Australian Government

Department of Climate Change, Energy, the Environment and Water

Enabling supply of renewable diesel in Australia

A consultation paper on establishing a paraffinic diesel fuel standard for Australia

November 2023

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Acknowledgement of Country

Our department recognises the First Peoples of this nation and their ongoing connection to culture and country. We acknowledge Aboriginal and Torres Strait Islander Peoples as the Traditional Owners, Custodians and Lore Keepers of the world's oldest living culture and pay respects to their Elders past, and present.

Contents

About this consultation paper

The Department of Climate Change, Energy, the Environment and Water (the department) is examining options to enable the supply of renewable diesel under the *Fuel Quality Standards Act 2000*. The department has undertaken initial consultation with key industry groups prior to the development of this paper. This consultation paper considers options to include renewable diesel as part of Australia's fuel quality standards and seeks views to inform next steps.

The scope of this paper is limited to the implementation of the *Fuel Quality Standards Act 2000* and enabling the supply of renewable diesel through fuel quality standards. This is an important first step that will allow the fuel industry to import, produce and supply renewable diesel of a consistent quality to ensure efficient engine operability for vehicles and machinery. The department acknowledges there are broader activities being investigated to reduce greenhouse gas emissions in the transport and liquid fuels sectors.

There are two components of the paper:

- Part 1 provides information about renewable diesel and the benefits of broader uptake in Australia.
- Part 2 discusses how Australia's fuel quality standards could include renewable diesel. A summary of the technical specifications of the fuel and the legislative mechanisms for enabling supply in Australia are provided.

Making a submission

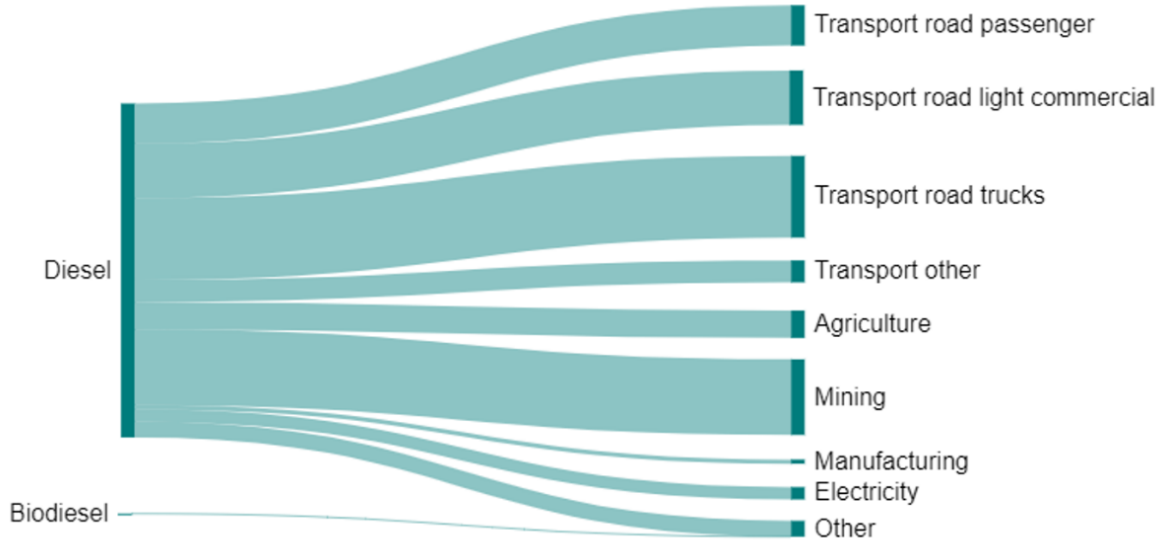
The department seeks responses on this paper to inform the development of a fuel quality standard that includes renewable diesel. This will provide the Australian Government with up-to-date information about the benefits and impacts of making changes to Australia's fuel quality standards. Throughout this paper and consolidated at page 16, there are questions to consider and guide your submission. There is no obligation to answer any or all of the consultation questions, and there is no limit on the length of submissions. You may also provide any additional comments or information. Where appropriate, technical or other evidentiary materials to support your submission are encouraged.

How to make a submission
We invite your views on the contents of the paper. You can make submissions via our Consultation Hub by clicking the Make a Submission button. All submissions will remain confidential and will not be published. The department may elect to include de-identified information in a Summary of Outcomes paper after the consultation period closes. This consultation period will close on **Friday, 2 February 2024**.

Overview: An opportunity to reduce emissions from liquid fuel use

The Australian economy is currently reliant on fossil fuels. We consumed more than 50,000 megalitres of fuel in the 2022 calendar year, nearly 60% of which was petroleum-derived (mineral) diesel (DCCEEW 2023a). Australia uses more energy from diesel than electricity and as shown in Figure 1, diesel is a crucial energy source for sectors such as transport (particularly freight), mining, agriculture, construction and defence (DCCEEW 2023b). The combustion of diesel produces considerable greenhouse gas emissions. The transport sector alone (primarily through petrol and diesel-powered road transport) accounted for 20.9% of Australia's greenhouse gas emissions in the year to March 2023 (DCCEEW 2023c).

Figure 1: Diesel use by activity in Australia, 2021–22[1]



Source: DCCEEW 2023, Australian Energy Statistics, Tables F & R; DCCEEW estimates for road transport passenger, light commercial and trucks.

Urgent action on emissions reduction is critical for mitigating the effects of climate change. In the shift to a net-zero emissions economy, Australia needs to reduce greenhouse gas emissions produced from diesel combustion. Electric and hydrogen-powered vehicles are expected to provide alternatives to diesel-fuelled light passenger vehicles, light commercial vehicles, and a range of trucks and buses during this transition. However, alternative options for large long-haul trucks and trains, and industrial equipment (such as that used in construction, mining and agriculture) are in many cases not yet commercially viable.

Diesel will remain a key fuel over the coming decades to service existing vehicles and equipment. The Australian on-road vehicle fleet turns over slowly, with the average age of a heavy vehicle ranging from 9.9–16.3 years depending on vehicle type and an average age of 11.2 years for a light vehicle (BITRE 2023). Around 40% of the diesel used in Australia is for non-transport purposes, such as in heavy construction and mining machinery (DCCEEW 2023b). This machinery often has a long

[1] Biodiesel use by sector is not published in the Australian Energy Statistics so it is categorised as 'Other'.

lifespan and replacement of the diesel fleet prior to expiration of the equipment would not be viable for industry.

A low-carbon substitute for mineral diesel is vital to assist hard-to-abate sectors in efforts to decarbonise until other options are viable. Renewable diesel can offer a sustainably sourced alternative to mineral diesel. Unlike biodiesel, renewable diesel has the potential to be used in many existing heavy duty diesel engines in its pure form (neat) without the need for engine modifications. However, renewable diesel has some different components to mineral diesel that require consideration as part of its inclusion within a fuel quality standard (discussed in section 1.3).

What is renewable diesel?

Renewable diesel is a low-carbon biofuel which can be used as a direct substitute for mineral diesel. Renewable diesel presents an excellent opportunity to reduce emissions from liquid fuel use in the transition to net-zero emissions. It has potential to deliver larger reductions in greenhouse gas emissions than traditional biodiesel as it can be used with a wider range of unmodified diesel engines at higher blend ratios. The benefits of renewable diesel are discussed further in section 1.1.

The *Fuel Quality Standards Act 2000* (FQS Act) regulates the quality of fuel supplied (fuel sold, exchanged or gifted) in Australia.[2] Renewable diesel can already be legally supplied in Australia (either neat or blended) provided it meets all the parameters in the Fuel Quality Standards (Automotive Diesel) Determination 2019 (diesel standard). However, as neat renewable diesel does not meet the minimum density specification in the diesel standard, suppliers must apply for an approval (under section 13 of the FQS Act) to allow them to sell neat and high percentage blends of renewable diesel. These approvals must be obtained before supplying the fuel and are time limited, requiring renewal for longer-term use. These approvals may also include additional caveats, such as restrictions on where the fuel can be supplied and special labelling requirements.

There have been four approvals to vary the fuel standard to supply renewable diesel in Australia since 2022, demonstrating the increasing interest in renewable diesel from industry. Several projects seeking to produce renewable diesel in Australia have also been announced. The Australian Government Department of Climate Change, Energy, the Environment and Water (the department) is considering options to modify or create a fuel quality standard to enable the supply of renewable diesel (neat and at all blend rates) without the need to apply for time-limited approvals. This will allow suppliers to sell renewable diesel without burdensome administrative processes, ensure consumers are consistently provided fuel that enables efficient engine operability, and provide a market signal that can increase the uptake of renewable diesel in Australia.

[2] The FQS Act aims to reduce environmental and health impacts from vehicle emissions and ensure vehicle operability. It does not regulate marine fuel or aviation fuel.

Part 1: An introduction to renewable diesel

Sustainable and low-carbon alternatives to conventional mineral diesel can play an important role in decarbonising our economy, especially in hard-to-abate sectors. Biodiesel already plays a role in reducing greenhouse gas emissions from diesel.[3] However, biodiesel is chemically quite different to mineral diesel and can generally only be used in existing diesel engines at a limited blend ratio (see section 1.2). Renewable diesel can overcome the constraints of biodiesel and be used in many diesel engines as a direct substitute, enabling more widespread use.

1.1 Benefits of renewable diesel

Renewable diesel is a low-carbon biomass-derived fuel which is chemically similar to mineral diesel and behaves similarly to mineral diesel when combusted in an engine. Renewable diesel can be produced from a wide variety of renewable feedstocks including plant and animal fats and non-food biomass including straw, cotton trash, grass, woody biomass and algae (DPI 2022). While renewable diesel can be produced through a variety of processes, it is predominately produced through hydrotreatment. Hydrotreatment involves adding hydrogen to the feedstock in a high temperature environment.[4]

Renewable diesel is a type of paraffinic diesel

Paraffinic diesel is primarily made up of paraffins, which are comprised of long hydrocarbon chains and are the simplest types of hydrocarbons.[5] Renewable diesel is a type of paraffinic diesel that is produced exclusively from renewable sources.

In comparison, mineral diesel is made from crude oil, which has a more complex chemical composition. This complex chemistry is maintained when the crude oil is refined into mineral diesel. Specifically, mineral diesel is made up of paraffins, as well as naphthenes and aromatics, which are comprised of hydrocarbons arranged in a cyclic or ring shape (see Glossary for further details).

The main benefit of renewable diesel over other diesel fuels is its ability to reduce greenhouse gas emissions while maintaining similar chemical properties to mineral diesel. Using renewable diesel can deliver significant reductions in lifecycle greenhouse gas emissions. The specific benefits can be variable, as the total reductions are dependent on the lifecycle analysis of feedstocks and production methods. In Europe, the Renewable Energy Directive (RED II) requires renewable diesel used in the transport sector to deliver greenhouse gas emissions savings of at least 50–65%.[6] In California,

[3] The lifecycle greenhouse gas emissions reduction capabilities of biodiesel are dependent on the feedstock and production method.

[4] Other production methods include biological sugar upgrading, catalytic conversion of sugars, gasification, pyrolysis and hydrothermal processing (AFDC 2022).

[5] Hydrocarbons are chemical compounds exclusively made up of carbon and hydrogen atoms. Hydrocarbons are commonly found in crude oil, natural gas and coal and are a major source for energy production globally (IEA 2020).

[6] Under RED II, biofuels produced in plants operating on or before 5 October 2015 must provide greenhouse gas emission savings of at least 50%. Biofuels from plants in operation between 6 October 2015 and 31 December 2020 must provide at least 60% greenhouse gas emission savings. Biofuels from plants starting operation from 1 January 2021 must provide greenhouse gas emission savings of at least 65%.

renewable diesel has delivered on average a 65% reduction in lifecycle greenhouse gas emissions (AFDC 2022).

Using renewable diesel in place of mineral diesel also aids in reducing air pollution. Renewable diesel contains almost no sulfur and aromatics, both of which can have harmful impacts on human health and the environment. Some studies suggest using renewable diesel either neat or blended with mineral diesel may reduce emissions of other air pollutants such as fine particulates and oxides of nitrogen (Hajbabaei et al. 2012).

There has been growing interest in renewable diesel in the Australian fuel industry and internationally. Multiple projects to produce renewable diesel have been announced in recent years and are now in the early stages of planning, design and engineering work. The department has also heard from several stakeholders that are keen to used renewable diesel to decrease their greenhouse gas emissions. To reflect this, four approvals have been granted in the last year to allow for neat renewable diesel and renewable diesel/mineral diesel blends to be supplied in Australia.[7]

The department anticipates receiving further applications and wants to enable the supply of renewable diesel in Australia without the fuel industry needing to apply for a time-limited approval. Removing this barrier will enable further development of the renewable diesel market in Australia and allow the benefits of renewable diesel to be realised.

1.2 Differences between renewable diesel and biodiesel

While renewable diesel and biodiesel are both made from biogenic sources, they are chemically different fuels. Biodiesel is a low-carbon alternative fuel produced from plant and animal fats via a simple chemical reaction process called transesterification, creating fatty acid methyl esters (FAME).[8] Biodiesel is therefore chemically quite different to mineral diesel and cannot generally be used as a direct substitute at a high blend ratio without affecting engine operability. Biodiesel also has a high oxygen content which can present some problems with long-term storage.[9] For these reasons, biodiesel is usually only blended with mineral diesel in small amounts to allow a reduction in greenhouse gas emissions without impacting engine operability.

The department recognises the benefits of increasing biodiesel use in Australia. A biodiesel fuel quality standard is in place in Australia, and the Australian diesel standard allows the supply of a mineral diesel blend containing up to 5.0% biodiesel, as this is generally the maximum blend rate suitable for light diesel vehicles. We are separately investigating the merits of a fuel quality standard that would allow supply of a 5.1–20% blend to provide a further option for industry sectors using heavy duty diesel engines that can operate effectively on this fuel.

In comparison to biodiesel, renewable diesel has similar chemical and physical properties to mineral diesel. This potentially allows it to be used as a drop-in fuel for many diesel engines used in heavy vehicles and machinery, and some light vehicles. It can also be blended with mineral diesel at all blend rates with minimal risk of engine operability issues. This engine compatibility is one of the key advantages of renewable diesel.

[7] Further details of the current approvals to supply renewable diesel are published online.

[8] Transesterification is a process by which the feedstock chemically reacts with an alcohol (usually methanol) in the presence of a catalyst such as lye. The resulting products are glycerine and FAME (AFDC n.d.).

[9] The oxygen content of biodiesel means that it is prone to oxidation. This limits the length of time biodiesel can be stored for, as oxidised biodiesel can become corrosive for the storage tank. When storage tanks are poorly managed, biodiesel is also more susceptible to microbial fouling, which can cause further tank corrosion and clog fuel lines (Gerveni et al. 2023).

1.3 Differences between renewable diesel and mineral diesel

Renewable diesel and mineral diesel have similar chemical properties but are not identical fuels. Renewable diesel is made up primarily of simple chemical compounds called paraffins, whereas mineral diesel is made up of a much more complex mixture of chemicals. These differing chemistries impact on the following properties of renewable diesel and mineral diesel:

- Renewable diesel has a lower density than mineral diesel.[10] The difference in density is the key reason why neat renewable diesel does not meet the Australian diesel standard and cannot be supplied without additional approval. The density of a fuel can affect the amount of energy released through combustion and cause differences in operability such as power, torque and fuel economy. Further information on renewable diesel and vehicle operability is at section 1.5.
- Renewable diesel has a lower aromatics content than mineral diesel. A lower level of aromatics improves how the fuel combusts in the engine, leading to increased engine efficiency and reduced emissions of known carcinogens.
- Renewable diesel contains less sulfur than mineral diesel, resulting in reduced emissions of sulfur oxides, which are harmful to human health and contribute to acid rain.
- All renewable diesel currently supplied in Australia under temporary approvals is imported and meets European specifications. However, the flash point of imported renewable diesel may be lower than that of Australian mineral diesel as Europe allows a lower minimum flash point for renewable diesel than the Australian diesel standard.[11] Australia requires a higher minimum flash point due to our climate and the likelihood of higher ambient temperatures (discussed further in section 2.4.2).

1.4 Regulation of renewable diesel overseas and in Australia

Fuel quality standards vary from country to country and can be dependent on factors such as climate and local refinery processes. For the purposes of this paper, we refer to the major renewable diesel markets: Europe and the United States (US). A comparison of the relevant diesel fuel quality standards with the Australian diesel standard is at Appendix A.

While diesel fuel quality is regulated in the US, the standard does not specify a minimum or maximum density for diesel.[12] As such, the lower density of renewable diesel does not provide any barriers for supply in the US. In Europe, a fuel quality standard was established in 2016 to regulate the quality of paraffinic diesel (which includes renewable diesel) separately from the existing European mineral diesel fuel quality standard.[13] This additional standard includes a lower minimum density specification than mineral diesel, allowing neat paraffinic diesel to be supplied in Europe.[14]

[10] The density of renewable diesel is around 5–10% lower than that of mineral diesel.

[11] The lower the flash point the more easily a material will ignite, which dictates handling and storage protocols (see section 2.4.2)

[12] Diesel fuel quality is regulated in the US by the standard ASTM D975.

[13] Mineral diesel quality is regulated in Europe by the standard EN 590 and paraffinic diesel quality is regulated by the standard EN 15940.

[14] EN 590 specifies a density of 820–845 kg/m^3. EN 15940 specifies density for two different class ratings, which are based on the cetane number of the fuel. Class A (higher cetane) allows a density of 765–800 kg/m^3 and Class B (normal cetane) allows a density of 780–810 kg/m^3.

The European paraffinic diesel standard

Europe is the largest vehicle market in the world that specifically regulates the quality of paraffinic diesel. As such, the majority of renewable diesel produced globally is made to meet the specifications of the European paraffinic diesel standard. The department is proposing to use the European specifications as a benchmark for the inclusion of renewable diesel within the Australian fuel quality standards as the global fuel industry is familiar with these specifications and it would allow most renewable diesel to be supplied in Australia without additional changes.

Under the FQS Act, the Australian mineral diesel standard specifies a minimum and maximum density parameter. Low-density diesel can impact vehicle operability and a very high-density diesel can lead to increased emissions of air pollutants. The current regulations in Australia mean that only blends of renewable diesel and mineral diesel that meet the minimum density requirement in the diesel fuel quality standard can be supplied. In order to supply neat renewable diesel and blends that have a lower density than this requirement, suppliers must apply for an approval to vary the diesel standard.

1.4.1 National Greenhouse and Energy Reporting Scheme

The National Greenhouse and Energy Reporting (NGER) Scheme, established by the *National Greenhouse and Energy Reporting Act 2007*, is Australia's single national framework for reporting and disseminating company information about greenhouse gas emissions, energy production and energy consumption. The data reported through the NGER Scheme is used to prepare the Australian National Greenhouse Accounts and Australian Energy Statistics, and also to ensure that companies are fulfilling their obligations under the Safeguard Mechanism. In 2023, the Government added renewable diesel as a reportable fuel type under the NGER Scheme. Renewable diesel is defined in the National Greenhouse and Energy Reporting Regulations 2008 as being a biofuel[15] and as such, is assigned a carbon dioxide scope 1[16] emission factor of zero in the National Greenhouse and Energy Reporting (Measurement) Determination 2008.[17] This reflects how the combustion of renewable diesel releases carbon absorbed from the atmosphere by the biogenic source materials.

From 1 July 2023, NGER Scheme reporters can report consumption of renewable diesel that meets the NGER Scheme definition. This will reflect the emissions benefits in emissions reporting, including by Safeguard Mechanism facilities to meet their baselines. By incentivising the use of renewable diesel, this will also increase demand for the fuel and accelerate the development of a renewable diesel market in Australia. The department will consider interactions with the NGER Scheme through consultation with stakeholders and further development on a standard.

1.4.2 Petroleum and Other Fuels Reporting

The *Petroleum and Other Fuels Reporting Act 2017* requires reporting on monthly production, sales and stocks of fuels and fuel related products to the department.[18] The data reported are used to prepare the monthly Australian Petroleum Statistics and to meet Australia's reporting obligations to

[15] *Biofuel* is defined in NGER Regulation 1.03 as a liquid fuel derived or recovered from biomass. Paraffinic diesels made from non-biomass feedstocks do not meet the definition of *renewable diesel* under the NGER Scheme.

[16] Direct (or scope 1) emissions are produced from sources within the boundary of an organisation and as a result of that organisation's activities. They are calculated at the point of emission release.

[17] These changes are legislated under the National Greenhouse and Energy Reporting Amendment (2023 Measures No. 1) Regulations 2023 and National Greenhouse and Energy Reporting (Measurement) Amendment (2023 Update) Determination 2023.

[18] Details on reporting requirements are available from the Australian Petroleum Statistics.

the International Energy Agency. This includes a requirement for reporting monthly renewable diesel production, sales and stocks. The department will consider opportunities to publish statistics on renewable diesel supply and use in Australia once there is sufficient reporting coverage to protect confidentiality of reporters.

1.5 Current equipment and vehicle compatibility and use

The department is seeking information from stakeholders about renewable diesel compatibility with existing and new diesel vehicles and equipment in Australia. Initial use of renewable diesel in Australia has been primarily for trials. Internationally, several machinery manufacturers have approved the use of renewable diesel in their engines, provided it meets the European paraffinic diesel standard.[19] There is also some usage of renewable diesel in light and heavy vehicles in the US and Europe. Several car and truck manufacturers have stated positions on vehicle models that can use renewable diesel. A list of vehicles and equipment compatible with renewable diesel can be found at Appendix B.

There are benefits to aligning Australia's approach to regulating renewable diesel quality with a major renewable diesel market such as Europe. All vehicles imported into Australia from Europe are tested with European fuel and all renewable diesel currently imported into Australia meets the European specifications. While the department expects heavy industry to be the initial primary consumer of renewable diesel, aligning Australia's renewable diesel standard closely with the European standard could enable a range of light vehicles to be approved for use with renewable diesel in Australia. This would eliminate the need for engine modifications and concerns about warranties due to misfuelling.

Question

1) Please provide information about the benefits or impacts from using renewable diesel within the existing vehicle and equipment fleet in Australia.

[19]The European paraffinic diesel standard EN 15940 regulates all paraffinic diesel. Renewable diesel is a type of paraffinic diesel and is the most commonly known form of paraffinic diesel. However, paraffinic fuels can be produced from non-renewable sources through other chemical processes such as Fischer-Tropsch synthesis, which although chemically similar are not considered the same as renewable diesel.

Part 2: Technical considerations of an Australian paraffinic diesel standard

2.1 Summary of key considerations

This section provides key considerations and indicative specifications for a fuel quality standard that incorporates renewable diesel. It is intended to elicit feedback from industry regarding the technical issues that need to be resolved before a standard can be determined by the Government.

The department is seeking views on:

- whether an amendment to the existing diesel fuel quality standard is sufficient versus the benefits of creating a standalone fuel quality standard for paraffinic diesel
- the specific technical parameters that may be needed to ensure optimal engine operability, while ensuring fuel that meets the standard can be readily produced and imported
- how the regulation of diesel and renewable diesel blends should be considered.

The department is proposing to enable *paraffinic diesel* supply under the fuel quality standards, rather than only *renewable diesel*

Using the term 'paraffinic diesel' would enable the supply of all paraffinic diesel while ensuring compliance can be tested under the FQS Act. Enabling the supply of paraffinic diesel would regulate the quality of renewable diesel as well as other paraffinic diesel alternatives (such as synthetic diesel) produced from non-renewable sources. The factors for this position are discussed further at section 2.2.

To achieve this, the department is considering:

1. a suitable approach to establish regulation of neat paraffinic diesel under the fuel quality standards. The two options discussed in this paper are:
    - amending the existing automotive diesel standard to include paraffinic diesel (discussed at section 2.3.1)
    - creating a standalone paraffinic diesel standard (discussed at section 2.3.2).
2. a suitable approach to enable the supply of blended paraffinic diesel at all blend ratios and the appropriate labelling requirements for paraffinic diesel. These issues are discussed at section 2.4.

The department has undertaken initial consultation with engaged industry groups prior to development of this paper. The department has considered the feedback gathered from these initial consultations to develop indicative specifications for comment at Appendix C and Appendix D.

The department recognises the benefits of aligning our approach with the European standard while maintaining practicality for the Australian context. This has been reflected in the department's consideration of approaches and indicative specifications.

2.2 An origin-neutral approach to paraffinic diesel

The Australian diesel fuel quality standard defines renewable diesel as *'liquid fuel that is manufactured by chemically altering and hydrotreating (or equivalent) vegetable oils, animal fats,*

organic waste and biomass, but also includes non-organic waste that cannot be reasonably recycled. It is not directly made from any fossil fuel'. Enabling the supply of only renewable diesel that meets this definition presents challenges to ensuring compliance under the FQS Act.

The FQS Act regulates the quality of fuel supplied in Australia. Its objectives are: to reduce the level of pollutants and emissions arising from the use of fuel that may cause environmental and health problems; to facilitate the adoption of better engine technology and emission control technology; to allow for more effective operation of engines; and to ensure that appropriate fuel information is provided at the point of supply. Fuel quality standards regulate fuel parameters and associated testing methods but do not regulate the origin of fuels. This falls beyond the scope of the standards, which is to ensure the quality of the end product.

The department is proposing to regulate fuel quality for paraffinic diesel in Australia and enable its supply, irrespective of its feedstock or source material. It would not serve as a mechanism to ensure that fuel labelled as renewable diesel is made from a biogenic source. However, should a consumer purchase paraffinic diesel which a supplier falsely advertised as having biogenic origins, the consumer would be provided protections under Australian Consumer Law.

The department is also in the process of developing an internationally aligned Guarantee of Origin Scheme (GO Scheme) to measure, track and verify the emissions and other attributes of Australian clean energy products, commencing with hydrogen. The scheme will expand in the future to incorporate additional low emissions products based on an annual product prioritisation process. The department released a consultation package in September 2023, which presented the detailed design of the GO scheme and the emissions accounting approach.

2.2.1 Defining paraffinic diesel in the diesel standard

In order to facilitate an origin-neutral approach, the definitions for 'renewable diesel' and 'synthetic diesel' will be removed and incorporated under an overarching definition of 'paraffinic diesel' in the Fuel Quality Standards (Automotive Diesel) Determination 2019 for both options discussed in this paper. The proposed definition for paraffinic diesel is:

Paraffinic diesel means a fuel that:

a) is produced through a process such as, but not limited to: gasification, Fischer-Tropsch synthesis, hydrothermal conversions or hydroprocessing; and

b) consists mainly of alkane hydrocarbons; and

c) is suitable for use as:

   i) a substitute for mineral diesel; or

   ii) a blending component substitute for mineral diesel.[20]

Question

2) Please provide any comments on the proposed approach or wording of the paraffinic diesel definition.

[20] The department would also introduce a definition of mineral diesel into the standards.

2.3 Options for enabling supply

The department is considering two options to enable supply in Australia under the FQS Act:

1. Make amendments to the existing diesel standard to include paraffinic diesel
2. Create standalone fuel quality standards for neat paraffinic diesel and paraffinic/mineral diesel blends.

2.3.1 Option 1: Inclusion of paraffinic diesel parameters within the existing diesel standard

Under this option, amendments would be made to reduce the minimum density specification for paraffinic diesel. The density range for mineral diesel would not change. Figure 2 provides an example of how this might be represented.

Figure 2: Example of how different density ranges could be incorporated in the diesel standard

Density at 15°C

Diesel not containing paraffinic diesel: 820–850 kg/m^3

Diesel containing paraffinic diesel: 765–850 kg/m^3*

*any mineral diesel used in a paraffinic diesel blend must meet the specifications of the diesel standard, including the density range for diesel not containing paraffinic diesel.

This approach is the administratively simplest option but the department has identified that further consideration is required for the following issues:

- As this approach would simply broaden the density parameters of the existing diesel standard, it would not mandate the quality of 100% paraffinic diesel. This could cause uncertainty for industry as suppliers would not have a 100% paraffinic diesel quality specification to meet through their imports.
- A caveat similar to the drafting in Figure 2 for minimum density may be required to change any other parameters of paraffinic diesel that may differ from mineral diesel in Australia, such as flash point (see section 2.4.2).
- It would be necessary to develop an information standard requiring specific labelling for neat paraffinic diesel and anything classified as a paraffinic diesel blend.

Preliminary discussions have not supported this approach.

Questions

3) What are the advantages and disadvantages of including the paraffinic diesel parameters within the existing diesel standard?
4) What should the minimum density limit be for paraffinic diesel in Australia and why?

2.3.2 Option 2: Create a new standard

Under Option 2, the Government would make a separate fuel quality standard for paraffinic diesel. This would be distinct from the diesel standard and provide specifications for 100% paraffinic diesel,

operating similarly to the Fuel Quality Standards (Biodiesel) Determination 2019, which regulates 100% biodiesel.

Industry groups supported this approach during initial engagement as it would provide more market differentiation. It would also mirror the regulatory framework of Europe, which has a standalone paraffinic diesel standard (EN 15940).

The department has formulated some indicative specifications for a paraffinic diesel standard in Australia (as shown in Appendix C) to elicit feedback. These specifications are intended to align with EN 15940 as closely as possible, with variations only where necessary to consider the Australian context and the quality standard for our mineral diesel.

The main point of differentiation is the maximum biodiesel content. Although EN 15940 allows both mineral and paraffinic diesel to contain up to 7% biodiesel by volume, there is a maximum of 5% biodiesel content allowed in the diesel fuel quality standards for Australia, the US, Japan and South Korea.[21] As a large portion of heavy vehicles imported into Australia come from countries with a 5% biodiesel limit and are tested on their respective fuels, the Australian diesel standard is aligned with this 5% limit to ensure operability with these vehicles. Further consideration of the appropriate blend rate for biodiesel is at section 2.4.3.

EN 15940 specifies parameters for two classes of paraffinic diesel, with different density ranges and minimum cetane levels. Class A paraffinic diesel has a density range of 765–800 kg/m^3 and a minimum cetane number of 70. Class B paraffinic diesel has a density range of 780–810 kg/m^3 and a minimum cetane number of 51. The department's indicative specifications do not mirror this structure and only provide parameters for one class of paraffinic diesel that has a density range of 765–810 kg/m^3 and a minimum cetane number of 51.

The indicative specifications in Appendix C also contain some additions to the EN 15940 specifications, namely conductivity at ambient temperature and filter blocking tendency. These parameters are not regulated under EN 15940 but are specified in the Australian diesel standard. The department suggests these parameters be retained to ensure the paraffinic diesel standard is fit for purpose in Australia.

The indicative specifications should not be considered as a draft fuel standard or the department's preferred option. They are intended solely to elicit comments. The department will consider all comments and feedback when analysing the merits of a standalone paraffinic diesel standard and the associated specifications. If Option 2 is progressed, the department will also consult with stakeholders on appropriate test methods for the parameters.

Some concerns have been raised that creating a paraffinic diesel standard may preclude the supply of renewable diesel that does not meet the definition of paraffinic diesel in future. The department has considered this but is proceeding with a paraffinic diesel standard on the basis that:

- The department understands all renewable diesel currently produced is paraffinic.
- The department acknowledges there is potential for technological advancement to produce non-paraffinic renewable diesel but is not aware of this being commercially viable at present.
- If such processes were to evolve and become commercially viable in future, the department would re-examine whether the definition of paraffinic diesel is fit for purpose.

[21] The US standard ASTM D975 specifies a maximum of 5% biodiesel content by volume for diesel. In Japan, under the Quality Control Law the blending rate of biodiesel is limited to 5% by mass. South Korea allows from 2–5% biodiesel to be blended with mineral diesel.

Questions

5) What are the advantages and disadvantages of creating a standalone paraffinic diesel standard?

6) Should a standalone paraffinic diesel standard follow the specifications of the European standard EN 15940 or another standard? Why? (See indicative specifications for comment at Appendix C.)

7) Are there benefits in having two classes of paraffinic diesel with different densities and cetane ratings per the European standard EN 15940?

2.4 Specific issues that need further consideration

The department is seeking comments on additional issues which are common to both options proposed in this paper.

2.4.1 Paraffinic and mineral diesel blends

The FQS Act already allows the supply of paraffinic diesel blends where the density of the paraffinic diesel blend is greater than or equal to 820 kg/m^3 and the blend meets all other specifications in the diesel standard. However, blends with high proportions of paraffinic diesel seldom meet this density specification. The department is seeking to enable the supply of paraffinic diesel blends at all ratios.

Blends under Option 1

If the Government were to proceed with Option 1, any paraffinic diesel blend could be supplied provided it meets all other specifications of the diesel standard.

Blends under Option 2

If the Government proceeded with a standalone paraffinic diesel standard under Option 2, the department would consider creating an additional standard for paraffinic diesel/mineral diesel blends (indicative standard for comment at Appendix D). Under this option, each blend component would be required to meet its respective standard (either the automotive diesel standard or the paraffinic diesel standard), and the final product would need to meet the blend standard. This would eliminate the risk of off-specification mineral diesel being blended with higher quality paraffinic diesel (and vice versa) to produce a final blend that would still meet the requirements of the blend standard.

Question

8) If the Government created a paraffinic diesel standard, what would be the best way to regulate paraffinic diesel/mineral diesel blends?

2.4.2 Flash point

The flash point of a flammable liquid is the lowest temperature at which there is sufficient flammable vapour generated to temporarily ignite in the presence of an ignition source. Put simply, the lower the flash point the more easily a material will ignite. As such, the flash point is a good indicator of the maximum temperature at which a fuel can be safely stored (Lois et al. 2003).

Depending on composition and the presence of additives or impurities, the flash point of diesel can vary. Density, ambient pressure and ambient temperature also have an impact on flash point. In turn, the flash point of diesel has wider implications for transport, storage and handling in Australia. The flash point of paraffinic diesel has been highlighted as an issue for further consideration.

Impacts on handling

The Australian Code for the Transport of Dangerous Goods by Road and Rail (ADG Code) sets out the requirements for transporting dangerous goods by road (National Transport Commission 2023). Under the ADG Code, flash point directly affects the hazard classification and safety requirements for the transportation of fuel. Any liquid with a flash point greater than 60°C is considered a 'combustible' liquid under the ADG Code and is therefore not considered a dangerous good for transport purposes. However, any liquid with flash point equal to or less than 60°C is considered a 'flammable' liquid, which has a higher hazard classification, and additional requirements must be met for labelling, storage and handling, and transportation in accordance with the ADG Code and the Australian standard for the storage and handling of flammable and combustible liquids, AS 1940.

Under the Australian diesel standard, all diesel (including any diesel that meets the definitions of renewable diesel or synthetic diesel) must meet a minimum flash point of 61.5°C. This higher limit reduces the hazard classification of diesel to a combustible liquid and ensures greater safety and ease with transport, storage and handling. However, the flash point of paraffinic diesel is regulated to a minimum of 55°C under the European standard EN 15940. Paraffinic diesel that meets this lower flash point would be considered a flammable liquid and require more stringent handling procedures in Australia, in line with the current storage and handling requirements for petrol.

All paraffinic diesel supplied in Australia meets European specifications and the department expects that this situation will remain moving forward. The department is considering whether the minimum flash point for paraffinic diesel should be aligned with the European limit to enable greater supply.

Question

9) What should the minimum flash point be for paraffinic diesel in Australia and why? What would the implications be if the minimum flash point of paraffinic diesel aligned with the European minimum at 55°C?

2.4.3 Biodiesel content

The indicative standards at Appendix C and Appendix D specify a maximum biodiesel content of 5%, aligning with the current 5% limit in the Australian diesel standard. As discussed in section 2.3.2, this is to align with international standards and ensure vehicle operability. However, the European paraffinic diesel standard EN 15940 allows a maximum of 7% fatty acid methyl esters (FAME), which aligns with the maximum FAME content in the European mineral diesel standard EN 590. The department is seeking further insight into this issue.

Question

10) What should the maximum FAME content of paraffinic diesel be? Would increasing the maximum FAME content to 7% lead to any vehicle operability or storage issues?

2.4.4 Developing an information standard

An information standard for paraffinic diesel would prescribe specific labelling requirements. This information standard would aim to ensure motorists do not misfuel vehicles that should not be operated on paraffinic diesel. The department is considering introducing a labelling requirement for 100% paraffinic diesel and paraffinic diesel blends with density lower than 820 kg/m^3. This would include a statement that the fuel may not be compatible with some diesel engines.

The following labelling requirements are prescribed under the European paraffinic diesel standard:

'*Paraffinic diesel fuel shall be distinguished from other diesel fuel by a dedicated marking. Indication on dispensing pumps of "Not suitable for all vehicles; consult vehicle manufacturer information or manual before use" is recommended.'*

Question

11) Should labelling requirements similar to the European standard EN 15940 be used or are there other labelling requirements appropriate for Australia?

Next steps

The department will consider submissions to this consultation paper and consult further with stakeholders as required. Following this process, the department will develop a draft fuel quality standard for consideration by the Fuel Standards Consultative Committee (FSCC). The FSCC provides a consultative mechanism for the Government and comprises representatives from each state and territory government, among other relevant parties. The Minister for Climate Change and Energy is required to consult the FSCC and consider its recommendations before creating or amending a fuel quality standard.

Following the FSCC review process, the draft standard and the FSCC's recommendation will be provided to the Minister for consideration.

Making a submission

Submissions are invited from all interested stakeholders. Submissions should be lodged via our Consultation Hub by clicking the Make a Submission button. Key dates for this consultation period are listed in Table 1.

Table 1: Key dates for consultation period

Timeline	Date
Consultation begins	Friday, 24 November 2023
Consultation ends	Friday, 2 February 2024
Department may contact stakeholders for further information	As required

Consultation questions

1. Please provide information about the benefits or impacts from using renewable diesel within the existing vehicle and equipment fleet in Australia.
2. Please provide any comments on the proposed approach or wording of the paraffinic diesel definition.
3. What are the advantages and disadvantages of including the paraffinic diesel parameters within the existing diesel standard?
4. What should the minimum density limit be for paraffinic diesel in Australia and why?
5. What are the advantages and disadvantages of creating a standalone paraffinic diesel standard?
6. Should a standalone paraffinic diesel standard follow the specifications of the European standard EN 15940 or another standard? Why? (See indicative specifications for comment at Appendix C.)
7. Are there benefits in having two classes of paraffinic diesel with different densities and cetane ratings per the European standard EN 15940?
8. If the Government created a paraffinic diesel standard, what would be the best way to regulate paraffinic diesel/mineral diesel blends?
9. What should the minimum flash point be for paraffinic diesel in Australia and why? What would the implications be if the minimum flash point of paraffinic diesel aligned with the European minimum at 55°C?
10. What should the maximum FAME content of paraffinic diesel be? Would increasing the maximum FAME content to 7% lead to any vehicle operability or storage issues?
11. Should labelling requirements similar to the European standard EN 15940 be used or are there other labelling requirements appropriate for Australia?

Appendix A: Diesel standards compared

Table 2 provides a comparison of the fuel parameters regulated under the European paraffinic diesel standard EN 15940, the US diesel standard ASTM D975 and the Australian automotive diesel standard.

Table 2: Comparison of international diesel standards with Australia

Parameter	European EN 15940 Specification (Class B) (Paraffinic Diesel)	US ASTM D975 Specification (Diesel)	Australian Automotive Diesel Specification (Mineral Diesel)
Derived cetane number	-	-	Diesel containing biodiesel: 51 minimum
Cetane number	51.0 minimum	40 minimum	-
Cetane index	-	40 minimum	46 minimum
Density at 15°C	780–810 kg/m^3	-	820–850 kg/m^3
Flash point	Above 55.0°C	52°C minimum	61.5°C minimum
[Kinematic] Viscosity at 40°C	2.000–4.500 mm^2/s	1.9–4.1 mm^2/s	2.0–4.5 mm^2/s
Distillation **% (v/v) recovered at 250°C** **% (v/v) recovered at 350°C** **90% (v/v) recovered at T°C** **95% (v/v) recovered at T°C** **Initial boiling point at T°C**	 < 65% (v/v) maximum 85% (v/v) minimum - 360° Report	 - - 282°–338° - -	 - - - 360°C maximum -
Lubricity, wear scar diameter (WSD) at 60°C	460 µm maximum	520 µm maximum	460 µm maximum
FAME [Biodiesel] content	7.0% (v/v) maximum	5.0% (v/v) maximum	5.0% (v/v) maximum
Manganese content	2.0 mg/l maximum	-	-
Total aromatics content	1.1% (m/m) maximum	35% (v/v) maximum	-
Polycyclic aromatic hydrocarbons (PAH)	-	-	11% (m/m) maximum
Sulfur content	5.0 mg/kg	15 mg/kg	10 mg/kg
Carbon residue (on 10% distillation residue)	0.30% (m/m) maximum	0.35% (m/m) maximum	0.2% (m/m) maximum
Ash content	0.010% (m/m) maximum	0.01% maximum	0.01% (m/m) maximum
Water content	200 mg/kg	-	Diesel containing biodiesel: 200 mg/kg maximum
Water and sediment	-	0.05% (v/v) maximum	0.05% (v/v) maximum
Total contamination	24 mg/kg	-	-
Copper strip corrosion (3h at 50°C)	Class 1 rating	No. 3	Class 1 rating
Oxidation stability **For all paraffinic diesel** **For all paraffinic diesel with >2.0% vol FAME content**	 - 25 g/m^3 maximum 20.0^m hours minimum	 - - -	 2.5 mg/100 mL maximum - -
Conductivity (at time of delivery)	-	25 pS/m	-
Conductivity at ambient temperature	-	-	Diesel held by a terminal or refinery for sale or distribution: 50 pS/m minimum at ambient temperature
Filter Blocking Tendency	-	-	2.0 maximum

Appendix B: International equipment and vehicle compatibility

Several vehicle and machinery manufacturers have approved the use of paraffinic diesel in their engines in Europe and North America, provided it meets the European paraffinic diesel standard. These approvals most commonly refer to compatibility with paraffinic diesel or hydrotreated vegetable oil (HVO, a type of renewable diesel).

Machinery compatible with paraffinic diesel in Europe and North America under the EN 15940 fuel quality standard[22]

- **Cummins** have approved the use of paraffinic fuels for certain engine models: B4.5, B6.7 and L9 (both on-highway and off-highway models), on-highway models ISB, ISL and ISF, and off-highway models QSB, QSC, QSL and QSF.
- **Deere** engines can be fuelled with paraffinic/mineral diesel blends or neat paraffinic diesel. Stage V engines operating in the EU can use blends of up to 30% paraffinic diesel.[23]
- **Deutz** has approved all engine series that meet Euro Stage V nonroad noxious emissions standards for use with paraffinic diesel in accordance with EN 15940.
- **JCB** 430, 444 and 448 engines compliant with Euro Stage IIIB – Stage V nonroad noxious emissions standards are compatible with HVO fuels that meet EN 15940.[24]
- **Kohler** has approved the use of EN 15940-compliant HVO in all its diesel engines from February 2022.
- **Komatsu** engines in Komatsu machinery can be operated with HVO that complies with EN 15940. From April 2023, Komatsu has switched to using HVO as the factory-fill fuel in select European plants.
- The majority of **Liebherr** construction machines, cranes and mining equipment can be fuelled with neat HVO or an HVO/mineral diesel blend.
- **mtu** Series 4000 and Series 1600 engines for power generation are approved to run on paraffinic fuels in accordance with EN 15940.
- **Perkins** engines can be fuelled with neat or blended paraffinic fuels which meet the specifications of EN 15940.
- **Trane Technologies** has approved the use of HVO in Thermo King global cold chain solutions, including refrigerated truck and trailer product lines. HVO is also approved for Thermo King truck and trailer products operating in Europe, the Middle East, Africa and the Asia Pacific.
- All **Volvo CE** machines (construction equipment) are approved for use with HVO.
- **Volvo Penta** (industrial engines) has approved the use of neat and blended HVO in all its engines globally.

[22] This information was gathered by the department between June and September 2023, but should not be relied upon as accurate.

[23] Stage V engines meet the European Stage V nonroad noxious emissions standards which came into effect in 2019.

[24] Euro Stage III nonroad noxious emissions standards (divided into Stages IIIA and IIIB) came into effect from 2006.

Vehicles compatible with paraffinic diesel in Europe under the EN 15940 fuel quality standard[25]

- **Audi models** with V6 diesel engines up to 210kW manufactured from mid-February 2022 can be fuelled with HVO in accordance with EN 15940. Some 4-cylinder diesel models have been approved for use in select European markets since mid-2021.
- **Volvo cars** permits the use of 100% renewable diesel for vehicles manufactured from 2015 onwards that have Volvo's own 4-cylinder diesel engine for owners in Sweden, Norway, Finland and Denmark.
- **All Volkswagen models** (Europe) with 4-cylinder diesel engines made from June 2021 are approved for operation with paraffinic diesel fuels (EN 15940).
- **All Peugeot and Citroen passenger cars and vans** with Euro 5 and Euro 6 standard engines in Norway and Sweden are approved to run on HVO-type renewable diesel, as long as these fuels meet EN 15940.[26]
- **Western European Toyota Hilux and Land Cruiser** diesel models manufactured from the first quarter of 2023 can be used with neat HVO.
- **All Scania Euro 5 and 6 engines** can run on HVO.
- **Ford Europe** has approved the use of HVO in its Transit vans.

Renewable diesel producer Neste provides a list of engine manufacturer approvals on their website, however as renewable diesel is only supplied in a few countries, this information is mostly applicable for European markets.

[25] These manufacturer approvals are valid for European markets only. These models have not been approved for use with renewable diesel in Australia. This information was gathered between July and September 2023 and should not be relied upon.

[26] Euro 5 and Euro 6 standards are the European standards which regulate noxious emissions from light vehicles. Euro 5 standards were implemented in Europe in 2005, which were superseded by the more stringent Euro 6 standards in 2014. Australia currently mandates Euro 5 standards, which came into effect in 2013.

Appendix C: An indicative neat paraffinic diesel standard

Table 3 provides indicative specifications for a paraffinic diesel standard in Australia.

Table 3: Indicative 100% paraffinic diesel fuel quality standard for Australia

Parameter	EN 15940 Specification	Proposed AU Specification	Aligned with EN 15940	Comment
Cetane number	51.0 minimum	51.0 minimum	✓	The proposed AU specification of minimum 51.0 is aligned with the EN 15940 Class B specification.
Density at 15°C	765.0–810 kg/m^3	765.0–810.0 kg/m^3	✓	This density range spans the specified range across both classes in EN 15940: Class A: 765.0 – 800.0 kg/m^3 Class B: 780.0 – 810.0 kg/m^3.
Flash point	Above 55.0°C	Above 55.0°C minimum	✓	This aligns with the specification in EN 15940 for both Class A and Class B.
[Kinematic] Viscosity at 40°C	2.000–4.500 mm^2/s	2.000–4.500 mm^2/s	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Distillation **% (v/v) recovered at 250°C** **% (v/v) recovered at 35 °C** **95% (v/v) recovered at T°C** **Initial boiling point at T°C**	 <65% (v/v) maximum 85% (v/v) minimum 360° Report	 <65% (v/v) maximum 85% (v/v) minimum 360.0°C maximum Report	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Lubricity, wear scar diameter (WSD) at 60°C	460 µm maximum	460 µm maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
FAME [Biodiesel] content	7.0% (v/v) maximum	5.0% (v/v) maximum	**Different**	This aligns with the Australian mineral diesel specification (5.0% v/v maximum). This does not align with the EN 15940 specification (7.0% v/v maximum).
Manganese content	2.0 mg/l maximum	2.0 mg/l maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Total aromatics content	1.1% (m/m) maximum	1.1% (m/m) maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Sulfur content	5.0 mg/kg	5.0 mg/kg maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Carbon residue (on 10% distillation residue)	0.30% (m/m) maximum	0.30% (m/m) maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Ash content	0.010% (m/m) maximum	0.010% (m/m) maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Water content	200 mg/kg	0.020% (m/m) maximum	✓	Aligns with EN 15940 (although different units).

Parameter	EN 15940 Specification	Proposed AU Specification	Aligned with EN 15940	Comment
Total contamination	24 mg/kg	24 mg/kg maximum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Copper strip corrosion (3h at 50°C)	Class 1 rating	Class 1	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Oxidation stability **For all paraffinic diesel** **For all paraffinic diesel with >2.0% vol FAME content**	 25 g/m^3 maximum 20.0 hours minimum	 25 g/m^3 maximum 20.0 hours minimum	✓	This aligns with the EN 15940 specification for both Class A and Class B.
Conductivity at ambient temperature	-	Paraffinic diesel held by a terminal or refinery for sale or distribution: 50 pS/m minimum at ambient temperature	**Different**	This aligns with the Australian automotive diesel standard, but this parameter is not regulated under EN 15940.
Filter Blocking Tendency	-	2.0 maximum	**Different**	This aligns with the Australian automotive diesel standard, but this parameter is not regulated under EN 15940.

- Any biodiesel component of paraffinic diesel must meet the requirements of the fuel quality standard for biodiesel set out in the Fuel Quality Standards (Biodiesel) Determination 2019.

Appendix D: An indicative paraffinic diesel blend standard

Table 4 outlines indicative specifications for a blend standard for paraffinic diesel/automotive diesel blends.

Table 4: Indicative standard for blends of paraffinic diesel and automotive diesel

Parameter	Specification	Comment
Paraffinic Diesel content	1–99% (v/v)	
Automotive Diesel content	1–99% (v/v)	
Cetane index **For blends with <20% paraffinic diesel**	46 minimum	Aligns with Australian diesel standard. Components must meet the respective standards for Cetane Index/DCN
Derived Cetane Number **For blends with 20–99% paraffinic diesel**	51 minimum	Minimum aligns with EN 15940
Density at 15°C	765.0–850.0 kg/m³	Minimum aligns with EN 15940 Class A, maximum aligns with the maximum in the Australian diesel standard
Flash point	55.1°C minimum	Aligns with EN 15940
[Kinematic] Viscosity at 40°C	2.000–4.500 mm²/s	Aligns with EN 15940 (more significant figures than mineral diesel)
Distillation **95% (v/v) recovered at T°C**	360.0°C maximum	
Lubricity, wear scar diameter (WSD) at 60°C	460 µm maximum	Aligns with EN 15940
FAME [Biodiesel] content	5.0% (v/v) maximum	5.0% AU mineral diesel, 7.0% EN 15940
Sulfur content	10 mg/kg maximum	Aligns with Australian diesel standard
Carbon residue **(on 10% distillation residue)**	0.30% (m/m) maximum	Aligns with EN 15940
Ash content	0.010% (m/m) maximum	Aligns with EN 15940
Water content	0.020 % (m/m) maximum	
Copper strip corrosion **(3h at 50°C)**	Class 1	Aligns with Australian diesel standard, not regulated in EN 15940
Oxidation stability **For all paraffinic diesel** **For all paraffinic diesel with >2.0 vol% FAME content**	 25 g/m³ maximum 20.0 hours minimum	Aligns with EN 15940
Conductivity at ambient temperature	Paraffinic diesel held by a terminal or refinery for sale or distribution: 50 pS/m minimum at ambient temperature	Aligns with Australian diesel standard, not regulated in EN 15940
Filter Blocking Tendency	2.0 maximum	Aligns with Australian diesel standard
Polycyclic aromatic hydrocarbons (PAH) **For blends <20% paraffinic diesel** **For blends with 20–99% paraffinic diesel**	 11% (m/m) maximum 8% (m/m maximum)	Aligns with Australian diesel standard

- Any paraffinic diesel component of blended diesel fuel must meet the requirements of an Australian paraffinic diesel standard.
- Any automotive diesel component of diesel must meet the requirements of the fuel quality standard for automotive diesel set out in the Fuel Quality Standards (Automotive Diesel) Determination 2019.
- Any biodiesel component of diesel must meet the requirements of the fuel quality standard for biodiesel set out in the Fuel Quality Standards (Biodiesel) Determination 2019.

Glossary

Diesel Parameter	Overview
Aromatics	A class of hydrocarbons in which, similar to naphthenes, some of the carbon atoms are arranged in a ring. However, aromatic hydrocarbons have a different (unsaturated) carbon bond structure compared to naphthenes. Aromatic hydrocarbons rings contain 6 carbon atoms.
Ash content	Indicates amount of oil- or water-soluble metals and contaminants like dirt or rust. High ash content affects the combustion and fuel system, leading to soot and other emissions.
Carbon residue	Approximation of the fuel's tendency for carbonaceous deposits, which can affect engine efficiency and combustion characteristics if built up. Can lead to soot and other emissions.
Cetane number	A measure of the combustion characteristics of the fuel.
Conductivity	Diesel is essentially non-conductive, so conductivity must be regulated to prevent the risk of static discharge during pumping and filtering operations causing fire or explosion.
Copper strip corrosion	Used to evaluate the quantity of corrosive (sulfur) compounds in the fuel. Corrosive compounds erode fuel and engine systems, affecting vehicle operability and producing more emissions.
Density	A measure of the mass of a fuel per volume. Too high or too low density can affect the viscosity parameter. Low density can affect vehicle operability. High density leads to increased noxious emissions.
Distillation range T95	Provides a distillation or boiling point 'profile' of the fuel. Too high or too low distillation range can lead to poor engine performance, resulting in increased emissions.
FAME content	The management of biodiesel in diesel fuel is complex and may impact vehicle operability in higher quantities if engines are not specifically designed for the fuel.
Filter blocking tendency	Numerical measurement of the tendency of the fuel to block the filtering system. Blocked or partially blocked filters can cause combustion issues in the engine and produce more emissions.
Flash point	Determines the temperature at which the fuel vapour will ignite in the presence of oxygen and an ignition source. A too-high flash point may lead to poor combustion, causing increased emissions. A too-low flash point can lead to fire or explosion.
Hydrocarbons	Organic compounds composed entirely of carbon and hydrogen atoms.
Lubricity	Measures extent of wear on metallic parts in fuel systems. Low lubricity = more wear. This can lead to combustion issues and higher emissions. Historically, sulfur content in diesel provided significant protection for the engine components. Since the maximum allowable sulfur content in diesel was reduced in 2009, wear properties are now measured and additives are used to improve lubricity.
Naphthenes	A class of hydrocarbons in which some of the carbon atoms are arranged in a ring, with saturated carbon bonds. The naphthenes in diesel fuel have rings of 5 or 6 carbon atoms.
Oxidation stability	Measures the tendency of the fuel to become oxidised. Oxidation can lead to incomplete combustion and increased emissions. Also causes issues with long-term storage.
Paraffins	A class of hydrocarbons in which all the carbon atoms are either linked to form chain-like molecules (normal-paraffins) or some of the carbon atoms are linked in a chain with one or more carbons branching off from the backbone (iso-paraffins). For the same number of carbons, normal-paraffins and iso-paraffins have similar chemical formulas, but different chemical properties, such as cetane number, and physical properties, such as boiling point and density.
Polyaromatic hydrocarbons	Compounds with two or more aromatic rings. These rings are fused together, with some carbons being shared by adjacent rings. Higher percentage increases the likelihood of poor or incomplete combustion, resulting in noxious emissions.
Total (particulate) contamination	Measures the total quantity of entrained particulates above a certain size. A high quantity can cause filter blocking and engine performance issues, leading to increased emissions.
Viscosity	Measures flow characteristics of the fuel and can indicate fuel composition. Fuel pumps are calibrated to a certain viscosity range. Anything outside this range can lead to poor combustion, resulting in soot and other emissions.
Water content	Determination of entrained water within the fuel. High water content prematurely corrodes the engine and causes issues in the combustion chamber. Free water also promotes bacterial growth in storage tanks.

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