Strategy, developed in 2021, sets out the vision and pathway for NSW to become a first mover in green hydrogen production and use. The Hydrogen Strategy announced up to $3 billion of incentives through 60 industry development actions. It recognises the critical role of hydrogen in decarbonising hard-to-abate sectors and as the building block for many renewable fuels.

Global efforts to cut emissions are driving continued growth in the hydrogen industry, with low-emissions hydrogen production forecast to reach 49 million tonnes per annum by 2030. In recent years, there has been a global surge in announced hydrogen production projects, along with ambitious demand announcements from prospective importer nations.[26] However, there have also been setbacks, including cancelled projects, due to unclear demand signals and financial hurdles.

The value and need for green hydrogen in a global net zero economy remains unchanged, but expectations around the speed of the industry's development and the range of use cases have matured. Persistent cost gaps with fossil fuels and uncertainty around demand has meant that both the pace and scope of hydrogen deployment are more restrained than originally forecast.

In this environment, government efforts must focus on supporting hydrogen transitions for priority sectors where hydrogen will be the primary route for decarbonisation. In NSW, our priority sectors for green hydrogen reflect those identified in the National Hydrogen Strategy (2024), including ammonia, heavy transport and green metals. The NSW Renewable Fuel Strategy also acknowledges the continuing need for green hydrogen as a feedstock to produce e-fuels, including SAF, methanol and renewable diesel.

Continuing support for hydrogen

Building on the foundations of the 2021 NSW Hydrogen Strategy, we will continue implementing key policies and actions to enable NSW to capture first mover advantages in green hydrogen.

Key hydrogen activities:

- **NSW Hydrogen Centre of Excellence:** The NSW Government is investing $25 million to establish a purpose-built training facility, in partnership with the Plumbing Industry Climate Action Centre (PICAC). The centre will deliver specialist training for apprentices, existing workers and industry, developing the skilled workforce needed to safely install, operate and maintain renewable hydrogen infrastructure.
- **NSW Hydrogen Hubs Initiative:** The NSW Government awarded $109.3 million in funding to 3 hub projects in the Hunter, Port Kembla and Moree regions. These projects will increase the production and availability of green hydrogen across the state, providing critical learnings of the opportunities and challenges in decarbonising the industrial, agricultural and heavy transport sectors. In addition, they provide significant investment in NSW and begin to develop the skills and local supply chains required to develop the industry.

26 International Energy Agency (IEA), Global Hydrogen Review 2024, IEA website.

- **Production incentives:** The NSW Government provides incentives to reduce the cost of green hydrogen production. Producers can sell green hydrogen at a lower cost by taking advantage of electricity concessions and the Renewable Fuel Scheme.
- **Port of Newcastle Clean Energy Precinct:** The Precinct is a 220-hectare development, being prepared as a production, storage, and export hub for clean energy products and technologies, including hydrogen and ammonia. It is supported by a $100 million Commonwealth Government grant administered by the NSW Government.

Research and tools

The NSW Government has already developed a range of studies and tools to support the renewable fuels industry, including those listed below.

NSW Power-to-X Program

Power-to-X (P2X) is an umbrella term for technologies that convert renewable energy and sustainable materials into power fuels and clean chemicals. The Office of the NSW Chief Scientist and Engineer (OCSE) has developed P2X feasibility and opportunity studies identifying activities that could realise economic and environmental benefits by accelerating industry deployment.

The NSW Powerfuel Value Chain tool can be used to evaluate the opportunities and costs of generating hydrogen and several key fuels. Users can then assess the feasibility of developing their renewable fuel projects in NSW.

Sustainable Aviation Fuel Prospectus

In 2024, DPIRD developed a Sustainable Aviation Fuel Prospectus to illustrate the economic opportunity of a SAF industry in NSW.

BioSmart

DPIRD, in partnership with CSIRO, has developed BioSmart, an interactive spatial tool that determines the potential for using biomass in NSW. The tool outlines existing biomass sources. It also allows users to identify potentially suitable land where woody biomass crops could be grown. The tool has been developed to help underpin a sustainable biomass supply, as demand for biomass grows.

Other research agencies have also created industry development tools, such as the:

- CSIRO Biomass Quality Database: a database of fuel and energy characteristics for a range of Australian biomass and wastes to support their use in a range of thermochemical technologies.
- Integrated Biomethane Viability Assessment Tool: created by the Future Fuels CRC to assist Australian biomethane project developers to explore how to de-risk biomethane projects and improve their viability in Australia.

National support for renewable fuels

Future Made in Australia

The 2024–25 Federal Budget includes targeted support for renewable fuels under the Future Made in Australia initiative. This includes a $250 million allocation through the Future Made in Australia Innovation Fund, administered by ARENA, to advance low carbon liquid fuels such as SAF and renewable diesel. The Australian Government is also exploring certification programs to ensure fuel integrity and traceability. In June 2024, public consultation was held on the Unlocking Australian Government Low Carbon Liquid Fuel Opportunity discussion paper, with industry and community feedback set to inform future policy and program development.

Cleaner Fuels Program

The 10-year Cleaner Fuels Program commits $1.1 billion towards a production-linked incentive for domestic producers of low carbon liquid fuels. The Australian Government plans to finalise details of the program in mid-2026, ahead of opening applications in 2026-27.

National Hydrogen Strategy

In late 2024, the Australian Government released an updated National Hydrogen Strategy. The strategy provides the framework to guide Australia's production, use and export of hydrogen. With significant production incentives and targets, this strategy will position Australia to become a global hydrogen leader.

ARENA – Sustainable Aviation Fuel Funding Initiative

In 2023, ARENA launched launched the Sustainable Aviation Fuel Funding initiative. To date, $33.5 million has been invested across 5 projects, including production facilities in Bundaberg and Townsville, to enable the supply of SAF at Brisbane Airport.[27]

Support for SAF will contribute towards decarbonising air travel.

27 Minister for Infrastructure, Transport, Regional Development, Low-carbon liquid fuels of the Future Made In Australia [joint media release], Australian Government, 2025.

International markets for renewable fuels

While production of renewable fuels is generally in the early stages in NSW and Australia, many technologies are mature in international markets. In 2023, the share of biomethane in the Danish gas system reached almost 40%. By 2030, Danish gas consumption is expected to be 100% green.[28]

In the European Union (EU), the Renewable Energy Directive establishes targets for the share of renewable energy in the transport sector. By 2030, EU countries are required to either achieve a share of 29% of renewable energy in transport, or to reduce the emissions intensity of transport fuels by 14.5%. They must also meet a combined sub-target for renewable hydrogen and advanced biogenic fuels of 5.5%.[29] The UK Government has mandated the use of SAF in its jet fuel supply increasing to 22% from 2040.[30]

More broadly, the International Civil Aviation Organisation has adopted a vision to reduce carbon emissions in international aviation by 5% by 2030.[31] The scale of production and commitment in international markets demonstrates the viability of renewable fuel technologies, and the impact government policies can have in driving adoption. This provides valuable learnings as NSW becomes a fast-follower in developing our own renewable fuels industry.

International markets also offer strong investment potential for an Australian e-fuel market, with many countries seeking to improve fuel security and improve decarbonisation. The value of current energy exports significantly contributes to NSW Gross State Product, with coal exports worth around $33 billion in 2023-24.[32] Although the level of competition is rising around the globe, Australia's renewable energy resources position Australia well for hydrogen production and related export and manufacturing opportunities.[33]

- Japan is targeting the use of 3 million tonnes of low carbon hydrogen per year by 2030, 12 million tonnes by 2040 and 20 million tonnes by 2050.
- The Republic of Korea is planning to import 1.96 million tonnes of green hydrogen per year by 2030.[34]
- The European Union aims to produce 10 million tonnes and import 10 million tonnes of renewable hydrogen by 2030.[35]
- The International Maritime Organization (IMO) has set decarbonisation targets for shipping, alongside advancement of fuel standards and global emissions pricing that will boost demand for e-fuels like methanol and ammonia.[36] Meeting IMO targets could require nearly 100 million tonnes of hydrogen by 2050 to produce these fuels.[37]

28 The Danish Energy Agency, Biogas in Denmark.
29 Directorate-General for Energy, Biofuels, European Commission website.
30 Department of Transport, Sustainable Aviation Fuel (SAF) mandate, UK Government website.
31 International Civil Aviation Organisation, ICAO cleaner energy tracker tools.
32 Department of Foreign Affairs and Trade, Australian Bureau of Statistics 2023-24 data on NSW.
33 Commonwealth DCCEEW, National Hydrogen Strategy.
34 Austrade, Korean hydrogen market update, 2022.
35 Directorate-General for Energy, Hydrogen, European Commission website.
36 International Maritime Organization (IMO), IMO approves net-zero regulations for global shipping, IMO website, 2025.
37 Global Maritime Forum, IMO policy measures: ensuring certainty for shipping's energy transition, 2025.

Industry barriers

The renewable fuels industry in NSW is nascent and faces several barriers to scaling, including:

- **Production cost and developing infrastructure:** Renewable fuels are generally more expensive to produce than their fossil fuel equivalents. The cost of production varies significantly depending on the fuel produced and the production method used. For biogenic fuels, some feedstocks, including agricultural residues, can be more expensive to collect and purchase. However, they are well suited to mature technology pathways such as anaerobic digestion.
- To meet the decarbonisation needs of our hard-to-abate sectors, we will need to utilise the variety of feedstock available in NSW via the relevant technology pathways. With emerging technologies still in late stages of commercialisation, production costs are likely to remain high until local supply chains and systems develop, establishing economies of scale.
- **Developing demand:** Secure demand is required for renewable fuel producers to invest and commence production. Renewable fuels can be an additional expense for users and need market confidence. Some renewable fuels still require certification systems to value their green credential.
- **Technology and investment risk:** Many renewable fuel production pathways are still developing. Until a precedent is available, attracting private investment in production pathways with lower technology readiness can be challenging.

These barriers compound and, under existing market conditions, industry is unlikely to grow or invest in scaled renewable fuel production. The NSW Government plays a critical role in seeding the market, accelerating the production and uptake of affordable renewable fuels where market barriers are delaying the adoption.

Actions to develop a thriving renewable fuels industry

Establishing strong and reliable renewable fuel supply

The transition to renewable fuels requires consistent supply at cost-effective prices.

Closing the cost gap, de-risking investment and establishing economies of scale

The NSW Government is providing targeted capital support to overcome commercial barriers to a local supply of renewable fuels. While renewable fuel technologies are already used around the world, few facilities in Australia have progressed to production.

Renewable fuels generally have higher production costs compared to fossil fuel equivalents. In Australia, supply chains are yet to establish, we have high labour costs, and prospective renewable fuel producers don't yet benefit from economies of scale when purchasing equipment.

Ahead of established supply, renewable fuel producers also face high feedstock costs compared to fossil fuel production. As electricity is a key input to e-fuel production, the continued rollout of renewable electricity infrastructure across NSW is essential to reducing production costs. Overseas, there is strong competition for our high-quality, low-cost feedstocks. For example, over half of the Australian canola crop is exported to the European biogenic fuels market.[38]

A reliable and affordable supply of renewable fuels can help power heavy transport.

38 ARENA, Australia's bioenergy roadmap, 2021.

Action 1 ▶

Expand the Renewable Fuel Scheme to support biomethane

The **Renewable Fuel Scheme** was established in 2021 under the NSW Energy Security Safeguard in the Electricity Supply Act 1995 (the Act). It operates as a market-based certificate scheme. The scheme's initial design supported green hydrogen only.

Under the scheme, renewable fuel producers can create a certificate for every gigajoule (GJ) of renewable fuel they produce. Liable parties must obtain and surrender certificates to meet their share of the scheme's renewable fuel production target/s or pay a penalty for a certificate shortfall. This creates a financial incentive to produce renewable fuel and supports projects to become commercially viable.

Biomethane production can help achieve early emissions reductions in NSW.

An expanded Renewable Fuel Scheme can serve as a catalyst to accelerate the deployment of renewable fuels. By providing a clear market signal and additional revenue for eligible producers, the scheme helps projects bridge production cost gaps and establish a stronger business case for investment. This long-term financial incentive can drive demand by reducing the sale price of renewable fuels, and further support producers to scale up their business.

The NSW Government will consequently introduce legislation to expand the scheme to support biomethane from 2028. This will include establishing a biomethane and green hydrogen target that grows to 8 PJ by 2038, with a $10.50 penalty rate. If producers of these fuels use an eligible production method, they'll be able to create and sell certificates for revenue based on the market rate of certificates.

Additionally, the NSW Government is committed to supporting hydrogen projects that are already progressing under the existing scheme. A target of up to 1 PJ from 2027 to 2037 will be allocated for first-mover green hydrogen projects.

Liable parties under the scheme will be gas retailers and large gas users who procure their gas directly.

The scheme will be periodically reviewed to ensure it:

- incorporates industry and technological developments
- remains effective and efficient in achieving its objective.

Action 2 ▶

Invest in commercial-scale production of renewable fuels from emerging technologies

NSW production facilities and supply chain infrastructure are eligible for financial support (estimated at up to $130 million) under the NSW Government's Net Zero Manufacturing Initiative. The grants will support scalable production through early to late-stage development and in strategic locations with environmental and economic benefits for NSW. Grants will also facilitate investment in the supply chain assets and infrastructure needed to deliver scale within the sector.

Feasibility and front-end engineering and design (FEED)

A variety of production pathways with varying inputs will be needed to establish the scale of renewable fuel required by NSW. Many of these production pathways are in the early stages of development. The NSW Government's engagement with industry to date confirms there is generally a low risk appetite from private investment to support pathways with lower Technical Readiness Levels (TRLs). The government can therefore play an important role in seeding the development of production pathways critical to supply.

Funding will support early-stage activities such as scoping, pre-feasibility and feasibility studies, along with FEED. These activities will identify project locations, feedstock and fuel customers, among other critical elements. Support for early-stage development activities in production pathways at various TRLs will allow project developers to progress projects towards delivery and subsequently attract private investment in later stages.

Construction

First-mover projects face higher costs to establish production and operation. The funding will support the construction of production facilities. This will reduce the cost gap for these producers, attract additional investment and deliver early renewable fuel production capability in NSW.

Supply chain infrastructure

A reliable supply chain is required to build confidence in both the production and use of renewable fuels. Support for feedstock collection, processing facilities and the upgrading or buildout of distribution infrastructure, such as pipeline gas compressors, will help commercialise renewable fuels in NSW, building technical capability and demand.

Over $1 billion is being co-invested with NSW industries and businesses under the NSW Net Zero Plan 2020-2030. Key initiatives include the Net Zero Manufacturing Initiative and High Emitting Industries Fund. This suite of existing programs is supporting the hard-to-abate sector to accelerate emissions reductions.

Action 3 ▶

Deliver up to $40 million in biohub funding to accelerate biomethane production

Up to $40 million will be available to support the development of biomethane production facilities, as a stream under the existing Industrial Decarbonisation Initiative. This action will provide co-funding for biomethane producers and prioritise projects that can most effectively deliver biomethane production in the near term, supporting our hard-to-abate sectors and NSW's fuel security.

These projects could be co-located near end-use, or across multiple smaller-scale sites, using existing facilities, with feedstock and production capabilities, such as wastewater treatment plants or food processing facilities. Production can be increased by sourcing additional feedstocks from the surrounding region.

Action 4 ▶

Develop a biohub demonstrator project on a NSW Government-owned asset

As an owner of major facilities, the NSW Government can play a key role in proving the commercial viability and circular economy benefits of renewable fuel production. Establishing a biohub demonstration project at a NSW Government site will send a clear investment signal to the market, while taking on some early-mover risk and providing a knowledge-sharing opportunity to showcase these benefits.

The project will demonstrate the methodology of collecting onsite organic waste and combining this with feedstock streams from the surrounding region to deliver greater scale. It will identify barriers and make recommendations for the development of future biohubs.

Wastewater can be combined with multiple types of organic waste in a process called co-digestion to boost biomethane production.

Building demand and support for hard-to-abate sectors

Our hard-to-abate sectors require support to use renewable fuels. A stable source of demand builds the case for production investment.

Providing market signals

Clear demand is required to de-risk production projects. Early adoption of renewable fuels and a better understanding of the market can help producers to raise capital and meet investor expectations ahead of construction.

Action 5 ▶

Investigate opportunities for the NSW Government to use renewable fuels in fleet and travel

The NSW Government purchases around $40 billion of goods, services and construction each year. The Net Zero Plan – Stage 1: 2020-2030 sets a priority for the NSW Government to play a leading role as an early adopter of sustainable goods. A significant number of commitments have already been made and progressed, including:

- Transport for NSW's operational and fleet emissions to reach net zero by 2035
- agencies must replace gas-fired plant and equipment with electric or other fossil fuel-free alternatives at end of life, or earlier if cost-effective
- agencies should aim to reduce scope 1 and 2 emissions to contribute to a whole-of-government target of 50% emissions reduction by 2030, 70% by 2035 (on 2018-19 levels), and net zero by 2050.

The inaugural 2024 Annual Report by the Net Zero Commission emphasised the need for all sectors in the economy to play an increasing role in meeting legislated targets. The NSW Government is committed to taking a leadership role in the transition to a low carbon economy.

The NSW Government will investigate opportunities to displace an increasing portion of our hard-to-abate fossil fuel consumption with renewable fuels. This will include corporate travel and across government-owned fleets, heavy rail, and stationary energy where electrification isn't available.

Incentivise replacing fossil fuel and adapting assets

Fuel users face their own challenges to adopting renewable fuels, including:

- the higher purchase price of renewable fuel
- their unfamiliarity with the technology
- in some cases, the high capital expense for fuel switching or adapting assets, which often have long lifespans.

These challenges are significant deterrents for potential customers. Incentivising the uptake of renewable fuels early, alongside developing supply chains, is imperative to successfully establishing a renewable fuels industry in NSW.

Action 6 ▶

Deliver studies on commodity markets emerging from the scale-up of a renewable fuels industry

Market studies investigate the economic potential and demand outlook for new commodities. For potential renewable fuel producers and investors, determining the demand and value for their product is essential for building a successful business case and proceeding to construction.

This action will deliver renewable fuel market studies that provide valuable insights to support the business case for renewable fuel projects. Priority areas in the short-term include the methanol, carbon dioxide, digestate and green fertiliser markets.

Action 7 ▶

Fund renewable diesel trials for transport, construction, mining, and agriculture sectors

Renewable diesel is a direct, drop-in replacement for fossil diesel. Trials are important to build confidence in the fuel's safety, performance and reliability. The NSW Government will expand renewable diesel trials, offering access to subsidised renewable diesel through a competitive grant process, open to transport, construction, mining, and agriculture sectors.

Action 8 ▶

Investigate options to drive decarbonisation in mining through low-carbon explosives

Low carbon explosives can be produced by using green ammonia as feedstock. These products are primarily used by the mining industry and contribute to their scope 3 emissions. The NSW Government will investigate methods to drive decarbonisation in the mining sector through low-carbon explosives. Transitioning to low-carbon explosives can support emission reductions for those using them and support up-stream renewable fuel production facilities that produce green ammonia and other e-fuels as derivatives of green hydrogen.

Explosives are used on mines to break up hard rock, enabling access to valuable resources like coal, minerals and metals.

Case Study:

Renewable Diesel Trials

The Beyond Fossil Diesel Program is delivered by the NSW Government and the Decarbonisation Innovation Hub, which supports collaboration between researchers and industry to increase the uptake of new low-carbon technologies. The 2-phase program focuses on agriculture and commercial fisheries, which are sectors of NSW primary industries currently reliant on fossil diesel.

The program trialed renewable diesel in a 30% blend with fossil diesel, initially in a hybrid truck trailer and then in an ocean-based fisheries pilot across 4 prawn trawlers. The pilot focused on the mid and far north coast of NSW and tested the fuel under commercial conditions.

More than 6,000 litres of renewable diesel was used in the program, reducing emissions by up to 75%.

Jars containing renewable diesel (left) and fossil diesel (right) at a Beyond Fossil Diesel event.

Optimising infrastructure and supply chains

Planning and delivery of state-wide infrastructure should be innovative and resourceful to enable accelerated industry growth with sustainable outcomes.

Planning and building infrastructure networks

Producing, storing and transporting renewable fuels will require an effective infrastructure network to minimise production costs and deliver circular economy outcomes. As facilities for biogenic fuel production are most economical when located near feedstocks, they will generally need to be located in regional areas and be serviced by distribution infrastructure. For some renewable fuels, such as biomethane, facilities will also need access to gas networks. Likewise, affordable renewable electricity supply is a key component of e-fuel production and scale up.

Renewable Energy Zones

Renewable Energy Zones (REZs) are the equivalent of power stations. They combine:

- new renewable energy infrastructure, including generators (such as solar and wind farms)
- storage (such as batteries and pumped hydro)
- high-voltage transmission infrastructure.

By connecting multiple renewable energy projects and electricity storage, these REZs capitalise on economies of scale to deliver cheap, reliable, and clean electricity for homes and businesses in NSW.

Action 9 ▶

Deliver an infrastructure and resources assessment to provide strategic recommendations for optimising supply chains

NSW has strong agricultural and industrial capability along with natural resources required for renewable electricity. However, there is a limit on the amount of biomass available for renewable fuels. In addition, the renewable electricity rollout is still progressing across NSW with developing Renewable Energy Zones.

The NSW Government will develop an infrastructure and resource assessment outlining optimal supply chain configurations, considering existing infrastructure and the resources and accessibility required to develop renewable fuels at scale. Optimising the reuse of assets and circular economy outcomes will be key to delivering the best outcomes for NSW. The assessment will be used to inform policymakers and help renewable fuel producers make decisions on their project development.

This assessment will build on previous studies and research undertaken across the NSW Government.

Distributing biomethane

NSW's gas supply is largely delivered from interstate and injected directly into the transmission network, which carries gas to the distribution network and its end use. Biomethane is generally most economical to produce near feedstocks across regional NSW and then inject into distribution or transmission networks. For biomethane to supplement fossil gas and be available to our hard-to-abate sectors where it's required, the network will need to be adapted.

Action 10 ▶

Produce a gas network load and distribution analysis to determine where the gas network may need adapting to support widespread biomethane injection

The NSW Government will investigate optimal arrangements for the gas pipelines to transport biomethane produced in regional NSW to high-demand industrial areas. Working closely with transmission pipeline owners and key stakeholders, this analysis will review barriers to network changes and determine ideal locations for placing biomethane plants and gas compressors on the network. The analysis will also provide recommendations to improve clarity and outcomes for biomethane producers while maintaining necessary due diligence appropriate to network modification.

Developing local equipment, technology and services

A strong renewable fuels industry requires a reliable network of equipment, technology and services to support it. Localising supply chain manufacture can avoid long replacement delays, builds security of supply and ensures compliance with Australian Standards.

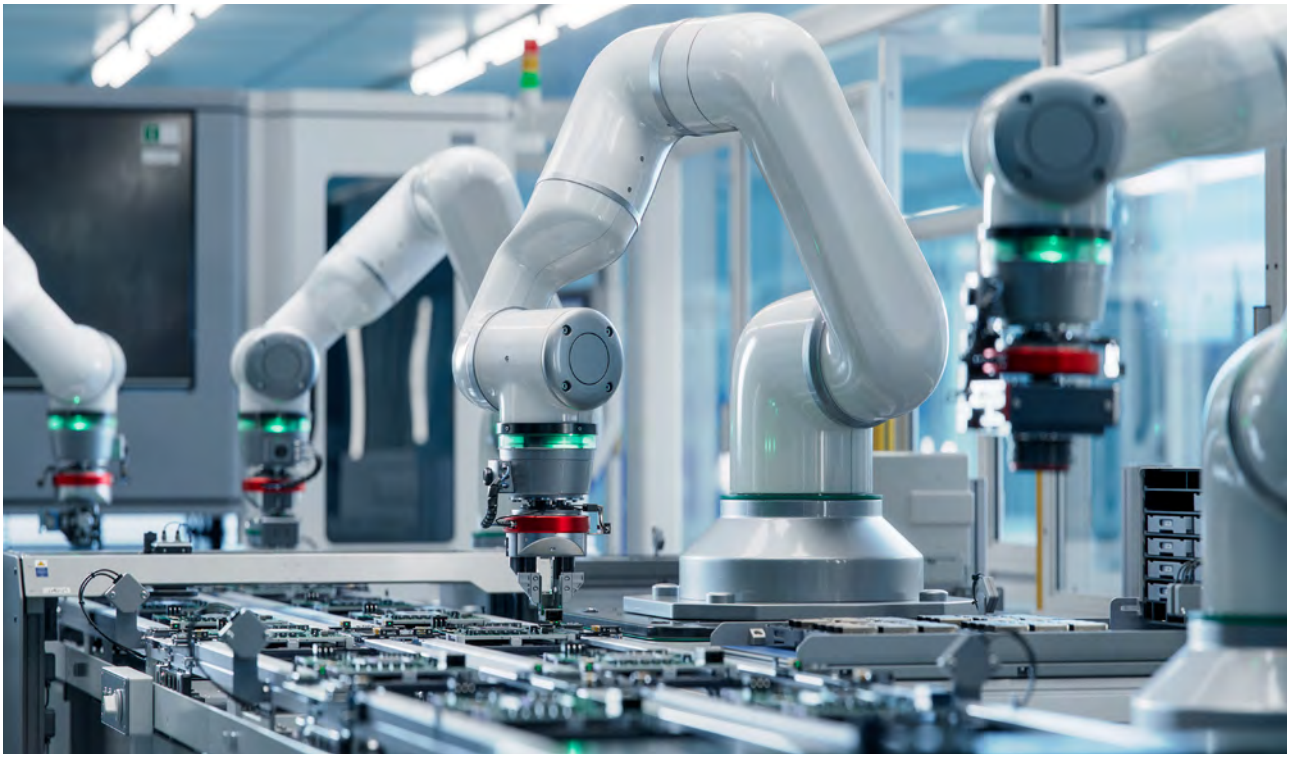
The user experience with renewable fuels will influence uptake across hard-to-abate sectors. A lack of service and maintenance capability for new assets will put the operations of these sectors at risk and delay their transition.

NSW has a world-class workforce and innovation capacity. Developing our capacity to service both the domestic and overseas markets will grow both jobs and export opportunities.

Action 11 ▶

Support local equipment, technology and services to grow NSW capacity in renewable fuel supply chain components

The NSW Government will undertake supply chain mapping and analysis to identify critical gaps to building NSW's local business and industry capability in renewable fuel equipment, technology and services. This analysis will determine barriers, areas for development and appropriate mechanisms to establish a strong local equipment, technology and services industry and create global leaders in this space.



A local equipment, technology and services industry creates jobs and strengthens the economy.

Providing value to NSW communities

A strong renewable fuels industry in NSW can provide new economic opportunities.

Export opportunities and guardrails

NSW's access to key export terminals and its established trade relationships with energy-importing markets in Asia and beyond provides a potential for e-fuel export. Tapping into multi-billion dollar markets for hydrogen, ammonia and methanol could accelerate economies of scale in NSW, reducing costs for producers and local customers.[39] However, appropriate guardrails are required to balance industry development and new jobs against emissions reduction objectives.

Action 12 ▶

Publish an export statement to outline NSW's interest in renewable fuel exports and where the NSW market should be serviced first

The NSW Government will develop a renewable fuel export statement to communicate NSW's approach to the renewable fuel export industry. The statement will outline NSW's interest in renewable fuel exports for economic opportunity, and where the NSW market should be serviced first due to input limitations or to ensure emissions reduction benefits.

Building participation in a clean transition

A key part of building a strong renewable fuels industry in NSW will be ensuring that industry and the community are aware of what renewable fuels are and have confidence in their production and use. Building awareness and knowledge will be essential to leveraging the economic opportunity of renewable fuels, particularly for primary producers in regional NSW and industry, who could develop a point of difference with low-carbon products.

Action 13 ▶

Build industry and community knowledge to boost confidence in the safe and effective use of renewable fuels

The production, sale and use of renewable fuels differs to traditional fossil fuels. The NSW Government will develop customised educational resources and technical advice to support industry and the community to participate in a clean transition to renewable fuels.

39 Commonwealth DCCEEW, National Hydrogen Strategy, 2024.

Fostering innovation

Support for research and development of emerging technologies can improve efficiencies and lower the cost of production over time.

Building on our research and development base

NSW has world-class, industry-led innovation networks, universities and research organisations. With many production pathways for renewable fuels at low technical readiness, these networks and institutions will play a key role in progressing the industry.

Table 3: Example networks, universities and research organisation working on renewable fuels in NSW

NSW Powerfuels including Hydrogen Network (PFHN)	The PFHN is an innovation network building local expertise for the commercialisation of clean fuel technologies. The network is led by the University of New South Wales (UNSW) in partnership with all major NSW universities and has strong industry partnerships.
Commonwealth Scientific and Industrial Research Organisation (CSIRO)	CSIRO's Towards Net Zero Mission provides industry, agriculture and regional communities with the tools to achieve net zero emissions and realise the opportunities of a low-carbon economy. It focuses on our hard-to-abate industries through research, demonstration projects and collaboration.
Newcastle Institute for Energy and Resources, University of Newcastle	The University of Newcastle, the Australian Government and Australian company Element One have partnered to build a simpler, more cost-effective and environmentally friendly production process for green ammonia.
Hydrogen Energy Program, University of Technology Sydney	The Hydrogen Energy Program aims to create a clean and sustainable future by building a society powered by hydrogen. It brings together experts for a whole-of-system approach to hydrogen technology development to provide high-quality training in and for the hydrogen economy.

Trailblazer for Recycling and Clean Energy (TRaCE)	TRaCE, established by the Australian Department of Education and delivered by UNSW and the University of Newcastle, builds new research capability to drive commercialisation. In its first year, TRaCE secured $117 million in industry co-funded research and development projects. This includes the collaboration between UNSW and Vecor Technologies, whose research into hydrogen production from seawater will provide a valuable resource for commercially-viable green hydrogen generation.
Australian Institute for Innovative Materials (AIIM), University of Wollongong	AIIM seeks to transform multi-functional materials research into a commercial reality. It has fabricated a high-performance electrocatalyst using a low-cost metal to improve the efficiency of hydrogen production from electrolysis.
Sustainable Energy Research Centre, Macquarie University	This Macquarie University-led collaborative project uses synthetic biology techniques to produce hydrogen rapidly and efficiently. The team has developed an engineered bacteria that converts renewable feedstocks such as cane sugar to hydrogen gas with minimal by-products.
Net Zero Institute, University of Sydney	Sydney University's Net Zero Institute brings more than 150 researchers together with industry collaborators to develop solutions across a range of disciplines. This includes R&D to optimise fuel efficiencies, aircraft design, adoption of hydrogen fuel cells and the development of battery and hybrid engines to create an emissions-free aviation sector.

Action 14 ▶

Provide $1.5 million to fund research and innovation for improved industry capability

The technology and supply chain systems required to produce low-cost renewable fuel at scale are still developing. Many of the production pathways that will be used to produce renewable fuels have low technology readiness or are in the early stages of commercialisation. Improved capability in renewable fuels technology and innovation in collection, storage, transport and biochemistry of feedstock can increase process efficiency and reduce the cost of production.

The NSW Government will provide $1.5 million in funding to seed innovation and research in renewable fuels that can help establish a strong renewable fuels industry in NSW and build on the economic opportunity it presents.

Action 15 ▶

Fund crop research and development trials to test and demonstrate biomass production opportunities in partnership with primary producers

The NSW Government will deliver crop trials in partnership with primary producers to develop innovation in biomass feedstock. $1 million funding will be available for trials that support the research, development and commercialisation of break crops, novel crops and short-rotation woody crops on marginal land. These crops can further diversify and increase feedstock availability in NSW.

A **break crop** refers to a crop grown in rotation with other crops to reduce the disease or pest burden, or to improve soil health.

Novel crops are produced through research and development for unique characteristics. For example, higher oil content, or heat and drought resilience.

Case Study:

Hysata electrolyser

In August 2023, Australian electrolyser company Hysata opened its new manufacturing facility in Port Kembla. Hysata is developing high-efficiency electrolysers with a simpler, cheaper modular system.

These innovative electrolysers will bring down the cost of green hydrogen and reduce energy usage as they operate at 95% efficiency. This is compared with around 65% efficiency for existing electrolysers.

The NSW Government has granted Hysata $1.5 million to pilot a 200-kilowatt electrolyser stack at its Port Kembla electrolyser manufacturing facility. The funding has helped Hysata progress the development of its high efficiency electrolyser.

The Clean Energy Finance Corporation (CEFC) and the Australian Renewable Energy Agency (ARENA) have provided $15 million and $30 million respectively to help Hysata develop its technology at commercial scale.

Hysata develops and manufactures electrolysers at its headquarters in Port Kembla.

Enabling industry

A strong framework of planning approvals, standards and sustainability will provide clarity for investment.

Clarity on renewable fuel development

Renewable fuel project developers need to obtain various government approvals, including environmental permits, planning approvals and safety compliance certifications.

The planning and policy frameworks supporting a developing industry need to be fit-for-purpose to enable large scale renewable fuel development.

It is vital that assessment processes for projects are appropriate, clear and provide confidence to industry. A robust regulatory framework is also crucial for the safe uptake of renewable fuels that meets Australian standards.

Action 16 ▶

Review regulation and standards to enable appropriate industry development

The NSW Government will investigate if NSW laws and national standards are appropriate to support the development of a renewable fuels industry, including:

- safety and technical legislation and standards
- environmental, land use planning, and development assessment legislation, policies and processes.

Robust standards ensure safety and consistent product quality in the industry.

Action 17 ▶

Provide planning guidance to improve access and clarity of approval processes for renewable fuel projects

Clarifying the development assessment process can reduce delays and save significant costs for developers. Support will be provided as guidance material on assessment pathways and regulations to assist project developers in their approvals process. Development of this guidance will build on work already undertaken to develop a Hydrogen Planning Guideline, expanding it to capture other renewable fuels.

Transparency and sustainability

Biogenic fuels have varying emissions reduction benefits and environmental impacts, depending on the type of bio-feedstock and production pathway used. Life cycle emissions include the emissions associated with the raw materials extraction, manufacture, storage, transport, use and end-of-life management of a resource. Biogenic fuels still have emissions associated with their production or use, but they have lower overall life cycle emissions than their fossil fuel alternatives.

Action 18 ▶

Publish environmental guidelines for the renewable fuels industry to access NSW Government funding

The NSW Government will provide guidelines for renewable fuel projects, detailing specific environmental and social criteria that projects should meet to be eligible for NSW grant funding and other renewable fuels initiatives. This includes clear criteria to avoid adverse land clearing outcomes in NSW.

Action 19 ▶

Develop disclosure requirements for the sale of renewable fuels

The NSW Government will develop disclosure requirements for energy retailers with renewable fuel offers to consistently and transparently share their environmental credentials (for example, GreenPower or the Commonwealth's Guarantee of Origin scheme) with customers. This action is designed to give businesses and communities confidence in the decarbonisation benefits they purchase and reduce the risk of 'greenwashing' in the renewable fuels industry.

Establish certification frameworks

Renewable fuels certification is a process that verifies whether a fuel product meets specific standards for sustainability, environmental impact, and renewable content. Certification is often required for producers to sell their products into certain markets and receive a green premium (the market value created by a lower emissions product). NSW organisations with their own corporate emissions reduction targets require certification and carbon accounting frameworks to validate their reductions.

In Australia, renewable gas certification is available for biogas, biomethane, e-methane and renewable hydrogen through the GreenPower Renewable Gas Certification. GreenPower ensures that each of its Renewable Gas Guarantee of Origin (RGGO) certificates represents accredited zero-to-low-emission renewable gas that displaces fossil gas in Australia. The RGGO certificates are particularly significant for producers injecting biomethane, e-methane or renewable hydrogen into the gas network, as these certificates can be traded separately from the physical gas.

Hydrogen will also be certified through the Commonwealth's Product Guarantee of Origin (PGO) scheme, managed by the Clean Energy Regulator (CER). The CER has announced that it will be expanding the PGO scheme to include biomethane, liquid fuels (SAF and renewable diesel) and green metals.

Certification needs to be recognised under the National Greenhouse and Energy Reporting Scheme (NGERS) for large Australian businesses to report on reductions in greenhouse gas emissions. NGERS is the national legislative framework for reporting and publishing company information about greenhouse gas emissions, energy production and energy consumption. In 2024, amendments to the NGERS framework were made to include SAF and renewable diesel in addition to biomethane and biodiesel as options for reducing emissions under national carbon accounting methods.

Action 20 ▶

Expand GreenPower certification to additional renewable fuels and co-products

GreenPower will expand accreditations to include SAF, renewable diesel, biodiesel and renewable LPG. GreenPower will also develop a certification for biogenic carbon dioxide produced from the decomposition or combustion of organic material derived from plants or animals. Biogenic carbon dioxide is a key by-product of biomethane production and combustion.

This certification will provide verified proof of origin and sustainability, helping to support projects by unlocking access to a green premium for carbon dioxide they produce. It will also enable end users to manufacture lower-carbon products and meet growing demand for sustainable solutions.

Actions summary

Table 4: Strategy actions and fuels eligible for support

Number	Action	Eligible fuels
1	Expand Renewable Fuel Scheme support to biomethane.	Green hydrogen, biomethane
2	Invest in commercial-scale production of renewable fuels from emerging technologies.	All
3	Deliver up to $40 million in biohub funding to accelerate biomethane production.	Biomethane
4	Develop a biohub demonstrator project on a NSW Government-owned asset.	Biogas, biomethane
5	Investigate opportunities for the NSW Government to use renewable fuels in fleet and travel.	All
6	Deliver studies on commodity markets emerging from the scale-up of a renewable fuels industry.	All
7	Fund renewable diesel trials for transport, construction, mining, and agriculture sectors.	Renewable diesel
8	Investigate options to drive decarbonisation in mining through low-carbon explosives.	Green ammonia
9	Deliver an infrastructure and resources assessment to provide strategic recommendations for optimising supply chains.	All
10	Produce a gas network load and distribution analysis to determine where the gas network may need adapting to support widespread biomethane injection.	Biomethane
11	Support local equipment, technology and services to grow NSW capacity in renewable fuel supply chain components.	All
12	Publish an export statement to outline NSW's interest in renewable fuel exports and where the NSW market should be serviced first.	All
13	Build industry and community knowledge to boost confidence in the safe and effective use of renewable fuels.	All

Number	Action	Eligible fuels
14	Provide $1.5 million to fund research and innovation for improved industry capability.	All
15	Fund crop research and development trials to test and demonstrate biomass production opportunities in partnership with primary producers.	Biogenic fuel
16	Review regulation and standards to enable appropriate industry development.	All
17	Provide planning guidance to improve access and clarity of approval processes.	All
18	Publish environmental guidelines for the renewable fuels industry to access NSW Government funding.	All
19	Develop disclosure requirements for the sale of renewable fuels.	All
20	Expand GreenPower certification to additional renewable fuels and co-products.	SAF, renewable diesel, biodiesel, renewable LPG and biogenic carbon dioxide

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