

Department of Climate Change,
Energy, the Environment and Water

Opportunities for a renewable fuel industry in NSW

Discussion paper

August 2024





Acknowledgment of Country

The Department of Climate Change, Energy, the Environment and Water acknowledges that it stands on Aboriginal land. We acknowledge the Traditional Custodians of the land and we show our respect for Elders past, present and emerging through thoughtful and collaborative approaches to our work, seeking to demonstrate our ongoing commitment to providing places in which Aboriginal people are included socially, culturally and economically.

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Introduction

The NSW Government has committed to reducing emissions by 50% of 2005 levels by 2030, 70% by 2035 and net zero by 2050.¹ The NSW Department of Climate Change, Energy, the Environment and Water (the Department) is implementing a range of policies and initiatives to achieve these targets.

Delivery of net zero initiatives, including the NSW Hydrogen Strategy, and industry feedback have identified that renewable fuels play a key role in reducing industrial emissions where electrification is not viable. Further government support is needed to diversify and scale up a renewable fuel industry in NSW, which can create new economic opportunities and improve fuel security.

This discussion paper seeks input from stakeholders on policy opportunities and challenges regarding the production and uptake of renewable fuels. This includes whether the NSW Renewable Fuel Scheme (the Scheme) should be expanded. Your feedback will help us identify where action is needed to accelerate our state's transition to net zero. It will also help inform a strategy that sets a clear path to unlocking availability and uptake of renewable fuels across NSW.

Making a submission

You can provide feedback to the questions and concepts raised in this paper via an online form or by emailing your submission as a PDF file to renewablefuelscheme@environment.nsw.gov.au. Visit the [consultation page](#) for details.

The closing date for written submissions is 5 pm AEST on 30 August 2024.

The NSW Government is committed to an open and transparent process. Unless a submission is requested to be confidential, all submissions will be made publicly available on our website. Only your organisation's name will be published. We will remove personal details from submissions made by individuals. If you would like your written submission to remain confidential, please clearly state this in your submission.

Please be aware that even if you state that you do not wish certain information to be published, there may be legal circumstances that require the NSW Government to release that information, for example under the [Government Information \(Public Access\) Act 2009](#).

¹ [Climate Change \(Net Zero Future\) Act 2023](#).

Consultation questions

Renewable fuel policy objectives

1. Do you support these primary objectives? Are there other objectives renewable fuel policies should address?

Existing policies and programs

2. What actions can the NSW Government take to continue support for hydrogen production in NSW?
3. What could be implemented or learnt from existing policies and programs?

Infrastructure

4. How can the NSW Government support infrastructure reuse and development that delivers efficient, low-cost renewable fuel supply chains across the state?
5. How can the NSW Government support regional renewable fuel supply? Is there an opportunity to aggregate feedstocks at existing regional facilities such as landfills or wastewater treatment plants to create hubs for renewable fuel production?
6. Would support for feasibility and front-end engineering and design studies assist with reaching final investment decisions? If so, how is this best delivered?
7. What action would best support investment in these projects or a NSW renewable fuel industry? Are there example projects where this would accelerate development?
8. Should the NSW Government establish renewable fuel demonstration projects? If so, what would be the best model to support these projects?
9. Are there current regulatory gaps or barriers to establishing renewable fuel facilities? If so, what are they and how could they be addressed?

Supporting demand

10. How can the NSW Government accelerate the use of renewable fuels?
11. Should the NSW Government set, or redesign existing mandates for the use of renewable fuels? If so, what industries or fuels should be prioritised?

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12. Would renewable fuel purchase requirements for the NSW Government's assets support investment in production facilities?
 13. Should the NSW Government set targets for renewable fuel use? If so, should these targets be broad or fuel and industry-specific?
 14. What incentives can the NSW Government put in place to accelerate the use of renewable fuels?
 15. What support do asset owners need to refurbish or upgrade existing assets for renewable fuel usage?

Accelerating supply

16. What funding mechanisms or support should the NSW Government consider to support research and innovation and improve the commercial viability of renewable fuel production?
 17. Should the Renewable Fuel Scheme be expanded to support other renewable fuels?
 18. If the Renewable Fuel Scheme is expanded to include other renewable fuels, who should be the liable parties and why? (See Appendix B for reference)
 19. Should the Renewable Fuel Scheme incentivise fuels that offer short-term emission reduction, longer-term emission reduction or a combination? (See Appendix C for more detail)
 20. How can the NSW Government support feedstock producers for local renewable fuel production (regulatory, research, financial etc.)? What are the potential risks that should be considered?
 21. For feedstock producers and businesses currently exporting biomass crops, tallow and used cooking oils for overseas renewable fuel production, would an incentive scheme support the local sale of these important feedstocks?
 22. Should a reservation policy be used to keep feedstock on shore to support the local industry?
 23. In setting guidelines for renewable fuels, what sustainability measures should be considered? Including food availability and affordability, lifecycle emissions calculations, changes in market prices for agricultural and waste products.
-

24. Should a hierarchy of use for bio-feedstocks be enforced to prioritise feedstocks for applications where there is no available alternative for decarbonisation?

Value for NSW communities

25. Would a NSW Government-sponsored outline of export opportunities and volumes assist with investment?

26. Should there be a limit on financial support for renewable fuel export projects? If so, what is that limit and when should it apply?

27. How can the NSW Government ensure that the export of renewable fuels benefits NSW communities? Are royalties an appropriate mechanism?

28. How can the NSW Government, education providers and industry best support the development of skills, training and the workforce needed in a renewable fuel industry?

Managing market risks

29. How can the NSW Government support companies and industries with cross-border markets to decarbonise?

30. How can the NSW Government encourage a fuel transition that aligns with technological advancement?

Building community understanding

31. What information should be provided to industry and the community to build an understanding of renewable fuels? How is this information best delivered?

Executive summary

Renewable fuels are produced through sustainable processes, and include (but are not limited to):

- green hydrogen
- methanol
- green ammonia
- biomethane
- biodiesel
- renewable diesel
- sustainable aviation fuel (SAF)
- biochar
- biogas

Renewable fuels will play a critical role in supporting emissions reduction in hard-to-abate industry sectors including:

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

Renewable fuels can provide both a short-term bridge for decarbonisation where electrification is unlikely or not yet available, and long-term solutions for energy and industrial feedstocks. A strong renewable fuel industry in NSW can accelerate a low carbon economic transition that benefits NSW communities. NSW has a number of strategic advantages and opportunities to develop renewable fuels and efforts are already underway to drive the uptake of renewable fuels through research, grant funding and industry action.² However, further government action is needed to accelerate supply and broader uptake in NSW.

The guiding policy objectives identified for developing a renewable fuel industry in NSW are:

- Achieve NSW's emissions reduction targets
- Decarbonise hard-to-abate sectors
- Drive economic development in regional NSW
- Improve fuel security

We are seeking feedback on what actions should be developed to support renewable fuel development in NSW, including:

- what action can be taken to ensure infrastructure is fit for purpose
- ways to drive demand, accelerate supply
- how to clearly communicate how the industry can add value for NSW communities.

² [NSW Decarbonisation Innovation 2023 Study](#), Office of the NSW Chief Scientist & Engineer.

Policy objectives

The Department has identified 4 strategic objectives to guide the development of policies and actions for growing a domestic renewable fuel industry.

Achieve NSW's emissions reduction targets

The NSW Government has legislated emissions reduction targets. Bold action is required to ensure emissions abatement is achieved across all sectors of the NSW economy. Fossil fuels (coal, oil and gas) provide around 90% (1230 PJ) of primary energy consumed in NSW.³ Replacing existing fossil fuel use with low emissions alternatives will play a critical role in NSW's decarbonisation.

Decarbonise hard-to-abate sectors

Hard-to-abate industries face complex technical and commercial challenges to electrification. These sectors currently account for around 20% of Australia's greenhouse gas emissions and this is expected to rise as other sectors decarbonise more rapidly.⁴ Renewable fuels are an alternative decarbonisation solution used for energy or as a feedstock that can drive emissions reduction.

Drive economic development in regional NSW

Regional areas have existing agricultural industry, manufacturing capabilities and infrastructure that are a foundation for renewable fuel supply chains.⁵ A renewable fuel industry would benefit new and existing workforces and create economic opportunities for NSW. The SAF industry could be worth A\$4.8 billion by 2050.⁶

Improve fuel security

Australia currently imports around 55,000 million litres of oil products each year. Of this, NSW uses 16,000 million litres.⁷ A domestic renewable fuel industry reduces our exposure to international supply chain shocks and elevated fuel prices. They can also help address long-term gas shortfalls on the east coast of Australia.⁸

³ [Australian Energy Update 2023](#), Australian Government Department of Climate Change, Energy, the Environment and Water (Australian Government DCCEEW).

⁴ [Reducing greenhouse gas emissions in hard-to-abate industries](#), CSIRO.

⁵ [NSW Power-to-X Industry Feasibility Study](#), Office of the NSW Chief Scientist & Engineer.

⁶ [Sustainable Aviation Fuel Prospectus](#), Department of Primary Industries and Regional Development.

⁷ [Australian Petroleum Statistics 2024](#), Australian Government DCCEEW.

⁸ [2023 Gas Statement of Opportunities](#), Australian Energy Market Operator (AEMO).

Consultation question:

Question 1

Do you support these primary objectives? Are there other objectives renewable fuel policies should address?

Renewable fuels

Renewable fuels are generally gaseous or liquid and used as fuel or feedstock in industrial processes. They are produced:

1. from sustainable biomass such as agriculture, organic wastes and other residues (**biogenic fuels**), and/or
2. using renewable electricity to generate hydrogen in the first phase of production (**e-fuels**).

Biogenic fuels, in particular, have varying emission reduction benefits, depending on the type of feedstock used and production method. This consultation focuses on renewable and sustainable fuels that have materially lower lifecycle emissions profiles than fossil fuels and align with Australian and NSW laws and policies around renewable resources and forms of energy. Incentives and policies developed through this process will apply sustainability criteria and guidelines to ensure emissions reduction is delivered effectively throughout the supply chain.

Table 1 Types of renewable fuels and their usage

	Bio-fuels	E-fuels
Drop-in or blending (No modification needed)	<ul style="list-style-type: none"> • Biokerosene (SAF) • Biodiesel • Biomethane • Ethanol • Biochar 	<ul style="list-style-type: none"> • E-kerosene (SAF) • Renewable diesel • E-methane
Non-drop-in (Modification to engine and/or infrastructure needed)	<ul style="list-style-type: none"> • Green hydrogen • Bio-methanol • Bio-ammonia • Bio-LPG 	<ul style="list-style-type: none"> • Green hydrogen • E-methanol • E-ammonia • E-LPG

Parallel development of biogenic fuels and e-fuels to achieve net zero

Biogenic fuels

Biogenic fuels are an attractive option for short-term decarbonisation, as some (renewable diesel and biomethane) can ‘drop-in’ to infrastructure with minimal or no modification. Others (biodiesel and ethanol), can be blended with existing fossil fuels at typically 5 to 20%.

They are also closer to price parity with existing fossil fuels than e-fuels. The cost of biogenic fuels is largely driven by the type of feedstock used and the purity of fuel produced. Biogas captured from landfills can be cost-competitive with natural gas, while biogenic fuels produced from dispersed agricultural residues (wheat and straw) are more expensive, as the collection and processing are resource-intensive. Biomethane, a near-pure source of methane is often made by upgrading biogas at additional cost, but provides a higher energy content and can be used in natural gas infrastructure. Currently, only one biomethane production facility is operating in NSW. Support is required to increase the production capacity and encourage the use of biogenic fuels.

The scaling potential of biogenic fuels is capped by the maximum available biomass (feedstock) in NSW at any given time and needs to balance environmental and agricultural outcomes (e.g. soil replenishment, biodiversity, water quality and quantity and air quality). Estimates of existing feedstocks suggest that biogenic fuels alone are unable to meet renewable fuel demand.⁹

E-fuels

E-fuels generally require hydrogen, produced through electrolysis as the first step in production. E-fuels are at earlier stages of development and have higher costs than biogenic fuels. They also have greater scaling and export potential than biogenic fuels and can provide long-term emission reduction solutions for hard-to-abate sectors.

E-fuel production costs are expected to fall as supply chains scale up and technology matures. To realise the economy of scale benefits and achieve net zero by 2050, the foundations for e-fuel production capacity need to be established now.

See Appendix A for a list of renewable fuels, their production pathways and uses.

⁹ [Australia's Bioenergy Roadmap](#), prepared by ENEA Australia and Deloitte Financial Advisory for the Australian Renewable Energy Agency.

Renewable fuel policies and programs

A range of initiatives are already underway to develop renewable fuel industries across Australia. This work provides a strong foundation and body of knowledge that can be built upon to develop renewable fuel supply chains at scale in NSW.

NSW Hydrogen Strategy

The [NSW Hydrogen Strategy](#) (the Strategy) sets out the bold vision and pathway to becoming a global first mover in green hydrogen production and use. The Strategy provides up to \$3 billion of incentives through 60 industry development actions that recognise the critical role of hydrogen in decarbonising hard-to-abate sectors and as the building block for many renewable fuels. Key actions of the Strategy include:

- **NSW hydrogen hubs initiative:** the program has awarded \$109 million of grant funding to 3 hydrogen hub projects. With an anticipated production capacity of 700 megawatt electrolyser capacity by 2030, these hubs are critical to decarbonising emissions-intensive industries.
- **Production incentives:** producers can sell green hydrogen at a lower cost by taking advantage of [a range of electricity concessions](#) and the [Renewable Fuel Scheme](#). These incentives are intended to significantly reduce the cost of green hydrogen production. In the Scheme, Green Hydrogen means hydrogen produced using Renewable Energy.

Building on the NSW Hydrogen Strategy

Policies for a range of renewable fuels will diversify energy options for the hard-to-abate industries and ensure all sectors have a viable decarbonisation pathway. Green hydrogen has a vital role both as a feedstock and fuel and as a precursor for other renewable fuels. This means it is important that momentum continues and we build on the progress made to date.

Consultation question:

Question 2

What actions can the NSW Government take to continue support for hydrogen production in NSW?

Other NSW actions

Net Zero Industry and Innovation Plan (NZIIP)

The [NZIIP](#) includes investment of \$360 million to support emissions reductions for high emitting industries, develop new low carbon industries and support the Hunter and Illawarra regions' shift to innovative clean technologies.

Net Zero Manufacturing Initiative

In February 2024, \$275 million in grants were made available under the [Net Zero Manufacturing Initiative](#) to develop new clean technologies and expand manufacturing of low carbon products and components for renewable energy projects.

GreenPower Renewable Gas Certification

GreenPower has expanded to Renewable Gas Certification, which includes biogas, biomethane and renewable hydrogen certification for business customers. This certification provides Australian renewable gas projects with an additional revenue stream from certificate sales to help make them commercially viable. It enables commercial and industrial gas customers to match their fossil gas use with low-emission renewable gas. Ethanol and biodiesel mandate

Current mandates

Under the [NSW Biofuels Act 2007 \(Biofuels Act\)](#), volume fuel retailers must ensure that:

- 6% of the total volume of petrol sold is ethanol (in petrol-ethanol blend)
- 2% of the total volume of diesel sold is biodiesel
- at each of the volume fuel retailer's service stations, a petrol-ethanol blend is available and is as accessible to customers as any other type of petrol at that service station.

NSW Gas Roadmap

The NSW Government has committed to delivering a NSW Gas Roadmap, which will provide clarity to industry and households on gas decarbonisation. The Gas Roadmap is in its early planning stages and will consider targets as part of its development.

Future Jobs Investment Authorities

The Future Jobs and Investment Authorities will support a dedicated focus on coal-reliant regions, to direct investment attraction efforts. This will also include coordinating supporting work programs, including skills and training linked to growth industries, and strategic planning to activate investment opportunities.

Research and tools

NSW Power-to-X

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 initiated a study to identify activities that could realise economic and environmental benefits by accelerating industry deployment. These activities include

- innovation networks
- industry feasibility studies
- education
- outreach
- targeted market analysis
- investment.

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 evaluate feasibility for developing their renewable fuel projects in NSW.

Sustainable Aviation Fuel (SAF) Prospectus

The NSW Department of Primary Industries and Regional Development (DPIRD) has developed a [Sustainable Aviation Fuel Prospectus](#) demonstrating the economic opportunity of a SAF industry in NSW. Modelling found that biogenic SAF is expected to make up around 52% of all aviation fuel in Australia by 2050, with the market value estimated to be \$11.9 billion in Australia and \$4.8 billion in NSW. It is predicted that NSW will need between 4,000 and 4,300 ML/year of SAF by 2050.

BioSmart

DPIRD has developed [BioSmart](#), an interactive spatial tool that determines the potential for using biomass in NSW. In addition to a variety of existing biomass sources, the tool allows users to identify potentially suitable land where woody biomass crops could be planted.

Interstate actions

Victoria

- [Victorian Gas Substitution Roadmap](#)
- [Victorian Renewable Hydrogen Industry Development plan](#)

Queensland

- [Queensland Liquid Fuel Strategy \(in development\)](#)

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- [Queensland Hydrogen Industry Strategy](#)

National actions

National programs are already developing support for renewable fuels, including the [National Greenhouse and Energy Reporting Scheme](#) which has proposed amendments to include sustainable aviation fuel and renewable diesel in addition to biomethane and biodiesel as options for reducing emissions under national carbon accounting methods.

The 2024-25 Federal Budget announced a range of support mechanisms for renewable fuels under the [Future Made in Australia](#) stream, including investigating certification programs for renewable fuels. In June 2024 the Commonwealth released a [Low Carbon Liquid Fuels consultation paper](#) to inform how an Australian low carbon liquid fuels industry will be supported. NSW will work with the Commonwealth to ensure that programs will be developed to complement action across jurisdictions and align intents and outcomes where appropriate, including with other key Australian Government emissions reduction schemes such as the Renewable Energy Target.

International actions

Californian Low Carbon Fuel Standard

The [Californian Low Carbon Fuel Standard \(LCFS\)](#) is a regulatory framework implemented by the California Air Resources Board (CARB) to reduce the carbon intensity of fuel. The LCFS is a trading mechanism that aims to reduce transport emissions. It assigns each fuel a carbon intensity score based on its lifecycle emissions. Fuel producers and importers must meet gradually declining carbon intensity targets or purchase credits to comply with the standard.

United Kingdom Renewable Transport Fuel Obligation

Under the [Renewable Transport Fuel Obligation](#), suppliers of relevant transport fuel in the United Kingdom must be able to show that a percentage of the fuel they supply comes from renewable and sustainable sources.

Consultation question:

Question 3 What could be implemented or learnt from existing policies and programs?

Accelerating renewable fuel development

Renewable fuels are in the early stages of development and are not yet cost-competitive with fossil fuels. Under existing policy settings, industry is unlikely to grow or invest in the renewable fuel production capacity needed to achieve net zero emissions by 2050. A clear policy roadmap and additional government support for renewable fuels can de-risk first-mover projects, cultivate innovation and ease the transition for users until supply chains are established and economies of scale reduce costs.

The recently released Sustainable Aviation Fuel Prospectus notes that SAF production alone could provide a market value of \$4.8 billion for NSW by 2050, while Bioenergy Australia projections indicate that the NSW share of the \$14 billion bioenergy industry could be up to \$2 billion a year by 2030.

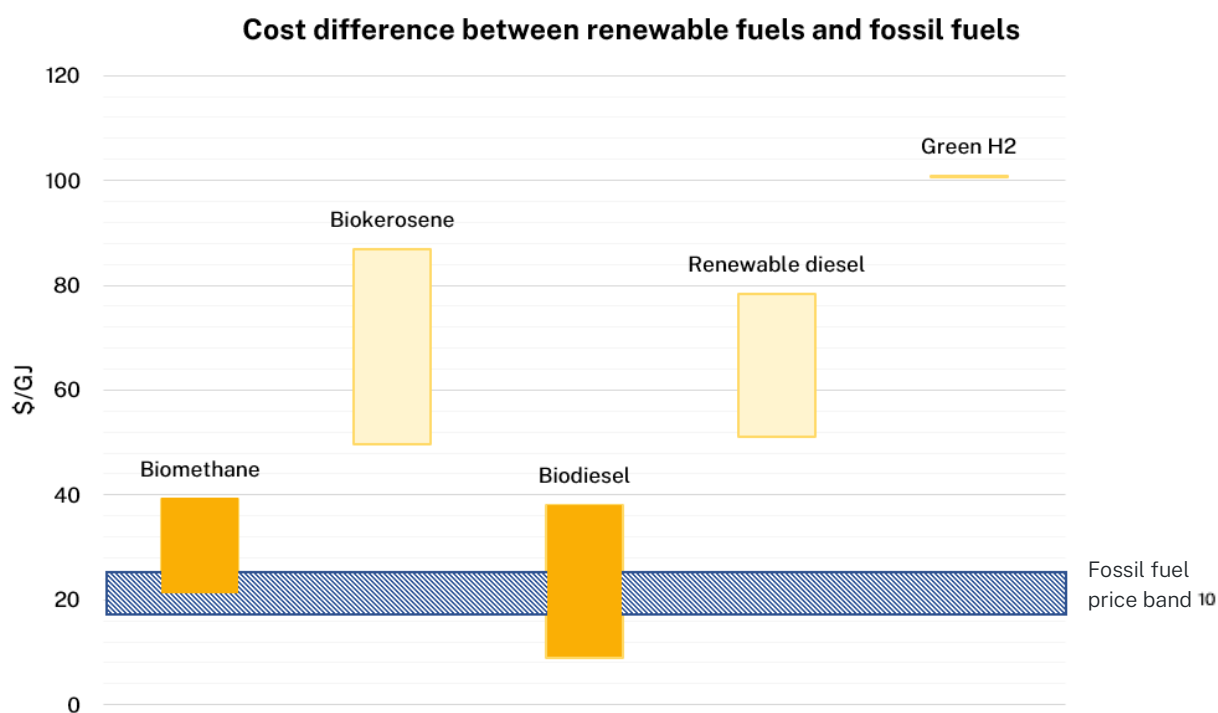


Figure 1 Modelled cost comparison between point-in-time wholesale fossil fuel prices and renewable fuel production costs.

¹⁰ AEMO Inputs, Assumptions and Scenarios (IASR), 2023

Infrastructure

Planning and building infrastructure networks

The production, storage and transport of renewable fuels will require an effective infrastructure network to minimise production costs and deliver circular economy outcomes. As facilities for biofuel production are most economical when located near feedstocks, they will need to be located in regional areas and be serviced by distribution infrastructure. For some renewable fuels, such as biomethane and hydrogen, facilities will also need access to gas networks. Planning and delivery of state-wide infrastructure should be innovative and resourceful to enable accelerated industry growth. This includes leveraging renewable energy zones, Special Activation Precincts, and hydrogen hubs.

Possible actions:

- Undertake infrastructure assessments to identify opportunities and requirements for lowest-cost supply chains
- Investigate opportunities for aggregating feedstock to improve the economics of regional facilities
- Identify and support the repurposing of under-utilised or mothballed facilities that can be used for renewable fuel production

Consultation questions:

Question 4

How can the NSW Government support infrastructure reuse and development that delivers efficient, low-cost renewable fuel supply chains across the state?

Question 5

How can the NSW Government support regional renewable fuel supply? Is there an opportunity to aggregate feedstocks at existing regional facilities such as landfills or wastewater treatment plants to create hubs for renewable fuel production?

De-risking investment

While technologies for developing renewable fuels are already used around the world, few facilities in NSW have progressed to development. Renewable fuel production facilities can involve multiple technologies, adding perceived technology risk. Supporting first-mover projects early on can help identify and minimise potential risks for future projects.

Possible actions:

- Support for renewable fuel facilities to complete feasibility and front-end engineering design (FEED) studies, which will assist with reaching final investment decision (FID).
- Signature demonstration projects (including NSW Government pilots) to reduce technology risk and provide clear roadmaps for future investments.
- Planning support that provides clarity on project assessment requirements (e.g. hydrogen planning guideline).

Consultation questions:

Question 6	Would support for feasibility and front-end engineering and design studies assist with reaching final investment decisions? If so, how is this best delivered?
Question 7	What action would best support investment in these projects or a NSW renewable fuel industry? Are there example projects where this would accelerate development?
Question 8	Should the NSW Government establish renewable fuel demonstration projects? If so, what would be the best model to support these projects?
Question 9	Are there current regulatory gaps or barriers to establishing renewable fuel facilities? If so, what are they and how could they be addressed?

Supporting demand

Providing market signals

Established demand plays a key role in reducing investment risk for renewable fuel producers who must identify a secure customer base before constructing facilities. While the technology for developing renewable fuels is available and industries are developed overseas, the industry is unlikely to grow in NSW without clear demand.

Government policies can use economic measures to establish demand, providing clear signals for increasing production. Targets have been used for renewable energy in the electricity market and tools such as Long Term Energy Service Agreements provide certainty for investors in renewable electricity.

[The Net Zero Plan – Stage 1: 2020-2030](#) sets a priority for the NSW Government to play a leading role in being an early adopter of sustainable goods. The NSW Government purchases around \$30 billion of goods, services and construction each year. As a large-scale customer, the NSW Government can accelerate demand for decarbonised products and services and potentially drive lower prices through economies of scale.

Possible actions:

- Purchase targets for renewable fuels in hard to abate industries
- Mandates, for example green ammonia purchase requirements in mining and/ or other sectors or renewable diesel and biodiesel blending in transport sector.
- NSW Government purchasing requirements including renewable gas and fuels

Consultation questions:

Question 10 How can the NSW Government accelerate the use of renewable fuels?

Question 11 Should the NSW Government set, or redesign existing mandates for the use of renewable fuels? If so, what industries or fuels should be prioritised?

Question 12 Would renewable fuel purchase requirements for the NSW Government's assets support investment in production facilities?

Question 13 Should the NSW Government set targets for renewable fuel use? If so, should these targets be broad or fuel and industry-specific?

Incentivise replacing fossil fuel and adaptation of assets

Fuel users face their own challenges to uptake of renewable fuels, including;

- the higher purchase price of renewable fuel
- unfamiliarity with the technology
- 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, at the same time as establishing supply chains, will be imperative to successfully develop a renewable fuel industry in NSW.

Net Zero Industry and Innovation Investment Plan

The [Net Zero Industry and Innovation Investment Plan](#) already provides opportunities for industrial businesses to apply for funding support to shift to clean technologies.

Possible actions:

- Incentives supporting businesses to increase renewable fuel consumption, and/or switch fossil fuel assets
- Support for research and development in new technical solutions

Consultation questions:

Question 14

What incentives can the NSW Government put in place to accelerate the use of renewable fuels?

Question 15

What support do asset owners need to refurbish or upgrade existing assets for renewable fuel usage?

Accelerating supply

Closing the cost gap and establishing economies of scale

A key barrier to an adequate supply of renewable fuels in NSW is their cost competitiveness, for example, Sustainable Aviation Fuel (SAF) can be 2 to 4 times more expensive than conventional jet fuel.¹¹ In Australia, capital and labour costs can drive production costs upwards. Significant competition for high-quality, low-cost feedstock and renewable electricity will also impact production costs. To support a renewable fuel industry, action needs to be taken to reduce the cost gap between fossil fuels and their renewable alternatives.

There are a range of options for closing the cost gap to help fuel producers compete with fossil fuels. Tax credits, like the recent announcement for hydrogen in the Federal Budget, need to be made at the national level, due to the Australian tax system. There are a number of options that can be undertaken at the state scale. The United Kingdom uses an auction system to guarantee prices for renewable energy production, known as a [contract for difference](#), which covers the difference between the price to produce renewable electricity and the wholesale electricity price. This provides price certainty to new suppliers and investors. In NSW, [Long Term Energy Service Agreements](#) provide revenue certainty for investment in renewable energy generation, with the aim to help secure financing for the construction of new renewable electricity projects.

An expanded Renewable Fuel Scheme could improve the commercial viability of renewable fuel production.

The Renewable Fuel Scheme (Scheme) was established under the [Electricity Supply Act 1995](#). It operates as a market-based certificate scheme, providing an additional revenue stream for renewable fuel producers. Renewable fuel producers can create a certificate for each gigajoule (GJ) of fuel they produce and liable parties are obliged to purchase certificates. In its current design, the scheme only incentivises green hydrogen, with legislated annual production targets increasing to 8 million GJ by 2030.

If the Scheme is expanded to include additional fuels, producers of these fuels would compete for the scheme incentive through the certificate market. Fuels with short-term abatement potential, such as biomethane and biodiesel, are able to generate cheaper certificates and would, therefore, outcompete more expensive fuels like hydrogen or SAF with longer-term

¹¹ [Sustainable Aviation Fuel Roadmap](#), Commonwealth Scientific and Industrial Research Organisation (CSIRO).

emissions reduction potential. To ensure that higher-cost fuels can receive the scheme incentive, they could have individual targets against which certificates must be surrendered. However, each fuel would receive less revenue under the Scheme as a result. Both the benefits of short-term abatement from bio-fuels and the need to commercially develop e-fuels for longer-term abatement should be factored in when considering changes to the Scheme.

If the Scheme is expanded to include other renewable fuels, it would impact the Scheme's cost to liable parties. Accordingly, new liable parties may be required. The current liable parties are gas retailers and large gas users who are not retail customers. See Appendix B and Appendix C for more detail on Renewable Fuel Scheme design.

The Scheme currently has legislated hydrogen production targets for 2024 and 2025. To ensure it aligns with industry developments, the Department intends to:

- In 2024, set a penalty rate for 2026 onwards.
- In 2025, lodge legislative amendments so the Scheme can commence in 2026. This would mean liable parties won't need to surrender certificates to meet 2024 and 2025 targets.

For updates on amendments, visit the [Renewable Fuel Scheme](#) webpage.

Possible actions:

- Explore options for supporting renewable fuels such as contracts for difference or long-term energy service agreements
- Expand the Renewable Fuel Scheme

Consultation questions:

Question 16 What funding mechanisms or support should the NSW Government consider to support innovation and improve the commercial viability of renewable fuel production?

Question 17 Should the Renewable Fuel Scheme be expanded to support other renewable fuels?

Question 18 If the Renewable Fuel Scheme is expanded to include other renewable fuels, who should be the liable parties and why? (See Appendix B for reference)

Question 19 Should the Renewable Fuel Scheme incentivise fuels that offer short-term emission reduction, longer-term emission reduction or a combination? (See Appendix C for more detail)

Developing domestic bio-feedstock supply

Biomass has various applications, all competing for the same limited resource. In Australia, biomass has a range of uses, including animal feed, to create compost and to generate electricity.

Large quantities of biomass are also exported overseas for renewable fuel production. For example, tallow, a by-product of the Australian meat processing industry is primarily exported overseas for renewable fuel production, with the industry passing \$1 billion dollars in export in 2022-23.¹² Over half the Australian canola crop is exported to the European biofuels market.¹³

Crops (crop residues, horticulture residues and non-food crop products) present a significant feedstock opportunity. The theoretical energy potential of biomass crops in NSW is around 145 PJ. They also have limited competing uses, few socioeconomic and environmental-sustainability obstacles.

Possible actions:

- Implement a reservation policy for feedstock, to prioritise and support energy outcomes for local NSW communities.
- Incentives for feedstock producers, to meet market prices currently earned through export of feedstock and encourage the local sale of crops to support renewable energy production.
- Hierarchy of use for bio-feedstocks to prioritise use cases that cannot be replaced by other energy sources.

Consultation questions:

Question 20 How can the NSW Government support feedstock producers for local renewable fuel production (regulatory, research, financial etc.)? What are the potential risks that should be considered?

Question 21 For feedstock producers and businesses currently exporting biomass crops, tallow and used cooking oils for overseas renewable fuel production, would an incentive scheme support the local sale of these important feedstocks?

Question 22 Should a reservation policy be used to keep feedstock on shore to support the local industry?

¹² [Overview of Agriculture, Fisheries and Forestry Exports 2022-23](#), Department of Agriculture, Fisheries and Forestry.

¹³ [Australia's Bioenergy Roadmap](#), prepared by ENEA Australia and Deloitte Financial Advisory for the Australian Renewable Energy Agency.

Question 23

In setting guidelines for renewable fuels, what sustainability measures should be considered? Including food availability and affordability, lifecycle emissions calculations, changes in market prices for agricultural and waste products.

Question 24

Should a hierarchy of use for bio-feedstocks be enforced to prioritise feedstocks for applications where there is no available alternative for decarbonisation?

Value for NSW communities

Return on investment to NSW

NSW could emerge as a leading exporter of renewable fuels.¹⁴ This is driven by the NSW's ability to scale up projects with access to key export terminals and its established trade relationships with energy-importing markets in Asia and beyond. Tapping into multi-billion dollar markets for hydrogen, ammonia and methanol could accelerate economies of scale in NSW, reducing costs for producers and local renewable fuel customers.¹⁵ To claim a share in any of these markets, NSW needs to move quickly.

Appropriate guardrails are required to ensure the cost-to-benefit of export favours NSW communities, balancing emissions reduction objectives, return on investment, local industry development and new jobs against the potential for an increase in domestic power prices that may occur if there is a significant draw on the electricity grid to support an export market for renewable fuels.

Over time, the renewable fuel industry will be expected to contribute to the tax base when it is able and specific government support mechanisms can be retired.

Possible actions:

- Export statement of intent to identify international demand and market NSW's potential contribution. Adopting appropriate export settings that ensure sufficient fuels remain in Australia to support local needs.
- Royalties for NSW from exports of green fuels and electrons, recognising the use of NSW natural resources in production.

Consultation questions:

Question 25 Would a NSW Government-sponsored outline of export opportunities and volumes assist with investment?

Question 26 Should there be a limit on financial support for renewable fuel export projects? If so, what is that limit and when should it apply?

Question 27 How can the NSW Government ensure that the export of renewable fuels benefits NSW communities? Are royalties an appropriate mechanism?

¹⁴ [NSW Hydrogen Strategy](#), the Department; [Sustainable Aviation Fuel Prospectus](#), DPIRD.

¹⁵ [NSW Power-to-X Industry Feasibility Study](#), Office of the NSW Chief Scientist & Engineer.

Building a clean energy workforce

The energy transformation will largely impact regional workforces where emissions-intensive activities have traditionally occurred, or where key renewable energy inputs (renewable electricity and biomass) develop. This presents both a challenge and an opportunity.

New jobs, skills, qualifications, training pathways, technologies and industries will emerge over the next 30 years, particularly in the regions.¹⁶ The bioenergy sector alone has the potential to provide up to 26,200 jobs by the 2030s.¹⁷ Government support is required to develop a workforce with the required skills and training to support the energy transformation. This could include upskilling and reskilling the workforce in fossil fuel and carbon-intensive industries, where skills are transferrable to renewable sectors.

Possible actions:

- Workforce analysis for the renewable fuel industry.
- Skills and training roadmap to identify how skills can be developed for the industry.

Consultation questions:

Question 28

How can the NSW Government, education providers and industry best support the development of skills, training and the workforce needed in a renewable fuel industry?

¹⁶ [The Clean Energy Generation: workforce needs for a net zero economy](#), Jobs and Skills Australia.

¹⁷ [Australia's Bioenergy Roadmap](#), prepared by ENEA Australia and Deloitte Financial Advisory for the Australian Renewable Energy Agency.

Managing market risks

Balancing risk and benefit

States and organisations that take action on renewable fuels first are best placed to establish a strong industrial presence and market share. However, supply chains for liquid fuel and gas are complex, crossing interstate and national borders. Organisations in first-mover jurisdictions will likely be exposed to additional challenges that require appropriate management. Otherwise, additional burdens may lead industries to relocate to regions with weaker carbon regulations.

Some mechanisms may be more effective if implemented across Australia, or uniformly across multiple states. Delays in support will also delay industry development and, consequently, emission reduction. The challenge for NSW is to accelerate decarbonisation while maintaining our existing competitive advantages of renewable energy and feedstock availability.

Renewable fuels can provide both a short-term bridge for decarbonisation where electrification is unlikely or not yet available, and long-term solutions for energy and industrial feedstocks. Where drop-in fuels are a bridge, policy design should support a transition as technological advancement occurs.

Possible actions:

- Engage with states and Commonwealth Government to establish appropriate market mechanisms, targets or mandates.

Consultation questions:

Question 29

How can the NSW Government support companies and industries with cross-border markets to decarbonise?

Question 30

How can the NSW Government encourage a fuel transition that aligns with technological advancement?

Building community understanding

A key part of building a renewable fuel industry in NSW will be ensuring that industry and the community are aware of what renewable fuels are and the benefits that they will provide.

These benefits include:

- meeting our net zero targets
- providing employment
- improving air quality
- supporting regional communities.

There should also be accessible information on the steps that will need to be taken and sharing of collective responsibility to facilitate the renewables transition.

Possible actions:

- Develop educational tools and materials.

Consultation question:

Question 31

What information should be provided to industry and the community to build an understanding of renewable fuels? How is this information best delivered?

Definitions

Table 2 Terms and definitions

Term	Definition
Emissions abatement	A reduction in atmospheric greenhouse gases through emissions avoidance or removal from the atmosphere.
Emissions	<p>Emissions, refers to the release of greenhouse gases including carbon dioxide, methane, nitrogen dioxide.</p> <p>There are 3 types of emissions.</p> <p>Scope 1 emissions are released as a direct result of activities at a facility</p> <p>Scope 2 emissions are released outside the facility boundary, but are released to produce the electricity used at the facility.</p> <p>Scope 3 emissions are also indirect emissions, other than Scope 2. Occurring upstream (extractions of fossil fuels) or downstream from the facility (transport of goods).</p>
Greenhouse gases	Greenhouse gases are gases that absorb heat from the Earth's surface and re-radiate it back, keeping heat trapped in the atmosphere like a greenhouse.
Feedstock	Feedstock refers to a product used as an input to industrial processes. In renewable fuel production feedstocks are generally organic matter, renewable electricity and water.
Mandate	A directive required by law.
Reservation policy	A government policy that sets a level of product to be retained for local use.

Appendix A

Types of renewable fuels

Table 3 Renewable fuel production pathways and uses

Fuel	Renewable production pathway	Use
Green hydrogen	Can be produced through a range of pathways including; splitting water through electrolysis with renewable electricity and steam reformation of biomethane.	<ul style="list-style-type: none">• Blending into the natural gas network.• Powering heavy transport, ships, rail and aircraft.• As a feedstock.• Power generation
Biomethane	Primarily produced by 'upgrading' biogas to increase the purity of methane.	<ul style="list-style-type: none">• Combusted for heat, particularly in manufacturing processes.• Blending into the natural gas network.
E-methane	Combining renewable hydrogen and a renewable carbon feedstock with a catalyst.	<ul style="list-style-type: none">• Combusted for heat.• Blending into the natural gas network.
Green ammonia	React renewable hydrogen and nitrogen from the air at high temperature and pressure.	<ul style="list-style-type: none">• Making fertiliser and explosives.• Emerging use as a marine fuel, and as an energy carrier for export.
Methanol	Combine renewable hydrogen with steam and a carbon feedstock in a reactor with a catalyst.	<ul style="list-style-type: none">• Producing plastics and synthetic fibres.• Emerging use as a marine fuel and competitor with ammonia to decarbonise shipping.

Fuel	Renewable production pathway	Use
BioKerosene and E-Kerosene (Sustainable Aviation Fuels)	Various production pathways, including sourcing hydrogen and carbon from solid waste and reacting together or refining fats and waste products using renewable hydrogen. (same production pathways as renewable diesel)	<ul style="list-style-type: none"> Blending into aviation fuel (BioKerosene). Emerging use as a drop-in fuel to power aircraft (E-Kerosene).
Bio Diesel	Biodiesel can be produced by various methods including reacting vegetable oils or animal fats with an alcohol (i.e methanol).	<ul style="list-style-type: none"> Can be blended with existing diesel. Blending limits apply - Australian diesel fuel standard allows up to 5% in pump fuel, engine manufacturers have limits up to around 10% blend.
Renewable Diesel	Various production pathways, including sourcing hydrogen and carbon from solid waste and reacting together or refining fats and waste products using renewable hydrogen. (same production pathways as biokerosene)	<ul style="list-style-type: none"> Drop in alternative to fossil diesel fuel. For use in transport, agriculture, marine and stationary energy generation.
Renewable Liquefied Petroleum Gas (rLPG)	By-product of renewable diesel and sustainable aviation fuel production.	<ul style="list-style-type: none"> Could replace fossil fuel LPG which is combusted for heat, sold in canisters for residential heat and in some manufacturing processes in regional NSW.
Ethanol	Fermenting sugar from food grade, waste grain, corn starches, or sugar cane residue.	<ul style="list-style-type: none"> Drop-in fuel with existing petroleum products. May be blending limits.

Fuel	Renewable production pathway	Use
Biochar	Controlled heating of plant or animal material at high temperatures (300 to 600 degrees) in a low-oxygen environment.	<ul style="list-style-type: none">• A form of charcoal that can be used as a feedstock, as an industrial agent, e.g. in steel making. It is also used as an agricultural soil enhancer.

Appendix B

Current Renewable Fuel Scheme design

Table 4 Renewable Fuel Scheme design features as currently legislated

Feature	Description
Production targets	Increasing to 8 million GJ per year from 2030
Penalty rate	Amount paid by a liable party for each certificate it fails to surrender against its liability under the scheme target
Eligible activities	Green hydrogen production
Certificates	Represents 1 GJ of green hydrogen and is tradable for 3 years
Liable parties	Natural gas retailers and large users without a retailer
Individual liability	Share of natural gas used in NSW
Scheme duration	2024 to 2044 (20 years), compliance commencing 2026***
Administrator and Regulator	The Independent Pricing and Regulatory Tribunal (IPART)

Table 5 Renewable Fuel Scheme targets as currently legislated

Year	Gigajoule	Equivalent tonnes of hydrogen*	Megawatt equivalent**
2024***	90,000	750	5
2025***	360,000	3,000	21
2026	890,000	7,417	53
2027	1,780,000	14,833	106
2028	3,200,000	26,667	190

Year	Gigajoule	Equivalent tonnes of hydrogen*	Megawatt equivalent**
2029	5,330,000	44,417	317
2030-2044	8,000,000	66,667	476

* Assuming lower heating value of 120 MJ per kilogram of hydrogen.

** Estimated assuming 140 tonnes produced per year per megawatt of electrolyser capacity.

*** The Department intends to make legislative amendments in 2025 so that the Scheme can commence in 2026. This would mean liable parties won't need to surrender certificates to meet 2024 and 2025 targets.

Appendix C

Expanded Renewable Fuel Scheme design options

Renewable fuels

Green hydrogen is currently the only renewable fuel with a production target under the scheme. While green hydrogen will be critical to achieving net zero emissions by 2050, so will other fuels made from renewable resources. An expanded Scheme could support additional fuels, see Appendix A for a list of renewable fuels, their production pathways, and potential uses to support net zero emissions.

Liable parties

Table 6 below summarises possible liable parties and the relationship between those parties and renewable fuels. For more information on liability please review the [Renewable Fuel Scheme frequently asked questions](#).

Table 6 Potential liable parties and their relationship to fossil fuel use

Potential liable party	Existing and continued fossil fuel use
Gas users (current liable parties)	<p>While demand from residential and commercial consumers is forecast to decrease because of electrification, AEMO forecasts demand from large industrial customers will continue to 2050.</p> <p>Gas users and networks could be primary beneficiaries of biomethane as it would mostly substitute fossil natural gas. Over time this would decarbonise consumers' gas use and could leverage existing gas network assets to deliver renewable energy.</p> <p>Gas users and networks could also benefit from hydrogen through blending into gas networks and from the use of hydrogen to increase biomethane production by increasing yields from biogas (i.e. methanation of the carbon dioxide in biogas).</p>

Potential liable party	Existing and continued fossil fuel use
Liquid fuel users (wholesalers or retailers)	<p>Petrol use and a portion of diesel use are expected to switch to electricity. However, aviation and some diesel use will rely on renewable fuels to decarbonise.</p> <p>Diesel and aviation fuel users would be the primary beneficiary of renewable diesel and SAF in the scheme as this will reduce their emissions. They will also benefit from hydrogen as an alternative fuel option in heavy transport and as a feedstock to renewable diesel and SAF production.</p>
Mine operators	<p>Mining operations are the biggest consumer of existing hydrogen produced in NSW in the form of ammonium nitrate-based explosives, equivalent to about 8 PJ of natural gas per annum. Mining operations across NSW also consume approximately 50 PJ of diesel per annum.¹⁸</p> <p>Hydrogen and renewable diesel could provide decarbonisation options to replace existing diesel consumption for remote power generation and vehicles on mining sites. Hydrogen could also reduce scope 3 emissions attributed to ammonium-nitrate explosives.</p>

Targets

When setting target/s for an expanded scheme, incentives for short-term and cost-effective decarbonisation must be balanced against establishing scalable renewable fuel supply chains for longer-term emission reduction. Table 7 summarises the advantages and disadvantages of target design options:

¹⁸ Department estimates based on aggregated National Greenhouse and Energy Reporting information.

Table 7 The advantages and disadvantages of target design options

Target option	Outcome
<p>Single fuel agnostic target</p>	<p>In certificate schemes like the Renewable Fuel Scheme, markets will drive the lowest cost pathway to meet a target. The subsidy required to achieve parity with fossil fuel prices is much lower for biodiesel and biomethane than other renewable fuels (i.e. renewable diesel, SAF and green hydrogen).</p> <p>Modelling demonstrates that in a single target scheme, green hydrogen would only be incentivised for a short time until production facilities for biodiesel and biomethane establish. High production costs of SAF and renewable diesel mean they are unlikely to receive any incentive.</p> <p>Biodiesel and biomethane have drop in capability, in the short term but biogenic fuels have limited scalability to achieve longer term net zero targets.</p> <p>A single fuel target would maximise cost-effective and short-term emissions abatement, but not provide incentives to produce fuels that have a role in longer-term abatement</p>
<p>Single fuel agnostic target, excluding biodiesel and biomethane</p>	<p>In a single target scheme excluding biodiesel and biomethane, sustainable aviation fuel would dominate the scheme design as it is closer in price to with aviation fuel, than green hydrogen is with its fossil fuel alternatives. It is likely that renewable diesel would also be incentivised throughout this period being produced in the same production process as SAF. However, demand industries for renewable diesel would need to rival interest demonstrated by the aviation industry.</p> <p>This design only incentivises long term abatement options and does not leverage the opportunity biogenic fuels offer as drop-in solutions to reduce emissions in the immediate term.</p>

Target option	Outcome
Separate targets for green hydrogen and SAF (including renewable diesel)	<p>A scheme with separate targets for green hydrogen and sustainable aviation fuel could also incentivise biomethane and biodiesel. It is likely that renewable diesel would be incentivised throughout this period being produced in the same production process as SAF.</p> <p>This scheme design incentivises short-term abatement options and fuels that are required in the long term but currently have a high-cost gap compared to existing fossil fuels. Separate targets would however limit the total amount of fuel incentivised through the scheme while keeping costs down.</p>



For more information

For more information about this discussion paper and consultation or the Renewable Fuel Scheme, visit our website or contact us by email.

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