Tasmania's Clean Fuel Future

A Submission on the Draft Future Clean Fuels Strategy

July 2025

Tasmanian Policy Exchange
at the
University of Tasmania

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Acknowledgment of Country

We acknowledge the palawa/pakana of Lutrutwita, the traditional owners of the land upon which we live and work.

We pay respects to Elders past and present as the knowledge holders and sharers. We honour their strong culture and knowledges as vital to the self-determination, wellbeing and resilience of their communities.

We stand for a future that profoundly respects and acknowledges Aboriginal perspectives, culture, language and history.

Acknowledgments

We would like to acknowledge the numerous colleagues from across the University and partners who have contributed to the TPE's climate change research and policy analysis, which underpins much of this submission. The views in this submission are those of the authors from the TPE, and not the University of Tasmania.

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The TPE also works with staff from across the University of Tasmania to develop evidence-based policy options and longer-term collaborations.

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- #8 Beyond the 2025 State Budget: Policy priorities for the next Parliament
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The TPE's recent submissions and reports include:

- *Energy in Tasmania: Submission to the Legislative Council Inquiry into Energy Prices in Tasmania* (October 2024)
- *Tasmanian forests and the carbon market: Barriers and opportunities* (August 2024)
- *Tasmania's sustainable transport future: Submission to the Draft Transport Emissions Reduction and Resilience Plan* (November 2023)

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Executive summary

We are at a critical juncture in the global energy transition. Good progress is being made in decarbonising electricity generation, and now we need to focus on reducing our dependence on fossil fuels through both electrification and the development and production of clean alternatives.

This brief submission to the Tasmanian *Future Clean Fuels Strategy* outlines our assessment of the emerging industry, as well as detailing high-level principles and policies to support the development of the industry and uptake in Tasmania. Our primary focus is on state-level policy, but given the complexity of the issues and vast investment required, we also identify national priorities. Establishing a viable clean fuel industry in Tasmania will require the alignment of national incentives and market design policy with state-level coordination.

Tasmania's electricity system may be dominated by renewables but over half of the state's total energy use comes from fossil fuels including diesel, petrol, natural gas and coal. The Tasmanian *Future Clean Fuels Strategy* should aim to support the production of low- or zero-emissions alternatives to these fossil fuels to power our future industries and transport system.

The technology for clean fuel production is evolving rapidly and a wide range of clean fuel options are being developed for various applications. While many clean fuels are derived from green hydrogen, the focus on green hydrogen as a fuel or a means of energy storage is waning around the world – it is proving too expensive and energy intensive to produce, store and use. Few if any green hydrogen projects are proceeding in Australia at scale.

The focus now is on alternative "clean fuels", some of which can be used as "drop in" low- or zero- carbon alternatives to petrol, diesel and even aviation fuel. While there is much potential, associated costs and the need to develop new technology at scale are major barriers.

Despite these challenges, Tasmania has many of the resources and assets to support the development of a future focused, sustainable clean fuel industry which delivers long-term benefits to the Tasmanian community.

While a Tasmanian clean fuels industry may initially have an export focus, both state and federal policies should ensure clean fuels are available for domestic use to support emissions reduction and future industries.

Federal leadership and investment will be required to establish a sustainable clean fuels industry in Australia. The aim of the Tasmanian *Future Clean Fuels Strategy* must align with and leverage federal initiatives to ensure that we are investment ready and able to capitalise on opportunities for the long-term benefit of the State. The principles which should inform the development of a Tasmanian clean fuel strategy are:

1. Any **public investment** to increase production must: be **time-limited**; leverage **private investment**, and; decrease over time with a primary focus on the **domestic market**. Subsidising production for export should be restricted to cases where there are clear domestic cost benefits through scaling production.
2. **Incentives** to encourage **domestic demand/consumption** should align with existing **climate policies** and only be applied once the supply of clean fuels has been established.
3. Policies to promote clean fuel production must ensure the **sustainable use of natural resources** and **renewable electricity** and be consistent with **circular economy** principles.
4. Clean fuel and associated renewable energy projects must deliver long term **community benefits** and **legacies**, and be informed by **regional systems modelling** and **community collaboration**.

The Tasmanian Government's role in developing clean fuels

Beyond the principles out lined above, the Tasmanian Government has an important supporting and enabling role in the development of a clean fuels industry and market. Specific policy priorities include:

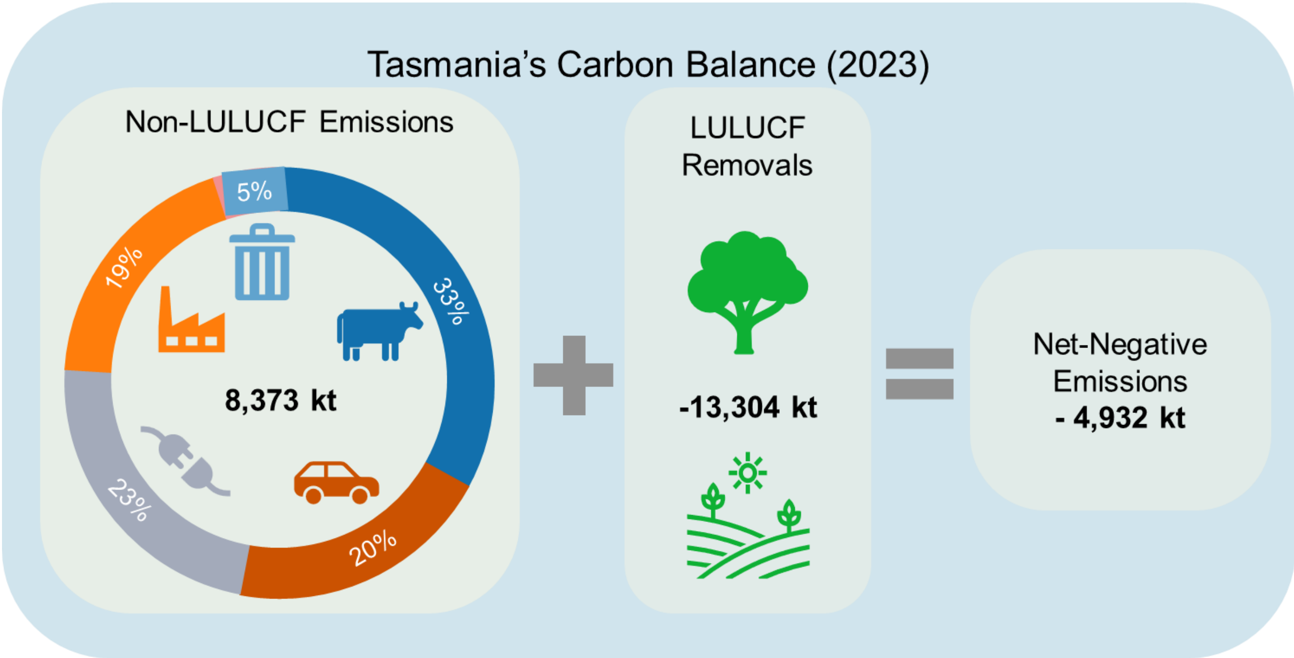
- A clear focus on supporting and enabling sustainable clean fuel projects, with a domestic offtake, that meet sustainability and community benefit tests.
- Conduct rigorous return on investment analysis for any public investment.
- Consider state-level clean fuel mandates to leverage any national policy. Both NSW and Queensland mandate low bio-diesel and ethanol blends.
- Ensure local offtake in return for public investment. Hard-to-abate industries should have preferential supply.
- Support local businesses and industries to convert processes, vehicles and vessels to clean fuels.
- Enabling functions include:
    - Integrated planning and approval support and processes
    - Expedited energy supply and grid connections
    - Coordinate GBEs to ensure resource inputs/supply
    - Leverage existing industrial infrastructure
    - Develop and deliver a workforce plan.
- Partnering with host communities and invest in social and community infrastructure especially housing and services. Political support for a clean fuels industry will depend on delivering long-term community benefits.

Establishing a sustainable clean fuel industry in Tasmania will help drive decarbonisation here, on the mainland, and in other parts of the world, while creating stable and well-paid jobs in regional areas of the State. However, the development of a clean fuels industry must be done sustainably and in partnership with host communities to deliver long-term community benefits.

1. Introduction

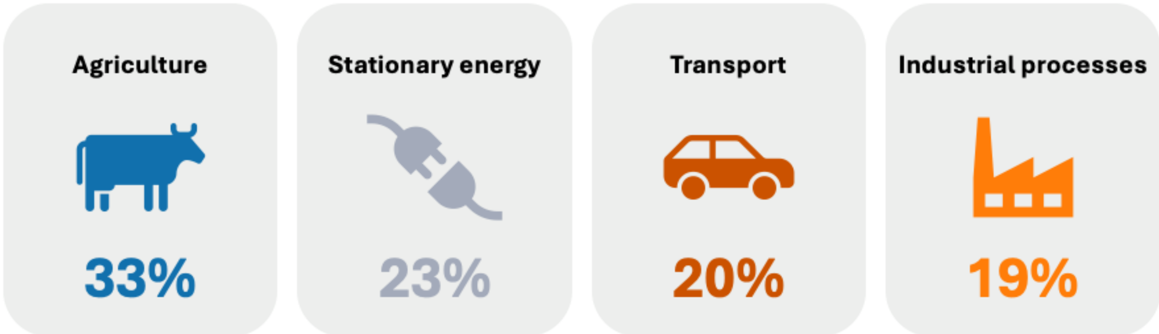
Tasmania has held a unique and enviable position in Australia's emissions landscape for over a decade. As of the latest State and Territory Greenhouse Gas Inventories (STGGI), Tasmania has been at net zero for twelve consecutive years.[1] This is a notable achievement for the State, due largely to our long-standing use of renewable hydroelectricity and significant increases in carbon being stored in our trees and soils.

Figure 1: Tasmania's carbon balance (2023). Source: State and Territory Greenhouse Gas Inventories (STGGI) 2023



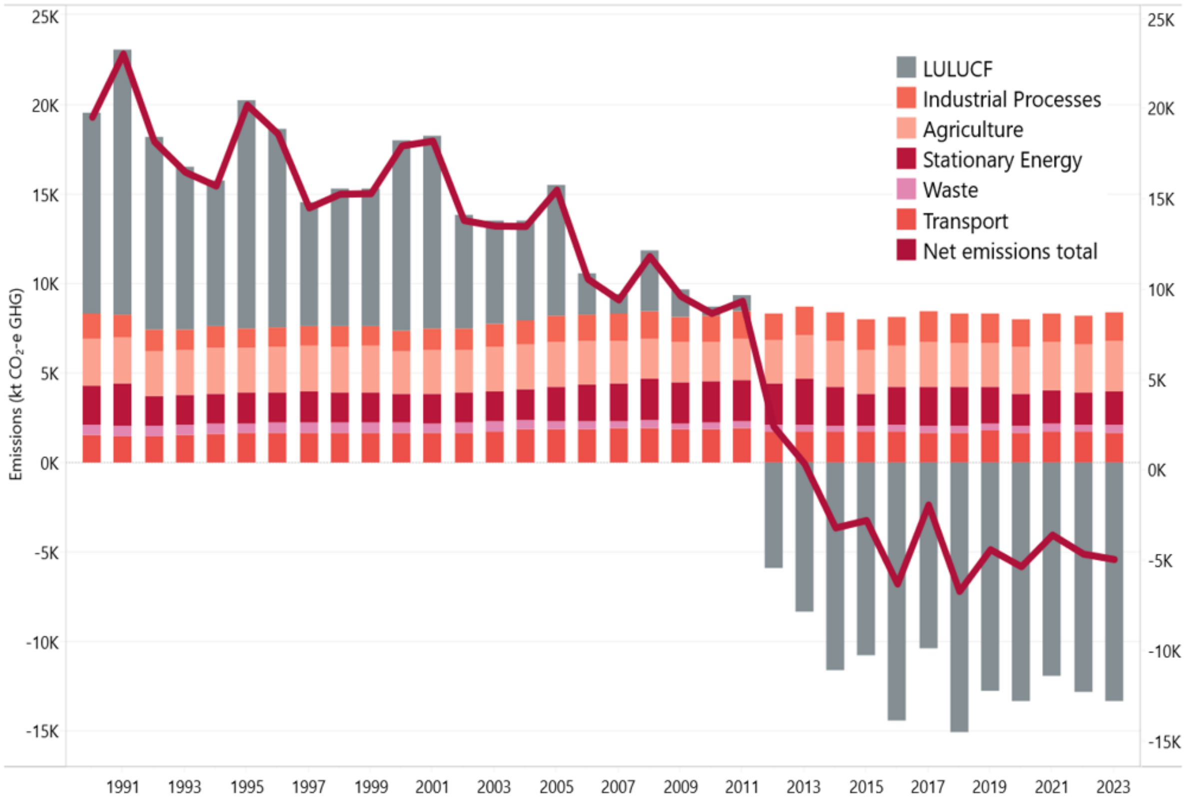
While net emissions remain below zero (Figure 1), Tasmania's absolute emissions have remained largely unchanged for the past 30 years (Figure 2).

Tasmania's absolute emissions come mostly from four sectors:



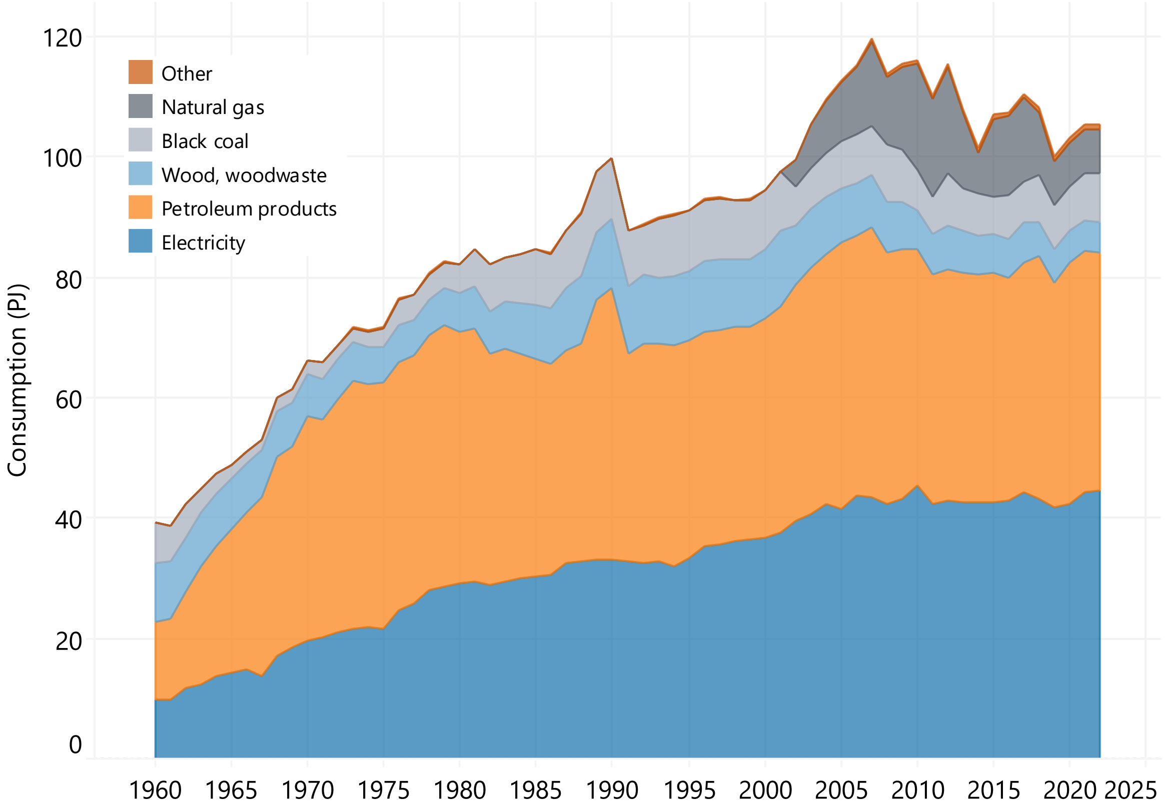
[1] Australian Government – Department of Climate Change, Energy, the Environment, and Water (2023), State and Territory Greenhouse Gas Emissions, https://www.dcceew.gov.au/climate-change/publications/state-and-territory-greenhouse-gas-inventories

Figure 2: Tasmania's absolute emissions by sector, 1990 – 2023. Source: State and Territory Greenhouse Gas Inventories, 2023



Within these sectors, the use of diesel, petrol, gas, and coal are both the major source of emissions and central to the Tasmanian economy, and still account for more than half of energy consumed (Figure 3).

Figure 3: Fuel consumption in Tasmania by type, 1960-2022. Source: Australian Petroleum Statistics

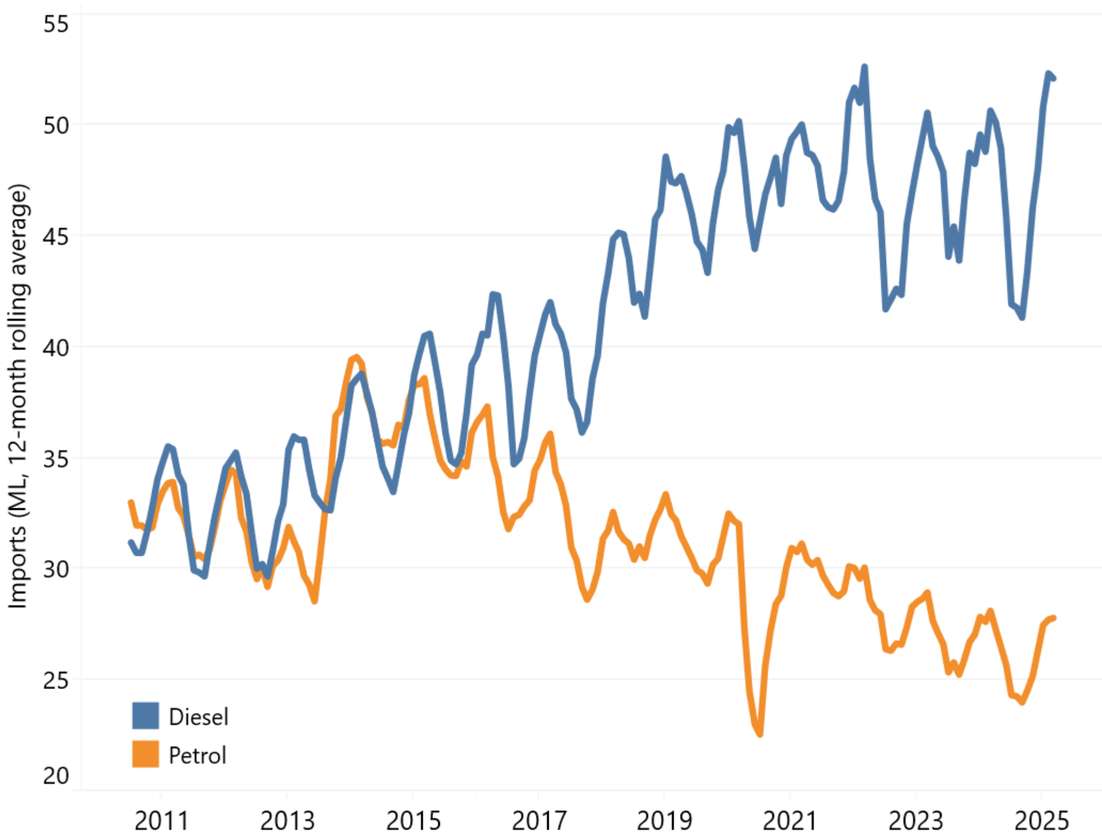


Petrol use in Tasmania is gradually declining due to more efficient cars and the uptake of electric vehicles. However, diesel consumption is increasing due to growing freight volumes, the popularity of diesel-powered vehicles and industrial processes (Figure 4).

Our reliance on fossil fuels creates several risks for Tasmania. As an island state, Tasmania is especially vulnerable to disruptions in fuel supply. All of the diesel and petrol used in the State must be imported which means any interruptions to production, supply or shipping impacts the economy and Tasmanians.[2]

[2] Tasmanian Government (2024), *State of Play Report: Tasmania's energy sector*, https://recfit.tas.gov.au/__data/assets/pdf_file/0005/533966/State_of_Play_Report_-_Tasmanias_energy_sector.pdf; The Australia Institute (2022), *Over a barrel: Addressing Australia's Liquid Fuel Security*, https://australiainstitute.org.au/wp-content/uploads/2022/04/P1036-Over-a-barrel_liquid-fuel-security-WEB.pdf

Figure 4: Monthly fuel imports to Tasmania, 2010-2024. Source: Australian Petroleum Statistics



This is problematic for Tasmania in a few ways – while we sometimes produce enough renewable energy to cover 100% of our current electricity needs, there is not enough generation to support new industries or continued electrification. As the recent difficulties faced by the Boyer Paper Mill to convert to electric boilers has shown, Tasmanian industries will not be able to decarbonise their operations unless there is enough clean energy to do so at reasonable cost.[3] The production of most clean fuels also requires significant, additional renewable electricity, in a timely fashion. Failure to increase renewable generation capacity will see investment in clean fuel projects lost to other jurisdictions.[4]

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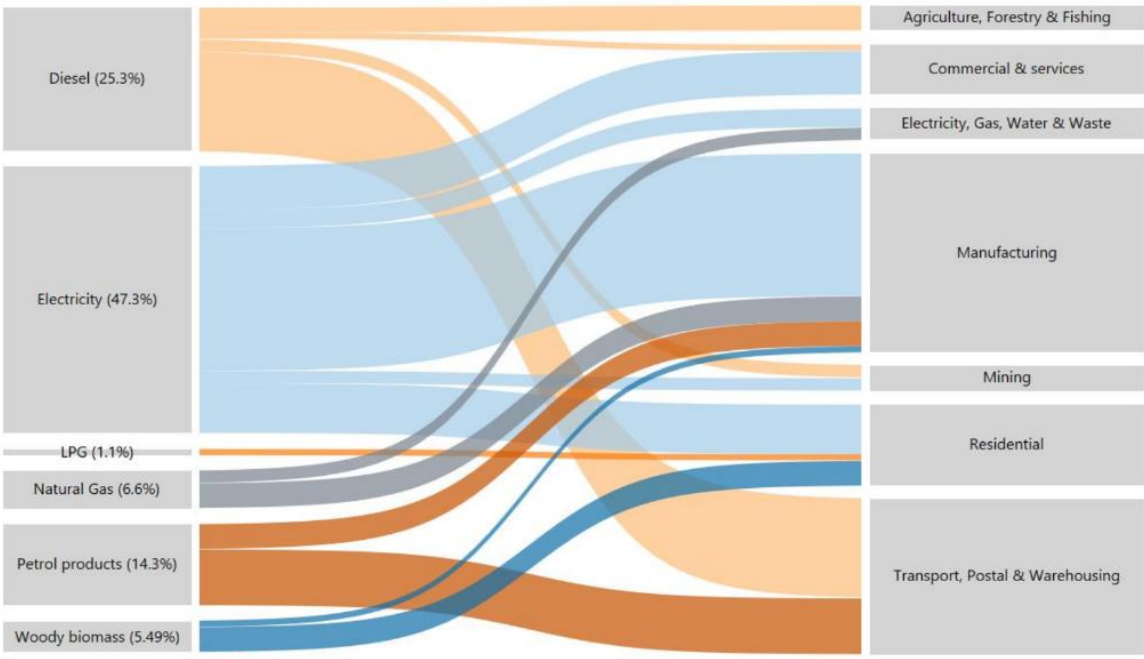
[3] Duggan, J. (2025), *Australia's last paper mill, Boyer, told of insufficient local power for electric conversion*, ABC News, June 2025, https://www.abc.net.au/news/2025-06-30/boyer-paper-mill-coal-to-electric-plans/105472606

[4] As defined in the Strategy, clean fuels are gases, liquids or solids that have lower greenhouse gas emissions than fossil fuels across their entire lifecycle, https://recfit.tas.gov.au/what_is_recfit/future_industries/draft-future-clean-fuels-strategy

Figure 5: Fuels and their uses in Tasmania: Source: Australian Energy Statistics, https://www.energy.gov.au/energy-data/australian-energy-statistics

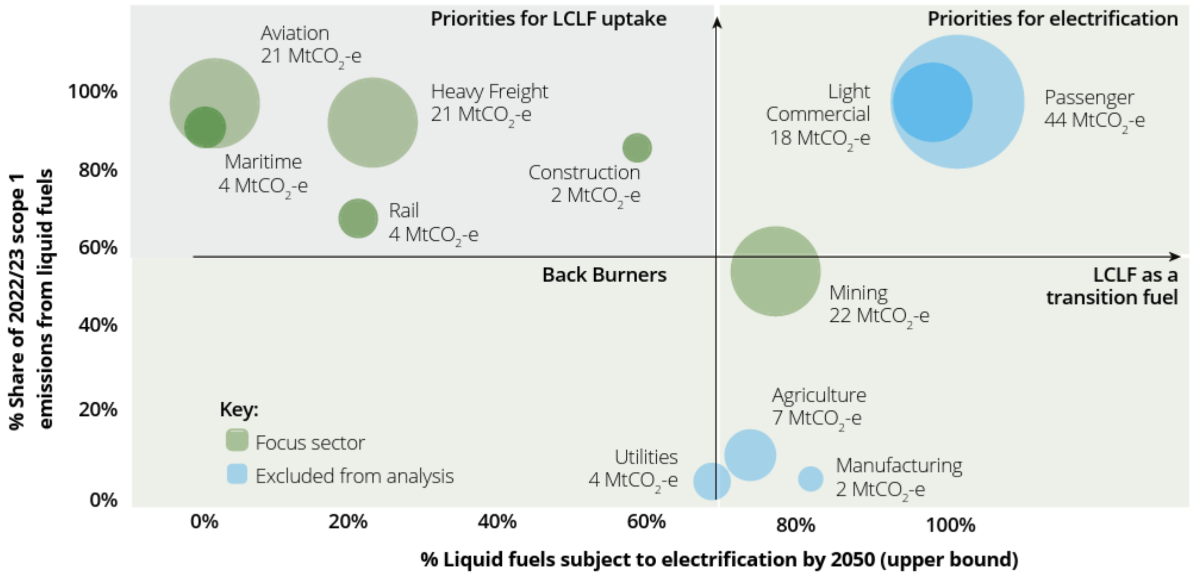


Electrification, while essential, will not be a universal solution. In many sectors, switching to electricity is not technically feasible, economically viable, or logistically practical. This is where clean fuels can play a part in tandem with renewable electricity. They offer an important pathway to:

- Decarbonise sectors that are difficult to electrify, such as heavy transport, maritime freight, aviation, and some industrial heat applications
- Enhance Tasmania's energy security and reduce reliance on imported fossil fuels
- Support community and economic development, including new export industries and skilled regional employment
- Maintain and extend Tasmania's climate credentials, ensuring that we reach our 2030 emissions goals and contribute to Australia's net-zero by 2050 target.

The Clean Energy Finance Corporation has identified priority sectors for transition to clean fuels (Figure 6).

Figure 6: Identifying priority sectors for clean (or low-carbon liquid fuels – LCLF) fuels uptake. Source: CEFC, https://www.cefc.com.au/media/jh3gvm14/refined-ambitions-exploring-australia-s-low-carbon-liquid-fuel-potential.pdf



Tasmania, with the right policy settings and investment environment, is in a relatively good position to take advantage of this opportunity.

Tasmania has several assets to support clean fuel production including:

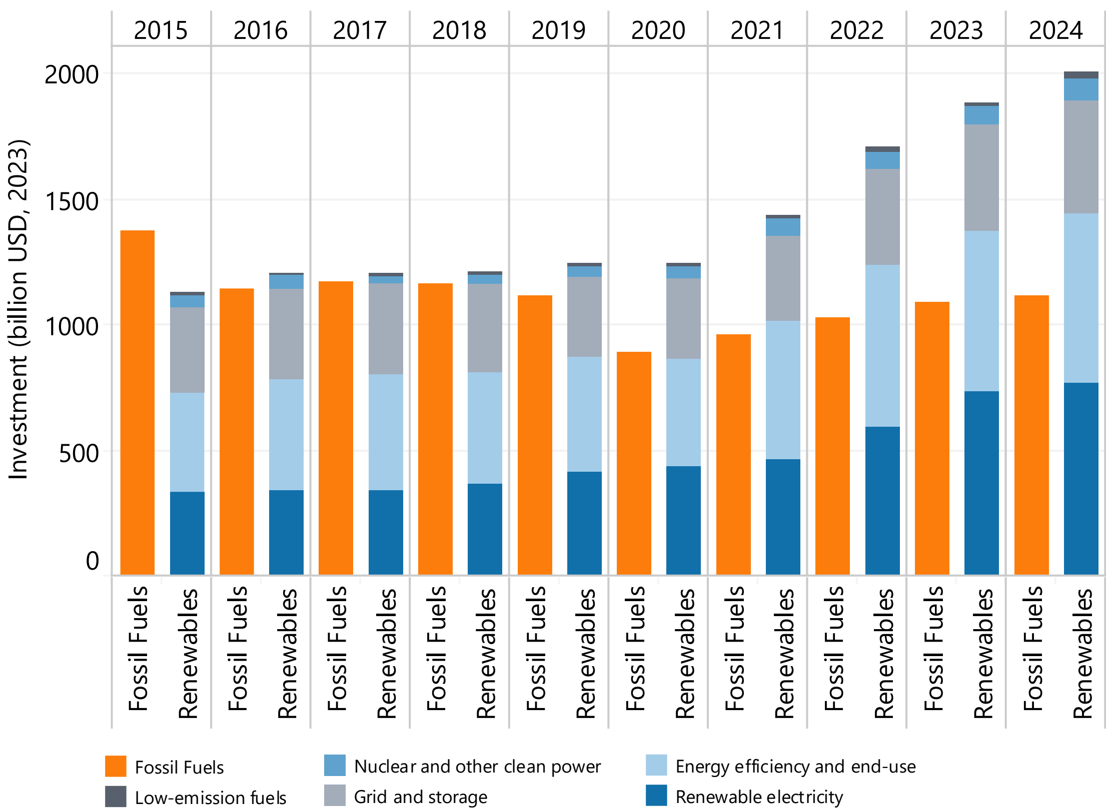
- Relatively abundant water
- Carbon sources including plantation forest residues
- Renewable electricity resources (while noting additional generation capacity will be required)
- Port infrastructure (Burnie and Bell Bay) and industrial land and associated infrastructure (such as the Bell Bay Advanced Manufacturing Zone – BBAMZ).

Several large projects are already in development, such as those focused on green methanol, e-fuels and biomethane. More focused and effective strategic planning, coordination and policy support from both the Tasmanian and Australian governments will be required to achieve at-scale investment in clean energy projects. The clean fuels transition is complex – it involves emerging technologies, high costs, and significant investment. But with strong state and national planning and leadership, Tasmania can play a key role in Australia's transition to clean fuels while also decarbonising the State economy.

2. Global clean fuel trends

Around the world, investment in clean energy is almost twice as much as in fossil fuels (see Figure 7 below). "Clean energy" here includes hydro- and solar electricity, as well as nuclear power and low-emissions fuels.

Figure 7: Global investment in fossil fuels and clean energy, 2015-2024. Source: IEA https://www.iea.org/reports/world-energy-investment-2024/overview-and-key-findings



Renewable electricity has been a focus globally for achieving emissions reduction, but attention is now also turning to the development of fossil fuel replacements, especially for applications that cannot easily be powered by renewable electricity. As such, investment in low-emissions fuels is rising rapidly, but from a very low base: in 2024, it received less than 4% of overall capital spending (see Figure 6). With more development, research and trials in process, the suitability and costs of different clean fuel types for different applications is becoming clearer.

While there was an expectation that green hydrogen would be the technology of choice to decarbonise the economy, it has become apparent that there are cleaner, safer and cheaper technologies that can be used in applications not suited to electrification.[5] The

[5] See for example: Purtill, J.(2021), What is green hydrogen, how is it made and will it be the fuel of the future, *ABC News*, 23 January 2021, https://www.abc.net.au/news/science/2021-01-23/green-hydrogen-renewable-energy-climate-emissions-explainer/13081872

focus is turning to a range of clean fuels that can be used in blends with fossil fuels or as direct diesel or petrol substitutes.

A technical and financial challenge for clean fuels is that they are generally less energy dense than conventional fossil fuels (see Figure 10, for example). This is where policies that emphasise the cost in terms of carbon emissions will be vital to develop new clean fuel technology and usage (see Section 4 below for a discussion of policy options).

While there is a wide variety of clean fuels in development, we limit discussion here to the four broad types most relevant to production and/or use here in Tasmania. These are:

- Green hydrogen (and green ammonia)
- Diesel and petrol alternatives
- Biogas and biomethane
- Green methanol.

2.1 Green hydrogen

"Green hydrogen" is hydrogen produced using renewable energy through a process where hydrogen is split from water.[6] It can be in a gaseous or liquid form.

It was anticipated that green hydrogen would help decarbonise new industries – including shipping and transport – or replace emissions-intensive fertilisers. Green hydrogen can also be used in fuel cells to produce electricity for vehicles, as energy storage and as a fuel in industrial uses. As a liquid, hydrogen may be used in its pure form, or as a hydrogen derivative such as green ammonia or green methanol. There have been hopes that Australia could establish a liquid green hydrogen export capability.

The major benefit of hydrogen as a fuel is its potential for almost no emissions. Unfortunately, there are significant barriers to its production, distribution and use that are proving difficult to break through.

Challenges for these new hydrogen applications include:

- **Cost** – To be cost competitive with fossil fuel hydrogen (let alone, with battery electric technology), green hydrogen needs to be produced at around $2 AUD per kilogram – this is known as the 'H2 under $2' benchmark that has been set by the Australian Government. With significant financial support and investment, current operation costs are estimated to be between $5 and $6 AUD per kilogram. This is due to a number of factors, including high input prices (i.e.,

[6] Rocky Mountain Institute (RMI) (2022), Hydrogen Reality Check: All "Clean Hydrogen" is not equally clean, https://rmi.org/all-clean-hydrogen-is-not-equally-clean/; Climate Council (n.d), What is Hydrogen?, https://www.climatecouncil.org.au/resources/what-is-hydrogen/

renewable energy prices and availability, water and water purification costs), as well as the capital expenditure and supply chain issues.

- **Access to resources** – The production of green hydrogen requires a considerable fresh water supply. Additional infrastructure, such as desalination plants may need to be developed and maintained to achieve levels of water that are required. Given also that renewable energy is needed to produce green hydrogen, jurisdictions will need to increase their renewable energy production in order to facilitate scaling up of green hydrogen.
- **Storage and distribution** – Green hydrogen is not suitable for export as a product itself due to transportation difficulties (including its highly reactive and explosive nature) – as Alison Reeve says, it's "a tricky gas to handle".[7] To be used in place of natural gas for heating and cooking, a whole new infrastructure system would be needed to be developed. As noted above, hydrogen cannot be used in traditional internal combustion engines but relies on fuel cell technology to produce electricity.

Given the costs involved, green hydrogen production seems to be a more appropriate solution for niche applications rather than as a general decarbonisation technology. Applications where hydrogen has been produced on-site, such as using green hydrogen in the process of manufacturing other products, may make the most sense due to hydrogen's volatility and the associated storage and transport challenges. The IEA advises that traditional applications of hydrogen, such as refining and the chemical industry, are where investments in green hydrogen should be prioritised. Such investments are lower risk than finding new sources of demand, such as in transport and as fuels.[8] Electrification is already proving itself to be a mature, lower-cost option for emissions reduction across many applications in transport, and other clean fuels may prove key in decarbonising other hard-to-abate areas – these developments make the case for broad use of green hydrogen less compelling.

Green ammonia

Green ammonia is created by combining green hydrogen and nitrogen using renewable electricity.[9]

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[7] Stock, P. (2025), Green hydrogen has stalled in nearly every corner of Australia. So why is the government still revving it up? *The Guardian,* 25 March 2025, https://www.theguardian.com/environment/2025/mar/24/green-hydrogen-stalled-australia-government-still-revving-it-up

[8] International Energy Agency (IEA) (2024), *Global Hydrogen Review 2024,* https://iea.blob.core.windows.net/assets/89c1e382-dc59-46ca-aa47-9f7d41531ab5/GlobalHydrogenReview2024.pdf

[9] The Royal Society (n.d.), Ammonia: zero-carbon fertiliser, fuel and energy store, https://royalsociety.org/news-resources/projects/low-carbon-energy-programme/green-ammonia/

There have been expectations that green hydrogen could be converted to green ammonia, and then liquefied, thus making green hydrogen more easily transportable so it could then be converted back into hydrogen and used to power trucks, trains and ships.[10] It can also be used to create fertilisers and is used in industrial processes, as well as being a potential fuel for maritime transport and power generation. While requiring additional steps and inputs than green hydrogen, green ammonia has several advantages:

- It is easier to store and transport than hydrogen as it can be liquefied at much lower temperatures and pressures. It is also less explosive.
- It is a liquid fuel that could potentially be used in existing internal combustion engines.[11]

However, it also has several disadvantages:[12]

- Due to the additional processing required, the costs of production are even higher than hydrogen and require larger volumes of renewable energy.
- As a fuel within a combustion engine or a fuel cell, it can be less efficient than other fuels (such as hydrogen) due to the conversions that need to occur to produce energy.
- When combusted, ammonia can produce nitrogen oxides – which contribute to air pollution, and if used in vehicles technologies, may be required to control these emissions.
- Ammonia is toxic and can be hazardous if mishandled – proper precautions and procedures must be followed.

Green ammonia will be an important technology to help decarbonise existing nitrogen-based fertilisers to improve the sustainability of agricultural processes.

2.2 Diesel and petrol alternatives

Given the widespread use of petrol and diesel and other fossil fuels, biofuels and synthetic fuels will likely play an important role in decarbonising sectors where electrification is impractical or impossible. A range of fuels are being developed to

[10] CSIRO (n.d.), The role of ammonia in reaching net zero, https://www.csiro.au/en/research/environmental-impacts/fuels/hydrogen/ammonia-and-reaching-net-zero

[11] Hive Energy (2023), Green hydrogen vs green ammonia, https://www.hiveenergy.co.uk/2023/02/27/green-hydrogen-vs-green-ammonia/; Jafar, U., Nuhu, U., Khan, W., and Hossain, M., (2024), A Review on green ammonia as a potential CO2 free fuel, *International Journal of Hydrogen Energy*, 71, 19 June 2024, https://www.sciencedirect.com/science/article/pii/S0360319924018159

[12] Stargate Hydrogen (2024), The potent Synergy between Green Hydrogen & Green Ammonia: A Partnership for a Sustainable Green Economy, https://stargatehydrogen.com/blog/green-ammonia/

reduce emissions in these areas. Across these fuels, there are multiple different feedstocks, production processes and uses.

At a high level, these fossil fuel alternatives include:

- Diesel
    - Biodiesel
    - Green diesel (or renewable diesel)
- Petrol or gasoline
    - E-gasoline
    - Ethanol (for example, E10)
- Sustainable Aviation Fuel (SAF)

Some of these fuels (i.e., green diesel and e-gasoline) can replace their fossil fuel counterparts while others (ie biodiesel and SAF) must be blended with fossil fuels as they cannot be used on their own.

A number of these fuels are made from organic matter – ie, farmed crops, plantation residues, waste (see Figure 7) – and as such there are considerable ethical and sustainability considerations. These are discussed in Section 3.2 below.

Figure 78: Feedstocks and uses of diesel and petrol alternatives. Sources: US Energy Information Administration, https://www.eia.gov/energyexplained/biofuels/biodiesel-rd-other-basics.php; US Department of Energy, https://afdc.energy.gov/fuels; Farmdoc Daily, https://farmdocdaily.illinois.edu/2023/02/biodiesel-and-renewable-diesel-whats-the-difference.html; Aslam, M., Maktedar, S., and Sarma, A., https://link.springer.com/book/10.1007/978-981-19-2235-0

	Diesel		Petrol		Aviation fuel
	Biodiesel	**Green diesel (Renewable diesel)**	**E-gasoline**	**Ethanol (E10, E85, E100)**	**Sustainable Aviation Fuel (SAF)**
Feedstock	Vegetable oils (mainly soybean) Cooking oil (waste oils) Animal fats	Vegetable oils (mainly soybean) Residual biomass (wood, waste oils, organic waste)	Methanol (from hydrogen mixed with carbon dioxide) which is converted to gasoline	Starch crops (such as corn or wheat) Sugar crops (sugar cane and sugar beet)	Oils and fatty acids Wastes/ residuals (including from forestry and agriculture)
Use	Must be blended to be used in existing vehicles.	A ‘drop in’ fuel.	A ‘drop in’ fuel.	Must be blended to be used in existing vehicles.	Must be blended to be used in existing vehicles.

Diesel replacements

Biodiesel was one of the very first forms of diesel: Rudolf Diesel, the inventor of the diesel engine in 1897, experimented with vegetable oils to power his engines. Commonly biodiesels are made through a transesterification process from soybeans, animal fats and recycled cooking oils, rapeseed oil, sunflower oil and palm oil. Algae is being considered as a potential feedstock.[13]

The different feedstocks can affect the chemical structure of biodiesel meaning the product is variable. A benefit of biodiesel is its flexibility in production in that it can be derived from a wide variety of feedstock. However, it cannot be used on its own, but must be blended with petroleum, meaning its potential for emissions reduction is limited. The current Australian diesel fuel standard allows up to 5% biodiesel in fuel at the bowser as any more can cause issues with current infrastructure and engines.[14]

Green diesel is similar to biodiesel but with key differences. Green diesel is chemically equivalent to petroleum diesel and can be developed from an even wider array of biomass feedstock than biodiesel using a hydrogenation process. Feedstock can include straw, woody biomass, cotton trash and urban waste.[15] Benefits include:

- It is a “drop-in” alternative to diesel, meaning that conventional internal combustion engines can be run on it alone
- It can be transported using existing infrastructure
- It can be sold at service stations – blended or unblended.

While green diesel is appealing, its production requires significantly quantities of hydrogen and associated electricity, and to be clean, this process must be powered renewably.[16] There are some pilot projects occurring in Australia, although scale is still limited.[17]

These diesel replacements may help to decarbonise industries where battery electric solutions are not feasible, such as agriculture and heavy-transport, including land and maritime freight. Alternatively, blended and unblended options may contribute to emissions reduction while superior low- and zero-emissions technology is developed.

Petrol replacements

Bio-ethanol is produced from starchy crops, such as corn, wheat or sugar cane, forming ethanol, which is then blended with unleaded petrol. In Australia, E10 is available,

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[13] US Energy Information Administration (2024), Biofuels Explained, https://www.eia.gov/energyexplained/biofuels/biodiesel-rd-other-basics.php
[14] Biodiesel must be used as a blend because it comprises less energy than traditional diesel and cannot be stored for as long. Additionally, it has a relatively high freezing temperature and ‘cloud point’ – resulting in solidification and gelling preventing it from flowing through fuel lines: Chevron (n.d.), Biodiesel Then and Now, https://www.regi.com/resources/insights/biodiesel-then-and-now; NSW Government (n.d.), Biodiesel, https://www.transport.nsw.gov.au/operations/freight-hub/towards-net-zero-emissions-freight-policy/knowledge-hub/biodiesel
[15] NSW Government (n.d.), Biodiesel, renewable diesel and bioethanol, https://www.dpi.nsw.gov.au/dpi/climate/energy/clean-energy/bioenergy/biofuels
[16] US Energy Information Administration (2024), Biofuels Explained, op cit.
[17] NSW Government (n.d.), Biodiesel, renewable diesel and bioethanol, op cit.

which is a blend of 10% bio-ethanol with 90% unleaded petrol. E85, made with up to 85% ethanol, is also available but is only suitable for purpose-built vehicles.[18]

Disadvantages of bio-ethanol include;

- Like biodiesel it must be used in blends limiting the emissions reduction opportunities.
- A reluctance from consumers to use blends including E10. It is unclear whether this is because only certain types of cars can safely utilise the fuel, or if it is due to costs and perceptions of the potential increase in wear and tear on vehicles.[19]
- The potential for food production to be diverted to bio-ethanol feedstock production as large quantities of organic feedstocks requiring considerable swathes of agricultural land are needed
- The success of battery electric vehicles as a pathway to transport emissions reductions.

E-gasoline is a type of e-fuel. E-fuels are produced from green hydrogen and electricity, which is where the "e" comes from. *E-gasoline* and other types of e-fuels are in relatively early stages of production and development and, because they are derived from hydrogen, face the challenges that green hydrogen faces.

Some car brands are undergoing testing with e-gasoline.[20]

Sustainable Aviation Fuel

Sustainable Aviation Fuel (SAF) is an alternative fuel made from non-petroleum feedstocks and can be blended with current aviation fuel at levels from 10 to 50%. SAF has been heralded as a 'game changer' for emissions reductions in aviation, with the US Department of Energy claiming it represents the best near-term opportunity to meet the net-zero carbon by 2050 goal for the international aviation industry.[21]

Similar to green diesel, SAF can be produced from urban waste, woody biomass and cooking oil, fats and grease.

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[18] NSW Government (n.d.), Biodiesel, renewable diesel and bioethanol (ibid.)

[19] Note though that some places have argued its use resulted in carbon increases: T&E (2016), Biodiesel's impact: emissions of an extra 12m cars on our roads, latest figures show https://www.transportenvironment.org/articles/biodiesels-impact-emissions-extra-12m-cars-our-roads-latest-figures-show

[20] Audi (2018), Audi advances e-fuels technology: new "e-benzin" fuel being tested https://www.audi-mediacenter.com/en/press-releases/audi-advances-e-fuels-technologynew-e-benzin-fuel-being-tested-9912; Porsche (n.d.), Porsche's synthetic fuel, https://dealer.porsche.com/ca/lauzon/en-CA/News-and-Events/Carburant-efuel

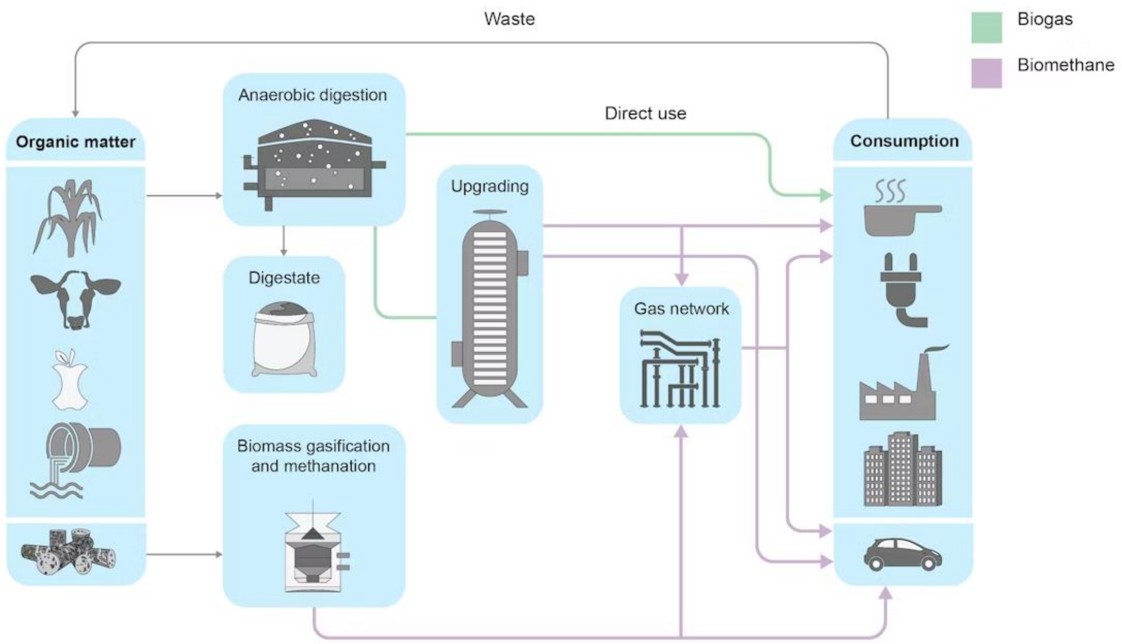
[21] Ahmad, S., (2025), Why your holiday flight is still not being powered by sustainable aviation fuel, *The Conversation*, 27 June 2025, https://theconversation.com/why-your-holiday-flight-is-still-not-being-powered-by-sustainable-aviation-fuel-258958; US Department of Energy (n.d.), Sustainable Aviation Fuel, https://afdc.energy.gov/fuels/sustainable-aviation-fuel

However, due to the need to blend SAF with other fuels and the high costs, flying for now remains dependent upon fossil fuels.[22] Research has found that a 'deeply fragmented landscape' has prevented sustainable aviation fuel development – with a mismatch occurring between priorities of producers (who focus their research and development on scaling production) and airlines (who find the costs prohibitive and focused more on inconsistent supply, and the need for clearer regulations and incentives across the industry).[23]

2.3 Biogas and biomethane

Biogas is made up of methane, carbon dioxide and small quantities of other gases produced by anaerobic digestion of organic matter in an oxygen-free environment. The composition of biogas depends on the type of feedstock and pathways (Figure 9). The process and choice of feedstock influence the methane content of biogas, impacting the energy content. Biogas can be used for electricity generation, heating or industrial applications.[24]

Figure 9: Production pathways for biogas and biomethane. Source: IEA https://www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth/an-introduction-to-biogas-and-biomethane



Biomethane (also called "renewable natural gas") is an almost pure source of methane that has been "upgraded" from biogas, with carbon dioxide and other ingredients

[22] Ahmad, S., (2025), *Why your holiday flight is still now being powered by sustainable aviation fuel, op cit.*
[23] Ibid.
[24] International Energy Agency (n.d.), An introduction to biogas and biomethane https://www.iea.org/reports/outlook-for-biogas-and-biomethane-prospects-for-organic-growth/an-introduction-to-biogas-and-biomethane

removed (this method accounts for around 90% of production) or through the gasification of solid biomass followed by methanation.[25] It is indistinguishable from natural gas, meaning it can be used in current infrastructure and technology.

Other beneficial uses of biomethane include:

- As flexible generation to balance electricity networks.
- In certain scenarios, its production can also provide a treatment for waste – reducing the amount of methane released and amplifying GHG reduction.
- Can be a local, sustainable supply of heat and power for communities – avoiding transport costs.
- Contributes to the circular economy when produced with organic waste.
- May lead to a digestate market (a by-product of biogas) for fertiliser.

A challenge for biogas and biomethane has been the concern that crops grown for food will be diverted for energy production. However, using waste and residues avoids this issue and captures methane that would otherwise have been emitted, although the scale of waste-based production is limited. Most production around the world utilises crops or animal manure, while municipal solid waste is the most used feedstock in the USA (see 3.2 below).[26] While it is a promising clean fuel, it is unlikely that it could be produced at sufficient scale to entirely replace natural gas.

The current cost of biogas (the levelized cost of generating electricity from biogas) is substantially higher than the cost of renewable electricity generation – ranging from USD $50 per megawatt (MWh) hour to USD $190 MWh.[27] However, the IEA foresees modest scope for cost reductions and it estimates that three and a half times the current production of biogas could be produced at a cost equal or lower than current natural gas prices. Based on modelling using STEPS and SDS methodology, the bioenergy market share of biogas and biomethane is projected to grow from 5% today to 12% or 20% respectively. [28]

2.4 Green methanol

Methanol is a colourless liquid traditionally used to produce other chemicals and products like formaldehyde, acetic acid and plastics. However, it can be used as a fuel to power engines. Traditional methanol is made from fossil fuels, but green methanol can be produced in two ways: The first, produced from sustainable biomass (often

[25] Ibid.
[26] International Energy Agency (2020), *Outlook for biogas and biomethane,* https://iea.blob.core.windows.net/assets/03aeb10c-c38c-4d10-bcec-de92e9ab815f/Outlook_for_biogas_and_biomethane.pdf
[27] Ibid.
[28] Ibid.

called "bio-methanol"), and the second, from carbon dioxide and hydrogen produced using renewable electricity.[29]

Production of methanol is predicted to increase to 500 million tonnes by 2050 (up from 98 million tonnes of traditional methanol and 0.2 million tonnes of green methanol), creating considerable opportunities for green methanol to replace traditional methanol.[30] This is particularly the case given the expansion of the green methanol market for:

- Buses and heavy vehicles - namely in China; and
- As an alternative bunker fuel for maritime uses - with significant projects underway in Sweden (production) and Canada (trialling use in shipping).[31]

The benefits of green methanol include:

- Emission reduction benefits from 65% to 95%, depending on the feedstock.
- Versatility in source material – it can be produced from a variety of sustainable feedstocks, such as biomass, waste or carbon, and from hydrogen.
- Versatility in application – with modifications it can be used in ICE vehicles and fuel cell vehicles and vessels.
- It is relatively easy to handle, transport, and store and current infrastructure can be adapted with minor and inexpensive modifications.
- The technology to produce methanol from biomass (and carbon and hydrogen) is almost identical to that for making it from fossil fuels.
- Unlike hydrogen or LNG, it does not require refrigeration or pressurisation, and is a liquid under ambient conditions.

However, there are some challenges:

- It is significantly more expensive to produce than traditional methanol, and prices are not expected to become comparable until production significantly ramps up.
- Methanol fuel requires fuel tanks that are about 2.5 times larger than oil tanks for the same energy content, due to its density and lower heating value (see Figure 10 for energy content of methanol compared to other fuels).
- It is highly flammable and can explode if not handled correctly; and is toxic if ingested (it is similar to fossil fuels in these respects).

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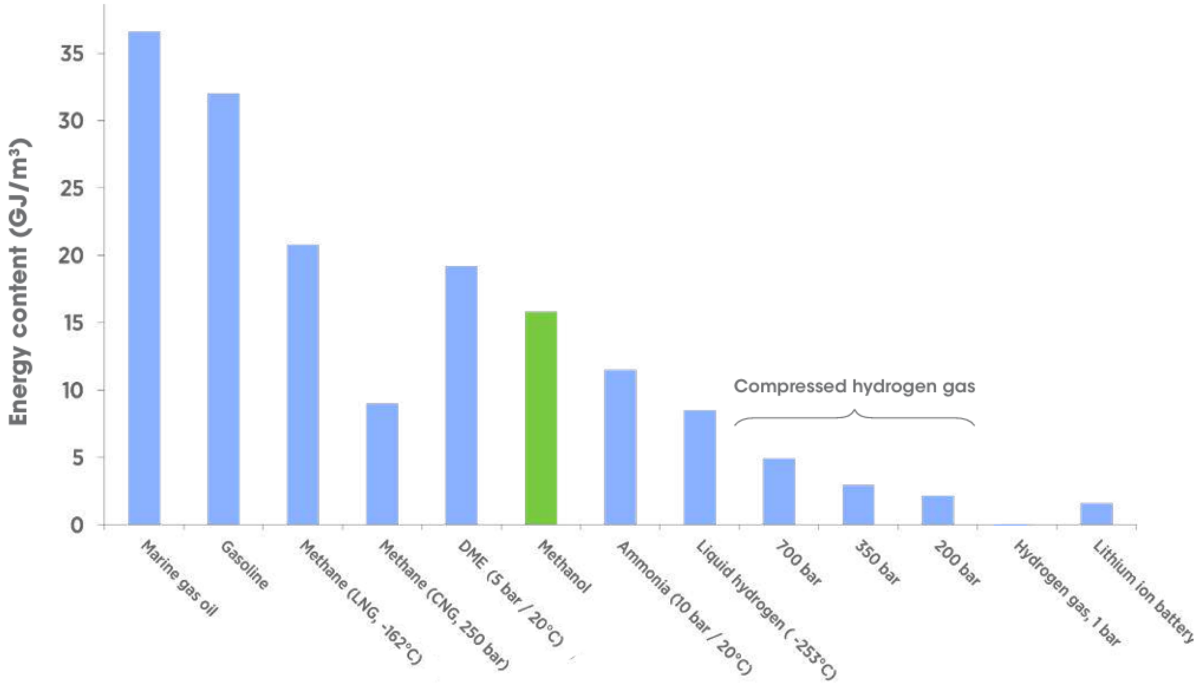
[29] Methanol Institute (n.d.), Renewable Methanol, https://www.methanol.org/renewable/; World Economic Forum (2023), Is green methanol the clean fuel the world is forgetting, https://www.weforum.org/stories/2023/08/green-methanol-clean-fuel/

[30] International Renewable Energy Agency (IRENA) (2021), *Innovation outlook – Renewable Methanol* https://www.methanol.org/wp-content/uploads/2020/04/IRENA_Innovation_Renewable_Methanol_2021.pdf

[31] World Economic Forum (2023), *Is green methanol the clean fuel the world is forgetting*, op cit.

- Green methanol produced from biomass must have sustainably sourced feedstock (see Section 3.2 below).

Figure 1010: Volumetric energy content of various fuels. Source: IRENA https://www.methanol.org/wp-content/uploads/2020/04/IRENA_Innovation_Renewable_Methanol_2021.pdf



3. The right clean fuels for Tasmania

Having considered some of the key clean fuels in development around the world, we can assess their potential for production and/or use in Tasmania. It is helpful to utilise a set of criteria to assist investment decisions. The Grattan Institute has developed four criteria to inform decisions on investment in hydrogen production – however these criteria can usefully be applied to investments across all clean fuels.[32] They are:

- **Criteria 1: Technical alternatives**: Is this the best technical alternative to replace fossil fuel use, bearing in mind this could vary across applications?
- **Criteria 2: Supply chain complexity**: Is the necessary supply chain complicated and/or lengthy?; Is the output continuous or intermittent?; Can the output piggyback on an existing supply chain?
- **Criteria 3: Abatement potential**: What are the emissions reductions that will be achieved?
- **Criteria 4: Export readiness** noting that export industries are easier to develop from an existing base or in cases where the commodity is already being produced.

While the promise of green hydrogen as a broad-scale emissions reduction technology has not been realised, there are still niche applications where it may be useful in our decarbonisation such as in oil refining industry and in the production of ammonia fertilisers.

Bio- and green diesel will be an important alternative for fossil-fuel derived diesel in Tasmania, especially for heavy transport and long haul tracking (see Figure 4). In particular, fuels that are "drop-in" are an attractive solution that can be used in conventional vehicles and generators with no need for any modifications or updates. This is especially true of emerging green products which are chemically identical to traditional fossil-fuel derived products. As a transition strategy, replacement petrol and diesel blends can be used in the short to medium term to contribute to emissions reductions while better technologies are developed. Drop-ins and blends may appeal to trucking companies, hobby car enthusiasts, and others who cannot afford to replace their internal combustion engine vehicles with EVs.

Given our resources – renewable energy, access to water, and biomass – fuels such as green methanol may be particularly suited for production here in Tasmania. Projects looking to use waste as feedstock for fuels like biomethane, such as the Westbury

[32] Wood, T., Reeve, A., and Yan, R. (2023), *Hydrogen – Hype, Hope or Hard Work?* Grattan Institute, https://grattan.edu.au/wp-content/uploads/2023/12/Hydrogen-hype-hope-or-hard-work-Grattan-Institute.pdf

BioHub, provide an opportunity to double down on emissions reduction with methane being harnessed for use rather than being released into the atmosphere.

Clean fuels developed from biomass could deliver significant financial benefits to Tasmanian farmers. A substantial market for fuel feedstocks is projected by the Clean Energy Finance Corporation to underpin future fuel production.

Biogas and biomethane could be used in Tasmania to enhance the flexible operation of our renewable electricity systems while also being blended into our small yet significant natural gas network.

Clean fuels, depending on cost of production, level of emissions reduction achieved across the supply chain, and sustainability of feedstock, could provide solutions for harder-to-abate applications such as road, rail and maritime freight, heavy vehicles, air travel, and industrial processes. In some of these areas, their use may be an intermediate solution until more sustainable, cheaper options are developed.

3.1 Clean fuel projects in Tasmania

There are a number of clean fuel projects under development in Tasmania. Two projects in the early stages – the Bell Bay Powerfuels project and the HIF Hampshire project – are looking to produce replacement fuels for diesel, aviation fuel and gasoline. The Westbury BioHub is focusing on producing biomethane from waste.

In order to host these largescale projects and similar endeavours in this field, Tasmania will need to develop additional renewable energy generation to support them. Offtake agreements with new renewable electricity projects will be required to secure finance for these projects, with Marinus Link seen as a key enabler of investment in new renewables projects and clean fuel projects.

Bell Bay Powerfuels Project

The Bell Bay Powerfuels project was originally conceived by ABEL Energy but has recently been acquired by Zen Energy. The project aims to produce 300,000 tonnes of green methanol per year as a fuel replacement for diesel for the aviation and maritime industries.

In its 2022 *Knowledge Sharing Report* project, ABEL Energy stated that the project will ensure: enhanced local liquid fuel security; reduced imports of methanol, diesel and propane, and; reduced greenhouse gas and pollutant emissions from mining, shipping and LPG consumption.[33] However, it is unclear if any of the project's green methanol will be designated for use on-island or whether it will all be exported.

[33] ABEL Energy (2022), *Knowledge-sharing report,* *https://abelenergy.com.au/volumes/documents/ABEL-Energy-Knowledge-Sharing-Report.pdf*

In terms of employment, ABEL Energy (in the same report) calculated that the Powerfuels project would employ nearly 500 people in the construction of the project, and then over 150 in its ongoing processes, and contributing up to $50 million in added value to Tasmania per year.[34] While this will potentially see some Tasmanians gaining employment in the emerging industry, the reality is that the project will need to import a sizeable number of workers with the necessary skills from further afield.

HIF Tasmania

HIF Asia Pacific, a subsidiary of HIF Global, is developing a project in Hampshire, Tasmania, to manufacture up to 10 million litres of synthetic fuel – aviation fuel, gasoline and diesel. Tasmania has been chosen because of its renewable electricity, its abundant water, and access to biomass residues from plantations.[35]

Although the planned facility could produce enough synthetic fuel to meet a quarter of Tasmania's demand, HIF has indicated it will likely export it. This is because, according to HIF Asia Pacific Chief Executive Ignacio Hernandez, other markets have more advanced regulation that will support uptake of these products.[36] In other words, until clean fuels are mandated and/or subsidised by governments (or demanded by consumers), fossil fuels will be preferred. To this extent federal policy will have a key role to play in supporting the transition to clean fuels.

The Westbury BioHub

Solstice and Optimal Renewable Gas is set to open the Westbury BioHub. This will be producing biomethane from organic waste – first of its type in Australia, enabling a "plug-in" anaerobic digestion solution to process organic waste streams and providing a reliable supply of renewable gas via existing gas infrastructure.[37]

The project aims to provide a decarbonisation solution for hard-to-abate sectors, such as industrial heat, while at the same time developing an "improved pathway" for managing organic waste and residues.

Promotional material emphasises the community benefits of this project, stating it will create "a circular economy system that will benefit local communities and deliver significant outcomes for Tasmania".[38]

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[34] ABEL Energy (2022), *Knowledge-sharing report,* p. 59
[35] Ibrahim, T. (2025), Low-carbon sustainable fuels headed for F1 but cost could keep them from Australian bowsers, *ABC News*, 26 May 2025, https://www.abc.net.au/news/2025-05-26/low-carbon-sustainable-fuel-headed-for-formula-one-qantas/105323712
[36] Ibid.
[37] Optimal Renewable Gas (n.d.), Westbury Bio Hub, https://optimalrenewablegas.com.au/project/westbury-bio-hub-project/
[38] Optimal Renewable Gas (2024), How Can We Make use of Biogas? https://optimalgroup.com.au/news/how-can-we-make-use-of-biogas

Construction of the Westbury BioHub is expected to be underway in 2025 and when production commences in late 2026 the plant should supply approximately 4.5% of Tasmania's natural gas needs.

3.2 The sustainability challenge for clean fuels

Tasmania is well positioned to support the production of clean fuels although this must be done at an appropriate scale to ensure the sustainable use of inputs such as forest products, water and electricity and without 'crowding out' established or higher value industries.

It is also essential that clean fuels produced in Tasmania are available for use on island and across Australia to support decarbonisation and future-proof domestic industries.

Projects must also deliver long-term benefits to host communities including maximising local employment and through improvement in local social and economic infrastructure including housing.

In terms of fuels that depend on biomass, according to the World Economic Forum, there is no "silver bullet" for scaling them.[39] Instead each fuel production initiatives will need to be carefully designed to address any potential negative impacts.

Potential impacts of biofuel production, and for that matter, production of all forms of clean fuel, across the supply chain must be kept front of mind. Clean fuel production should, for example:

- Positively contribute to the region, socially and economically
- Not displace crops for food[40]
- Not divert water and resources from other necessary uses or natural processes required for a healthy environment.

The adoption of sustainability criteria, like the Roundtable for Sustainable Biomaterials (RSB) principles (Figure 11) can help avoid the shifting of potential negative impacts being shifted along the supply chain.[41]

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[39] World Economic Forum (2022), These are the zero-emission fuels to decarbonize the shipping industry, 7 March 2022, https://www.weforum.org/stories/2022/03/transition-shipping-emissions-to-net-zero/
[40] This has been a long-standing concern for in particular biofuels, but may be addressed by appropriate feedstock management: Farm Energy (2019), Biodiesel and the Food vs. Fuel Debate https://farm-energy.extension.org/biodiesel-and-the-food-vs-fuel-debate/
[41] Roundtable on Sustainable Biomaterials (RSB) (2023), *RSB Principles & Criteria,* https://rsb.org/wp-content/uploads/2024/05/rsb-principles-criteria-std-01-001-v4-1.pdf

Figure 11: Roundtable for Sustainable Biomaterials Principles. Source: RSB https://rsb.org/framework/principles-and-criteria/

4. Policy priorities: Incentivising clean fuel production and use

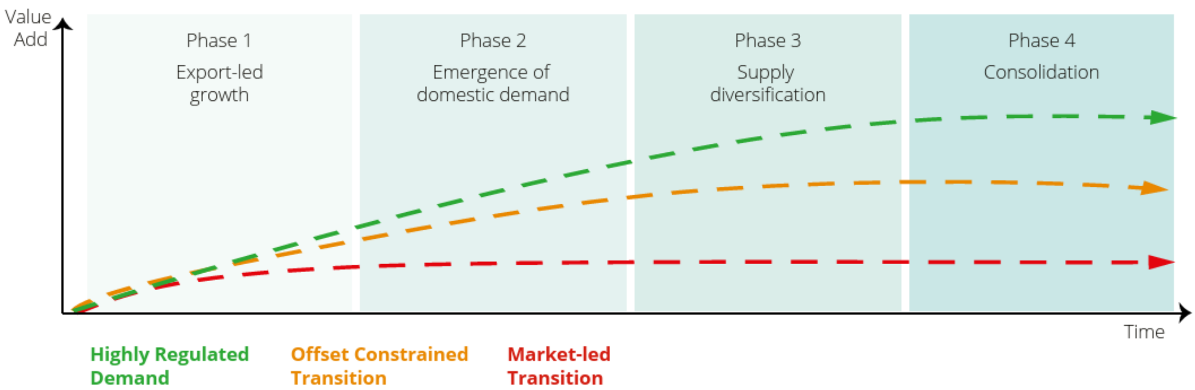
The production of clean fuels is an infant industry which will require carefully designed and sustainable incentives to attract investment, increase the scale, and reduce the cost of production as the industry matures. If Tasmania is to become a producer and user of clean fuels, the right policy settings will need to be implemented. Chief Executive of HIF Asia Pacific – the firm planning a clean fuel production facility in north west Tasmania – Ignacio Hernandez has said: "We are hopeful that...policies and regulation will come into play ... and we can actually sell these e-fuels in Australia."[42]

The Clean Energy Finance Corporation has modelled market development of clean fuels in Australia under three scenarios: 1. Highly regulated, including a comparable clean fuel mandate to the EU's ReFuelEU; 2. Offset constrained, with firms preferencing emissions reduction through voluntary adoption or the Safeguard Mechanism driving the clean fuels market with ACCUs freed up for use by sectors unable to achieve decarbonisation, and; 3. Market led, where an export industry may be established

[42] Ibrahm, T. (2025), Low-carbon sustainable fuels headed for F1 but cost could keep them from Australian bowsers, *ABC News*, https://www.abc.net.au/news/2025-05-26/low-carbon-sustainable-fuel-headed-for-formula-one-qantas/105323712

thanks to our comparative feedstock advantage, but with likely minimal domestic demand (see Figure 12). This analysis highlights the benefits of mandating clean fuel use when establishing the industry.

Figure 12: Expected phases of clean fuels market development under 3 scenarios. Source: CEFC, https://www.cefc.com.au/document?file=/media/jh3gvm14/refined-ambitions-exploring-australia-s-low-carbon-liquid-fuel-potential.pdf



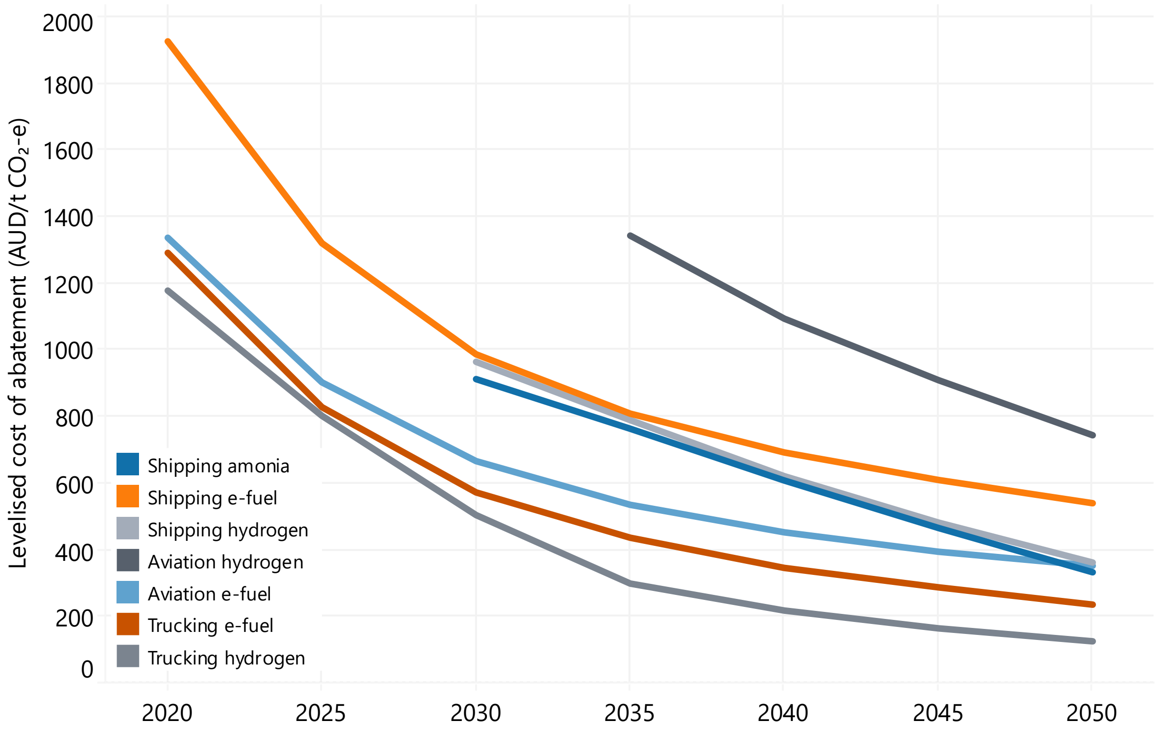
4.1 The cost of clean fuels

At present it is estimated that producing e-diesel at industrial scale using established technology is approximately two and a half times the cost of conventional oil-based diesel. Given that Australia's current annual diesel consumption is approximately 30 billion litres, a direct subsidy would cost about $50 billion per annum highlighting the need for a carefully planned transition.

Another way to look at it is to consider the carbon price at which this technology would be cheaper to adopt than fossil fuels. The Australian Carbon Credit Unit Scheme (ACCU) price is currently around $35/t and the EU Emissions Trading Scheme price is around €70/t. In other words, at a levelised abatement cost of more than $1000/t, e-fuels for trucking, for example, are currently a very expensive option to reduce emissions (Figure 13).

The industry policy challenge for both state and national governments is to support innovation and scaling in a targeted and technology neutral way such that incentives decline as production costs come down over time.

Figure 13: Modelled abatement costs of selected fuels in hard-to-abate sectors, 2020-2050. Source: MIT https://climate.mit.edu/posts/carbon-abatement-costs-hydrogen-fuels-hard-abate-transport-sectors-and-potential-climate



4.2 Principles for the development of an Australian clean fuel industry

5. Any **public investment** to increase production must: be **time-limited**; leverage **private investment**, and; decrease over time with a primary focus on the **domestic market**. Subsidising production for export should be restricted to cases where there are clear domestic cost benefits through scaling production.
6. **Incentives** to encourage **domestic demand/consumption** should align with existing **climate policies** and only be applied once the supply of clean fuels has been established.
7. Policies to promote clean fuel production must ensure the **sustainable use of natural resources** and **renewable electricity** and be consistent with **circular economy** principles.
8. Clean fuel and associated renewable energy projects must deliver long term **community benefits** and **legacies**, and be informed by **regional systems modelling** and **community collaboration**.

The promotion of clean fuel production represents the second phase of the energy transition after the decarbonisation of electricity generation. This is one of the most complex and challenging technical and economic transitions since the start of the industrial revolution, and demands a long-term focus and deep collaboration between industry, all levels of government and the Australian community. Despite the need for intergovernmental collaboration, there are distinct roles for the Australian and Tasmanian governments which should be reflected in the Tasmanian *Future Clean Fuels Strategy*.

Given the technological and commercial complexity of the transition to clean fuels, the policy priorities outlined below are general in nature and must be carefully designed with refence to the best available evidence and commercial insights.

4.3 The Australian Government's role in developing clean fuels

The Australian Government's role and policy options include those to incentivise both investment and demand.

Investment incentives

- Offer production tax credits – these can be distributed via the Hydrogen Production Tax Incentive (HPTI), expanded to include the production of other clean fuels. [43]
- Deliver the Hydrogen Headstart funding to support large-scale renewable hydrogen projects through competitive hydrogen production contracts.[44] One of the six Round 1 short-listed applicants is HIF Asia Pacific for its Tasmania eFuel Facility, although the final funding announcement is yet to be made (see above at 3.1 for more information on this project).[45] Round 2 features $2 billion in investment, with further information to be announced soon.[46]
- Provide targeted concessional finance through the Clean Energy Finance Corporation.[47]
- Implement excise concessions and prioritisation – removing existing primary production excise concessions and investing a proportion of excise revenue in clean fuel production.
- Update national clean fuel strategies and ARENA research strategic priorities so they are technology neutral and do not prioritise green hydrogen export.[48]
- Expand investment from the Future Made in Australia (FMA) Innovation Fund administered by ARENA (currently $250 million) to support pre-commercial

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[43] Australian Taxation Office (2025), *Hydrogen Production Tax Incentive* https://www.ato.gov.au/businesses-and-organisations/income-deductions-and-concessions/incentives-and-concessions/production-tax-incentives/hydrogen-production-tax-incentive

[44] Australian Government, Department of Climate Change, Energy, the Environment and Water (n.d.), Hydrogen Headstart program, https://www.dcceew.gov.au/energy/hydrogen/hydrogen-headstart-program

[45] Australian Government, Department of Climate Change, Energy, the Environment and Water (2023), Hydrogen Headstart applicants are potential world leaders, https://www.dcceew.gov.au/about/news/hydrogen-headstart-applicants-are-potential-world-leaders

[46] Australian Renewable Energy Agency (n.d.), Hydrogen Headstart Round 2, https://arena.gov.au/funding/hydrogen-headstart-round2/

[47] Clean Energy Finance Corporation, Where we invest, https://www.cefc.com.au/where-we-invest/

[48] https://arena.gov.au/about/strategic-priorities-2/

innovation, demonstration and deployment of Low Carbon Liquid Fuels (LCLFs) including sustainable aviation fuels and renewable diesel.[49]
- Consider the development of ACCU abatement certification for Australian produced e-fuels.

Demand-side

- Expand vehicle emissions standards over time and once clean fuels are available to include commercial and heavy vehicles.
- Mandate blends of clean petrol and diesel to reduce emissions as supply increases and production costs decline. For instance, in Europe under the European RED II, fuel suppliers are required to supply a minimum of 14% of the energy consumed in road and rail transport by 2030 as renewable energy.[50]
- Develop certification and reporting of carbon intensity of Australian-produced clean fuels.

8.4 The Tasmanian Government's role in developing clean fuels

The Tasmanian Government has an important supporting and enabling role in the development of a clean fuel industry and market.

- Clear focus on supporting and enabling sustainable clean fuel projects, with domestic offtake, that meet sustainability and community benefit tests.
- Conduct rigorous social and economic return on investment analysis for any public investment.
- Consider state-level clean fuel mandates to leverage any national policy. Both NSW and Queensland mandate low bio-diesel and ethanol blends. [51] While these policies have been designed to support farmers, they could also be used to reduce transport emissions over time.
- Ensure local offtake in return for public investment. Hard-to-abate industries should have preferential supply.
- Enabling functions include:
  - Integrated planning and approval support and processes
  - Expedited energy supply and grid connections
  - Coordinate GBEs to ensure resource inputs/supply
  - Leverage existing industrial infrastructure

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[49] Australian Renewable Energy Agency (n.d.), Future Made in Australia Innovation Fund, https://arena.gov.au/funding/future-made-in-australia-innovation-fund/
[50] https://joint-research-centre.ec.europa.eu/welcome-jec-website/reference-regulatory-framework/renewable-energy-recast-2030-red-ii_en; CEFC, Refined Potential
[51] Queensland Government (n.d.), Queensland biofuels mandates, https://www.business.qld.gov.au/industries/manufacturing-retail/retail-wholesale/selling-fuel-qld/qld-biofuels-mandates; NSW Government (n.d.), Service Stations, https://www.fairtrading.nsw.gov.au/trades-and-businesses/business-essentials/service-stations

    - Develop and deliver a workforce plan.
- Partner with host communities and invest in social and community infrastructure especially housing and services.