The Hague Centre
for Strategic Studies

Making e-SAF land

Opportunities for the Netherlands in the synthetic aviation fuel sector

Irina Patrahau and Ron Stoop

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The analysis presented in the paper, including the conclusions and recommendations, is the product of independent research. The responsibility for the content of this paper lies with the authors and the authors alone. The research was commissioned by the Ministry of Foreign Affairs and executed by The Hague Centre for Strategic Studies.

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Executive summary

The decarbonisation of aviation has been a major policy priority for the Netherlands and the European Union (EU) writ large. Efforts largely centre on reducing emissions by blending Sustainable Aviation Fuel (SAF) into conventional jet fuel, with the ultimate goal of gradually increasing the SAF consumption by aircraft engines. The SAF industry is very small worldwide, representing just 0.53% of jet fuel consumption in 2024, with the majority of it being bio-based SAF.[1]

Synthetic sustainable aviation fuels (e-SAF) offer a complementary option to bio-based SAF. Green hydrogen and captured carbon are turned into e-SAF through power-to-liquid production processes. Incorporating e-SAF into the energy mix contributes to feedstock diversification, particularly in terms of the energy source, though its production costs are significantly higher than those of Hydrotreated Vegetable Oils (HVO), made via the dominant HEFA (Hydroprocessed Esters and Fatty Acids) technology.

The high e-SAF production costs compared to alternatives make regulatory support critical for market development. The EU's *Renewable Energy Directive* (RED) and *ReFuelEU Aviation* set specific sustainability criteria and targets for SAF starting from 2025 and progressively intensifying. As a result of these targets, the global e-SAF market is expected to accelerate after 2030 when the first EU e-SAF mandates and penalties go into force. This is also due to the expected maturation of the green hydrogen and carbon capture industries, especially in the EU.

This report assesses opportunities for Dutch industry to engage with global partners in the e-SAF sector. Dutch companies have technical capabilities along the e-SAF supply chain, including in green hydrogen production, carbon capture and utilisation, and e-SAF production. They also have strengths in the field of project engineering, certification, trade, and research and development in the e-SAF sector. These industrial assets along the e-SAF supply chain are paired with substantial national and regional demand for aviation fuel. The largest Dutch airport, Amsterdam Schiphol Airport, is one of the busiest and most well connected in Europe. The Netherlands is also a European oil hub, serving not only its domestic market but also that of its neighbours. As production costs along the e-SAF supply chain are high in the Netherlands, it is essential to work with partners that benefit from lower costs in producing green electricity, green hydrogen and e-fuels in order to find new business opportunities and meet its consumption needs.

Together with the Netherlands Enterprise Agency (RVO) and representatives from the Dutch Ministries of Foreign Affairs, Climate Policy and Green Growth, and Infrastructure and Water Management, seven potential e-SAF partner countries were selected for analysis: France, Spain, Sweden, Canada, Morocco, Brazil, and Saudi Arabia. Each country analysis considers three aspects: (1) setup of the country's e-SAF sector, defined by national ambitions and capability gaps; (2) the business environment in said country, determined through six indicators assessing sovereign credit ratings, public institutions, infrastructure, innovation, climate resilience, country risk premium; and (3) geopolitical relations with the Netherlands, analysed based on political, economic and security ties.

1 European Union Aviation Safety Agency, 'Sustainable Aviation Fuels', EASA, 2024, https://www.easa.europa.eu/en/domains/environment/eaer/sustainable-aviation-fuels.

Spain, Sweden and France are moving faster than other countries on e-SAF development due to European regulations, bringing the most immediate opportunities for Dutch companies. Spain and Sweden have the highest potential out of the seven countries for short-term collaboration with Dutch companies. This is because of their optimal conditions for e-fuel/e-SAF production (green grid, low energy costs) and a relatively small domestic market, providing more opportunities for export to the Netherlands. The two are already very active in the production of green hydrogen, but less in e-fuels and e-SAF. Spain scores slightly lower than Sweden on sovereign credit ratings, country risk, and climate resilience, but is nonetheless closely aligned with the Netherlands from a regulatory and geopolitical perspective. While France stands out as the fastest mover in the e-SAF sector, most of the existing projects are undertaken by French companies and in collaboration with AirFrance/KLM as a customer. The strong French capabilities point to fewer gaps in the market compared to Spain and Sweden, though new project initiatives aimed at export could arise moving forward.

Canada offers business opportunities for Dutch companies along the entire e-SAF supply chain. Canada offers good conditions for e-SAF production and has a relatively small domestic e-SAF market. This opens up opportunities for export. It also has a very stable business environment and excellent geopolitical relations with the Netherlands. In addition, the country has strong resilience measures in place to prevent climate-related risks to physical facilities and infrastructure. Even though significant green hydrogen projects have been announced, e-fuel and e-SAF production capabilities remain limited. This is an opportunity for Dutch companies to step into this part of the supply chain and establish an export corridor towards the Netherlands. This can be partly explained by the lack of domestic regulations requiring e-SAF uptake. The lack of regulatory push for the adoption of e-SAF in Canada could be a challenge if it slows down domestic decision-making, creating a less certain business environment. This, in turn, could heighten the perceived investment risk for European companies planning to expand in the region.

Although **Morocco's** domestic capabilities are lacking in the e-SAF supply chain, the country is very open to foreign investment and offers space and low energy costs. Morocco's significant agricultural sector and forestry and wood waste could be sources of biogenic CO_2 for the production of EU-compliant e-SAF, though carbon infrastructure is so far limited. For Dutch companies, Morocco may constitute a promising opportunity for building an integrated facility, from green hydrogen to e-SAF. Out of all analysed countries, Morocco's business environment scores the lowest across the different indicators, but geopolitically the relation with the Netherlands is stable.

Brazil could bring significant opportunities for cooperation to Dutch companies in the e-SAF supply chain, though it faces some challenges in its business environment. Brazil has highly attractive domestic conditions for the production of e-SAF, including affordable and abundant green electricity and very abundant biogenic carbon, but its e-fuel sector remains limited. Even though the Brazilian aviation market is substantial, consumption is heavily dominated by SAF produced from sugarcane-based ethanol feedstock. This translates into limited domestic incentives to invest in e-SAF. The main driver for the establishment of e-SAF operations would be export, which is possible but not as likely as other investments with domestic applicability. Moreover, Brazil's business environment can be challenging to operate in due to relatively non-transparent public institutions and a heightened risk premium. This is partly mitigated by the generally good geopolitical relations with the Netherlands and the EU but remains a point of attention for companies interested in investing in Brazil. Finally, Brazil is the most climate vulnerable country of all the seven analysed. Still, its social, economic and governance readiness measures to climate vulnerability are considered strong enough to manage these risks.

The Kingdom of Saudi Arabia (KSA) is projected to be an important green hydrogen exporter, which could be an attractive opportunity for the Netherlands. The country is investing in green hydrogen mainly in the form of ammonia. The Saudi business environment is considered very stable. Geopolitically, KSA has stable relations with the Netherlands but the two face occasional divergences on political and global security issues. The main challenge from an e-SAF perspective is Saudi Arabia's lack of biogenic carbon. Post-2040 EU regulation may only allow either biogenic carbon or direct air capture (DAC) carbon sources, of which the latter is considerably more expensive to produce, thus hurting the e-fuel business case in Saudi Arabia in the short term.[2] As such, Saudi Arabia brings opportunities in the green hydrogen production and export to the Netherlands, but limited in the short-term in e-SAF that complies with EU legislation.

Based on this, seven recommendations have been developed for the Dutch government and industry. Given the importance of regulation in the emerging e-SAF supply chain, governmental support is recommended in opening avenues for collaboration and supporting relationship development.

Country-based recommendations

1. **Set up the e-SAF supply chain within the European Union**
   The adoption of e-SAF is driven by EU regulations, which are unique in the world. This means that there is no higher urgency for this market to emerge than in EU countries. On the flip side, it also means that non-EU countries have little incentive to step into the new market if even projects in the EU struggle to reach Final Investment Decision (FID). Therefore, the e-SAF supply chain should be built first in the EU. Sweden, Spain and France are promising candidates for collaboration with the Netherlands.

   1.1. **Prioritise collaboration with Sweden and Spain to develop concrete project collaboration plans.** These relatively mature and regulatory aligned markets offer opportunities along the supply chain. In the collaboration with Spain, the focus should be placed on the import of green hydrogen and/or e-methanol to the Netherlands, where it would be converted into e-SAF. In Sweden the business case is very strong for a full production site that can deliver e-SAF as an end product to the Dutch market. As both Sweden and Spain can benefit from a larger demand centre, collaborating with the Netherlands as the energy hub of Northwestern Europe would also open up more markets, in addition to the Dutch one.

   1.1. **Exchange ideas and facilitate interaction with French counterparts and develop collaborative ideas for export to the Netherlands.** France has the highest number of announced e-SAF projects out of the analysed countries. Capabilities along the e-SAF supply chain are present and much of the domestic market will be fulfilled through announced projects, but alternative new projects for export may be explored, with Dutch companies potentially being able to play a role.

2 Graham Brook, 'Sustainable Aviation: Production of e-SAF', Io Consulting, 23 September 2024, https://ioconsulting.com/sustainable-aviation-production-of-e-saf.

2. **Work with Canadian counterparts on an import corridor**

   The Dutch government, companies and research institutes should seek collaboration with Canadian counterparts in knowledge exchange and to explore what a Canadian-Dutch e-SAF corridor could look like. Canada has a rich R&D sector in e-SAF, from research, to testing centres and new technologies developed by start-ups. This brings opportunities for Dutch research institutes to deepen R&D collaboration with Canadian actors. At the same time, Canada's e-SAF sector is relatively underdeveloped despite highly attractive production conditions – renewable energy, low prices, abundant biogenic carbon, growing green hydrogen sector. As Canada does not have e-SAF mandates, a facility in Canada would rely on a European customer in the first instance. Alignment on regulation, mandates and certification between Canada and the EU would make it easier for Dutch industry to invest in e-SAF in Canada. In this context, opportunities should be explored about what a Canadian-Dutch e-SAF corridor could look like.

3. **Align regulation, standards and certification schemes with Brazil and Morocco**

   The Dutch government should engage with Brazil and Morocco as high potential partners to find mutually beneficial collaboration pathways even if immediate opportunities may be limited. Brazil and Morocco are attractive markets that may require further governmental and market-based exchanges to create concrete collaboration options for the production of e-methanol and/or e-SAF. In both countries, domestic capabilities for green hydrogen are growing, making them potential partners for the import of green hydrogen to the Netherlands. At the same time, it gives opportunities for Dutch companies to step into the two markets to produce e-methanol or e-SAF. There are opportunities for Dutch companies to step in, though the regulatory frameworks, domestic priorities and certification may require some further alignment due to the complex business environment, country risk and climate resilience.

4. **In the short term, engage with KSA on green hydrogen, not necessarily e-SAF**

   The Dutch government should focus on cooperation on green hydrogen with the KSA given the country's lack of domestic focus on producing e-fuels for the European market. Saudi Arabia is a strong player in the emerging green hydrogen market, but so far it does not have concrete plans or ambitions to serve the EU e-SAF market. The existing e-SAF projects are being built for other consumers. As such, Dutch companies should look at Saudi Arabia for the first part of the e-SAF supply chain, notably the production of green hydrogen. In the long term, the price levelling for Direct Air Capture (DAC) may bring opportunities for Saudi Arabia, but today it remains the most expensive type of e-SAF to produce.

Recommendations applicable to all countries

5. **Work on streamlining regulations along the e-SAF supply chains with non-EU countries and multilateral certification institutions.**

   As the regulatory drive is pivotal to the e-SAF market development and the EU regulations are the strictest and most detailed in the world, alignment on regulations and certification with other countries can be of significant help for Dutch companies. The more countries that adopt domestic targets, the more 'de-risked' the investments in those markets, given the diversification of possible offtake agreements. Moreover, the Dutch government and the EU should push for the methanol-to-jet production pathway to be certified internationally (e.g., ASTM) to increase business certainty in this emerging market.

6. **Act as a 'match maker' between Dutch companies and potential partners already operating in the country of interest**.

   In most contexts, Dutch companies would have to identify partners active in a part of the supply chain in a country. In order to accelerate relationship building, organising trade missions and match making events would be beneficial, especially in countries outside of the EU with different regulatory frameworks and complex business environments.

7. **Promote cross-border R&D collaboration, learning collaboration and start-up to scale-up support for companies.**

   Knowledge sharing between countries, for example by countries like France that have progressed further in project planning, can help accelerate e-SAF development and contribute to a faster maturing of the e-SAF market globally. It is also a first step toward the concrete development and scaling of joint projects. Platforms like *GroenvermogenNL* that aim at the expansion of the green hydrogen market in the Netherlands and *Luchtvaart in transitie,* focused on the decarbonization of the aviation sector, could take the lead on the Dutch side. This can be paired with subsidy programmes under development at the Ministry of Infrastructure and Water Management for the production of e-SAF in the Netherlands. These will be accessible in 2026 for pre-FID and capital expenditure (CAPEX).

1. Introduction

The European Union (EU) and its member states are committed to decarbonizing aviation as an integral part of the path to carbon neutrality by 2050. Aviation accounts for about 2.5% of global energy-related CO_2 emissions.[3] Despite a temporary reduction during the Covid-19 pandemic, emissions reached 98% of pre-pandemic levels by 2024.[4] The aviation sector has invested in energy efficiency to reduce the consumption of fossil fuels, specifically jet fuel, but the absolute demand is growing due to the constant rise in activity.[5] This is expected to continue until at least 2030, despite increasingly strict climate regulations running in parallel.[6]

Sustainable Aviation Fuels (SAF) are seen by the EU as the most promising way to reduce carbon emissions from aviation. Aviation is one of the hardest sectors to decarbonize because few technologies can match the energy density and reliability of jet fuel. While no full replacement for jet fuel has been found, SAF offers a strong alternative. SAF is a drop-in fuel made from non-fossil fuel feedstock that can be blended in with jet fuel without any changes to engines or infrastructure. There are two main types of SAF: e-SAF, which is the focus of this study, produced from green hydrogen and CO_2 via Power-to-Liquid (PtL) technology; and bio-based SAF, that can be produced from different feedstocks like biomass, fats, used cooking oils, or waste. The EU requires SAF to be produced in a sustainable way and blended into aviation fuel under the Renewable Energy Directive (RED) and the ReFuelEU Aviation Regulation, respectively.[7] Starting in 2030, a share of this blend must come from e-SAF.

Aside from EU regulations setting targets for the adoption of SAF and e-SAF, the Netherlands also has a significant domestic focus on the decarbonization of aviation through SAF. The *Klimaatplan* recognizes the need for an increase in the production and deployment of advanced biofuels (SAF) and renewable synthetic fuels (e-SAF) for cost-effective CO_2 reductions.[8] The *Akkoord Duurzame Luchtvaart* emphasizes that national policy should focus on domestic SAF production due to the opportunities arising from the strong combination of the chemical industry, infrastructure (pipelines, airports, and seaports), and research institutions present in the Netherlands.[9] The 2025 National SAF Roadmap was developed with over 30 stakeholders and sets out a pathway towards 2035 to fulfil legislative obligations and strengthen the Dutch SAF sector.[10]

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3 Teo Lombardo, 'Aviation', International Energy Agency (IEA), 2025, https://www.iea.org/energy-system/transport/aviation.

4 Transport & Environment, 'Airline Emissions Soar to Pre-COVID Levels as Europe Fails to Price Their Pollution', T&E, 18 June 2025, https://www.transportenvironment.org/articles/airline-emissions-soar-to-pre-covid-levels.

5 Lombardo, 'Aviation'.

6 Lombardo, 'Aviation'.

7 European Parliament and Council of the European Union, 'Regulation (EU) 2023/2405 - ReFuelEU Aviation', Official Journal of the European Union, 18 October 2023, https://eur-lex.europa.eu/eli/reg/2023/2405/oj/eng; European Parliament and Council of the European Union, 'Directive 2023/2413 - Renewable Energy Directive', Official Journal of the European Union, 2023, https://eur-lex.europa.eu/eli/dir/2023/2413/oj/eng.

8 Ministerie van Klimaat en Groene Groei, 'Klimaatplan 2025-2035 - Op weg naar een klimaatneutraal Nederland', https://www.rijksoverheid.nl/documenten/rapporten/2025/03/14/minvkgg-klimaatplan-2025-2035.

9 'In stappen naar verduurzaming van de luchtvaart', Ministerie van Infrastructuur en Waterstaat, accessed 22 June 2025, https://www.luchtvaartindetoekomst.nl/duurzame-luchtvaart/in-stappen-naar-verduurzaming.

10 'National SAF Roadmap', 2025, https://www.deloitte.com/nl/en/Industries/energy/perspectives/sustainable-aviation-fuel-roadmap.html.

As not all (e-)SAF required in the Netherlands will be produced domestically, establishing reliable trade relations with emerging suppliers is a priority for the government. In short, the Netherlands has high potential to become an important player in e-SAF supply chains, but will need to collaborate with international partners to meet its EU obligations by 2030.

This report explores opportunities for Dutch industry to engage with global partners in the e-SAF sector. The seven markets examined in this report are France, Spain, Sweden, Canada, Brazil, Morocco, and Saudi Arabia. These countries have either already partnered with Dutch institutions at a governmental, private or semi-private level; or have national ambitions to become important producers of e-SAF or one or more of its precursors in the supply chain. In the context of this project, they have been selected together with the Netherlands Enterprise Agency (RVO) and representatives from the Ministries of Foreign Affairs, Climate Policy and Green Growth, and Infrastructure and Water Management.

The research is shaped by the seven country case studies and is designed to support both government engagement and business decisions related to e-SAF supply chains. Each case study is based on three indicators: (1) setup of the country's e-SAF sector; (2) the business environment in said country; and (3) geopolitical relations with the Netherlands. The data has been collected through desk research as well as interviews with thirteen stakeholders representing Dutch industry and the seven countries.

The rest of the report is structured as follows. Section two provides some context about the characteristics of e-SAF and related market and regulatory dynamics. Section three includes an analysis of the Dutch e-SAF landscape. The seven case studies are included in section four, followed by conclusions and recommendations in section five.

2. e-SAF: The fuel, the market and the regulation

The e-SAF market is still in its early stages, constituting a minority of the already small 0.53% share of global jet fuel that is made up of SAF.[11] Its development is primarily driven by EU policy and targets, rather than by natural market demand. Understanding what e-SAF is, how it is produced, and how upcoming EU regulations will require its use from 2030 onward is essential for identifying opportunities for industrial collaboration. The following sections provide a short overview of the e-SAF supply chain, market developments, and the regulatory environment.

2.1. What is e-SAF and what kind of actors participate in the supply chain?

Synthetic sustainable aviation fuels, or e-SAF, are produced using energy contents derived from non-biological origin. E-SAF is produced from green hydrogen and captured carbon via the power-to-liquid method. This can be done in two ways: through the methanol-to-jet (MtJ) pathway or the Fischer Tropsch (FT) synthesis process (Figure 1).

Green hydrogen, produced through electrolysis from renewable electricity, is combined with captured carbon. In the MtJ process, e-methanol is made from hydrogen and captured carbon, which is later converted into e-SAF. Contrastingly, the FT method produces synthetic gas (syngas) from hydrogen and carbon, which is then turned into synthetic crude (syncrude), and, lastly, refined into different types of synthetic fuels, including e-SAF.

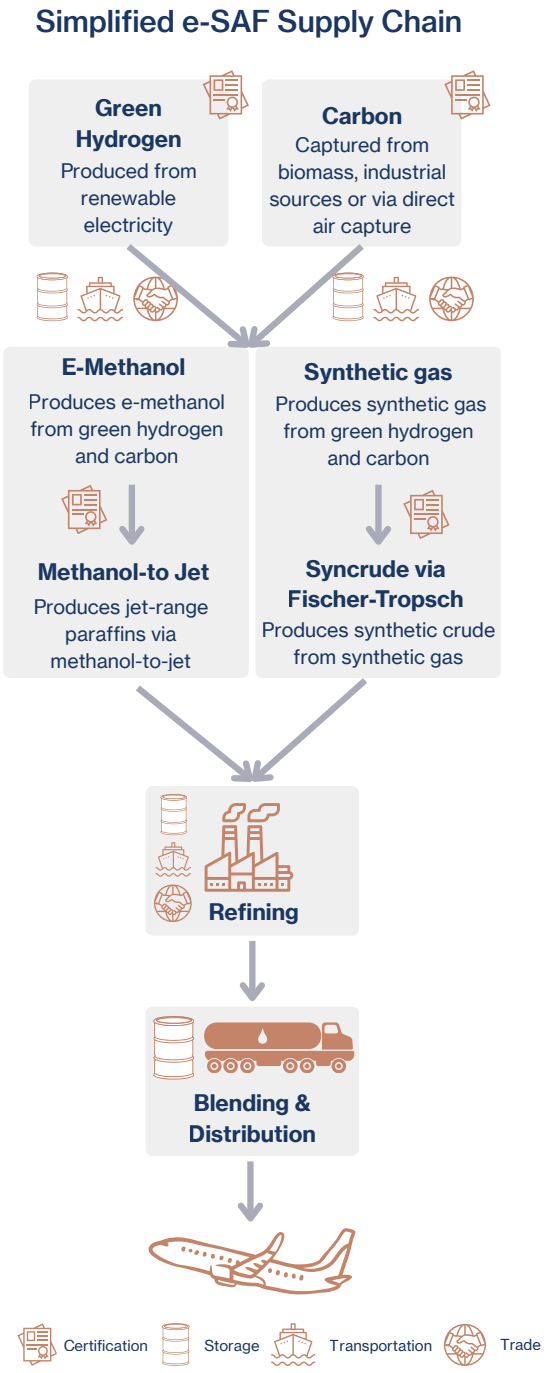
In order to produce fuels according to the Third Renewable Energy Directive (REDIII) – referred to as Renewable Fuels of Non-Biological Origin (RFNBO) – the carbon used for synthetic fuels must come from biomass, industrial sources (e.g., steel and cement plants) or Direct Air Capture (DAC) technologies. As the EU's 2040 climate targets introduce stricter carbon accounting rules, potential changes such as restricting the use of CO_2 comes from fossil-based industrial processes, may be introduced.

The REDIII sets additional sustainability criteria for the production of RFNBOs, including additionality, temporal correlation, and emission reduction. Additionality refers to the electricity sources used to produce the RFNBOs, which need to be new installations in order to avoid diverting existing renewables from the grid. This applies from 2028. Temporal correlation implies that the electricity production should align with the green hydrogen production, to ensure real-time matching between the moment when renewables are generated and when hydrogen is made. Until 2030 production can be matched on a monthly basis, while after 2030

[11] European Union Aviation Safety Agency, 'Sustainable Aviation Fuels'.

it needs to be correlated by hour. Third, RFNBOs should achieve at least 70% greenhouse gas emissions savings when taking into account full lifecycle emissions, compared to fossil fuels.

Figure 1. Production pathways for e-SAF



The e-SAF supply chain consists of the physical production of e-SAF together with other industrial capabilities that bring it to airports. When it comes to production, companies that make green hydrogen and that specialize in carbon capture and utilisation (CCU) are essential in the production of e-methanol or syngas as intermediate steps. Then, the e-SAF itself is produced.

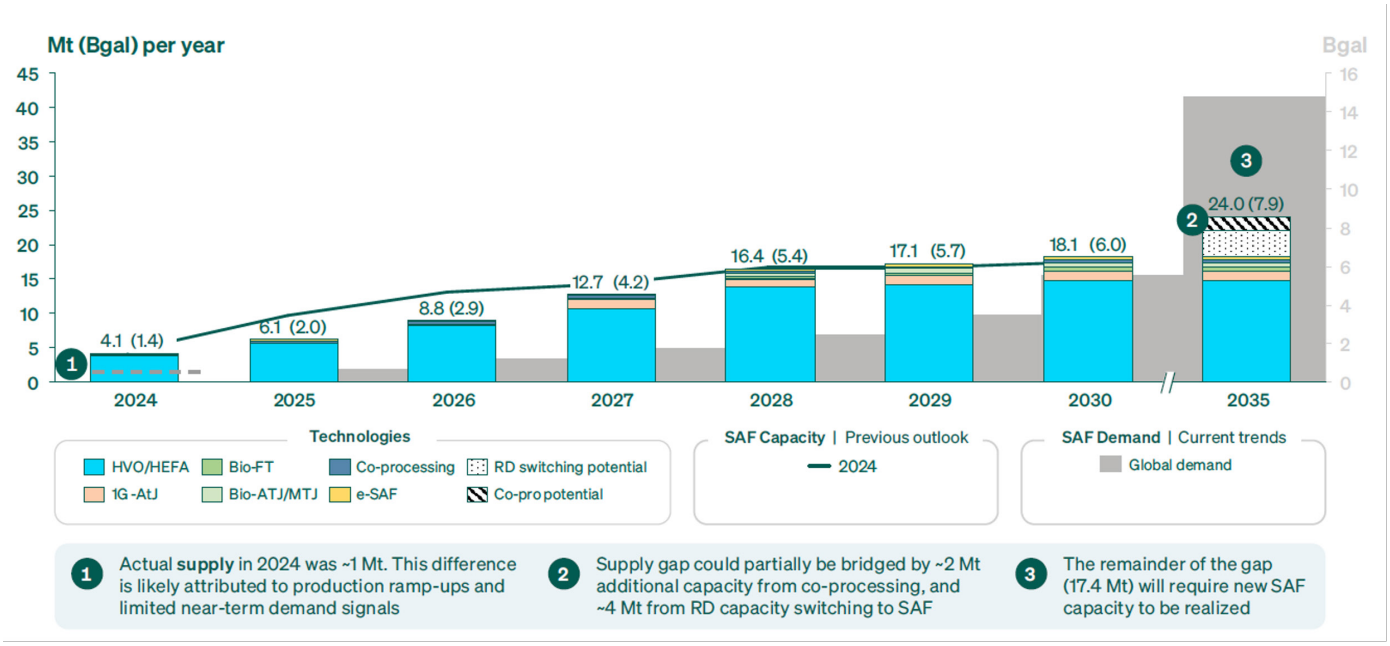
Certification is key to ensure that e-SAF is recognized as RFNBO in the EU – guaranteeing that the hydrogen is green and the carbon is accepted under the technical requirements. Moreover, trading, storage, logistics and transportation, either through pipelines or barges and ships, ensures that the product is blended and distributed across all aircraft for refuelling at airports.

In short, e-SAF production and its transportation to the customer – or offtaker – is complex but technically possible. Whether e-SAF is widely adopted and used in the decarbonization of aviation is dependent on regulation and costs, which are discussed below.

2.2. How is the market developing and what are the expectations moving forward?

Globally, most of the SAF used in 2024 was bio-based, and represented 0.53% of jet fuel consumption.[12] This marked an increase from 0.2% in 2023. The dominant technology used to produce bio-based SAF is the Hydroprocessed Esters and Fatty Acids (HEFA) process, which makes Hydrotreated vegetable oils (HVO). The production of HVO is expected to continue rising and remain dominant in 2030 (Figure 2). The expansion of e-SAF will become more notable in 2028-2030.

Figure 2. Global SAF capacity by 2030.
Source: SkyNRG SAF Market Outlook 2025[13]



[12] European Union Aviation Safety Agency, 'Sustainable Aviation Fuels'.

[13] SkyNRG, 'SAF Market Outlook 2025', SkyNRG, 2025, https://skynrg.com/safmo25/.

The production of HVO is currently dominant due to the maturity of the technology, but e-SAF is expected to gain significance in the medium to long term, as it does not depend on bio-based feedstock availability and offers an alternative to bio-based SAF. This is a particular advantage given that biofuels rely on either food crops and plant-derived oils (in the case of conventional biofuels) or waste and residues (in the case of advanced biofuels) as feedstock. Especially the former, but also the latter, are vulnerable to geographical availability and/or market prices, thus suffering from limited scalability. The e-SAF production pathways overcome these issues by relying on green hydrogen and carbon dioxide as feedstock, which in theory can be made anywhere.

This advantage of relying on synthetic feedstocks (green hydrogen and carbon dioxide) is simultaneously one of the main obstacles to e-SAF market expansion. The reasons are twofold. First is the relatively slow market development for synthetic feedstocks. Second are the resulting high costs of e-SAF production. As of 2024 there were 56 e-SAF projects announced in the European Economic Area (EEA), but none of these had reached a final investment decision (FID).[14]

The green hydrogen and carbon capture markets are developing slower than anticipated. Most of the demand for green hydrogen is met by traditional sectors like refining and chemicals. These are the same ones that have been using grey (fossil-based) hydrogen for years, rather than the new green sectors. Although the market development pace has picked up since 2023, most green hydrogen projects are still in their early phases.[15] This is primarily related to the high costs compared to fossil fuels, which are added to other challenges like limited surplus of renewable electricity, slow infrastructure development, and complex permitting processes. Additionally, while the carbon capture and utilisation (CCU) industry is rapidly growing, with 45 facilities operating globally in 2023, this is not enough to reach the global Net Zero Scenario of the International Energy Agency.[16]

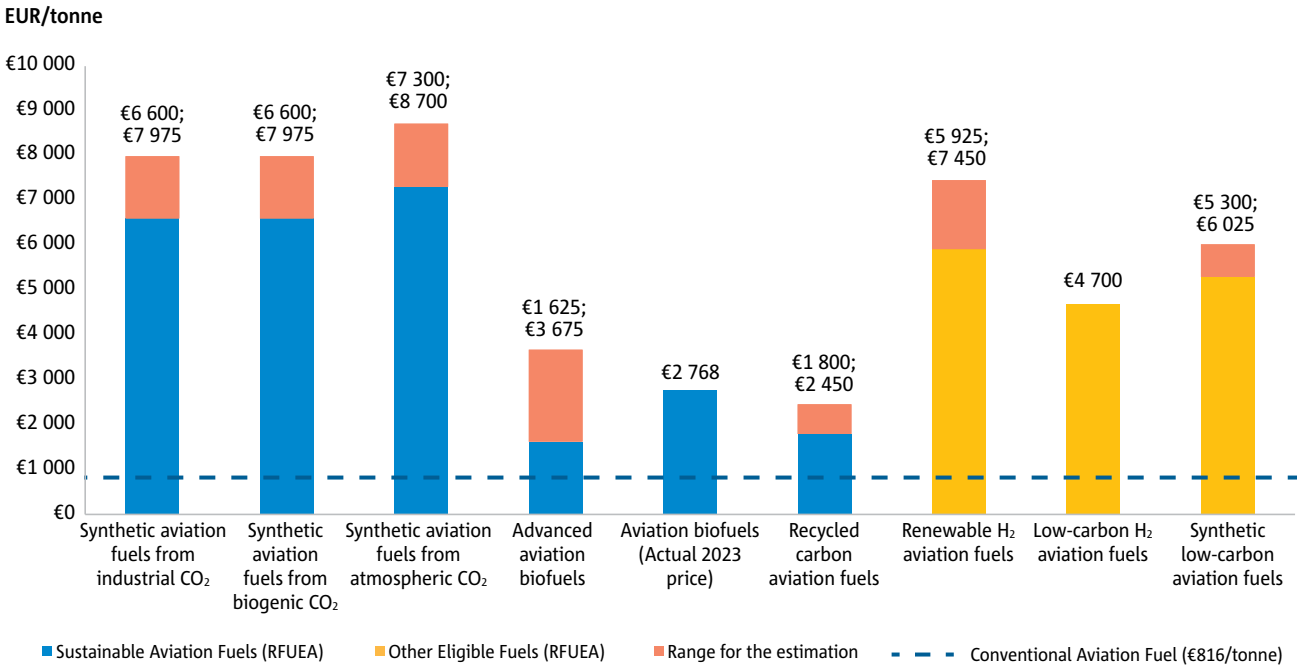
The challenges in sourcing abundant affordable feedstock – green hydrogen and eligible carbon – makes the production of e-SAF much more expensive compared to SAF, which is in turn more expensive than conventional jet fuel (see Figure 3). The average SAF price in 2023 was €2768 per tonne, which is more than three times the price of conventional fuel, €816 per tonne. The e-SAF produced from either industrial CO_2 or biogenic CO_2 is estimated at the same price, ranging from €6600- €7975 per tonne. This is about 2.5 times higher than the presently used SAF. The highest price is estimated for e-SAF with carbon from DAC technologies, ranging from €7300- €8700 per tonne.

14 Transport & Environment, 'How Is E-Kerosene Developing in Europe?', T&E, 22 February 2024, https://www.transportenvironment.org/articles/how-is-e-kerosene-developing-in-europe.

15 International Energy Agency, 'Global Hydrogen Review 2024', International Energy Agency (IEA), 2 October 2024, https://www.iea.org/reports/global-hydrogen-review-2024/hydrogen-demand.

16 Sara Budinis et al., 'Carbon Capture Utilisation and Storage', IEA, 2024, https://www.iea.org/energy-system/carbon-capture-utilisation-and-storage.

Figure 3. Estimated prices and production costs in 2023 for ReFuelEU Aviation eligible fuels. Source: EASA, 2025[17]



These competitive issues in the synthetic feedstock market make the move from bio-based SAF toward e-SAF strongly driven by regulation. The EU's REDIII and the ReFuelEU Aviation regulation establish specific targets and requirements for SAF blending starting from 2025 and intensifying by 2030. ReFuelEU Aviation mandates that at least 2% of aviation fuel supplied to all EU airports should be SAF in 2025, a target which will progressively increase to 70% by 2050.[18] Within this broader mandate there is also a specific requirement for e-SAF. This starts in 2030 with 1.2%, expanding to 35% in 2050.[19] All SAF must comply with the production requirements laid out in the REDIII. Specifically, e-SAF has to follow RFNBO standards.

Both bio-based SAF and e-SAF can be blended with jet fuel with relative ease. They are compatible with existing aircraft engines and storage and distribution infrastructure. Depending on its production pathways and feedstock, bio-based SAF can be blended with kerosene at levels between 10-50% according to ASTM International (formerly known as the American Society for Testing and Materials), one of the leading standardization agencies in this field.[20] This percentage is expected to grow, as ReFuelEU mandates a minimum of 70% SAF blend in kerosene by 2050.[21] Tests with 100% SAF have already been conducted in Sweden in July 2022, with the first ever 100% SAF-powered regional commercial aircraft.[22] The percentage of e-SAF that is certified to be blended is 50% if produced through the

17 European Union Aviation Safety Agency, 'Sustainable Aviation Fuels'.

18 European Commission, 'ReFuelEU Aviation', European Commission, 2024, https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation_en.

19 European Commission, 'ReFuelEU Aviation'.

20 U.S. Department of Energy, 'Alternative Fuels Data Center: Sustainable Aviation Fuel', U.S. Department of Energy, 2023, https://afdc.energy.gov/fuels/sustainable-aviation-fuel.

21 European Parliament and Council of the European Union, 'Regulation (EU) 2023/2405 - ReFuelEU Aviation'.

22 European Union Aviation Safety Agency, 'Sustainable Aviation Fuels'.

Fischer-Tropsch process. The methanol-to-jet route has not yet been certified under ASTM, but this will likely change by 2030-2035 when regulatory obligations for e-SAF consumption kick-in in the EU.[23]

Every member state is responsible for transposing the REDIII into national legislation, while ReFuelEU Aviation is a regulation that directly applies to all countries.[24] In the Netherlands, the *Akkoord Duurzame Luchtvaart*[5] (2019) introduces a 14% voluntary SAF blending target by 2030 and 100% by 2050, both of which are more ambitious than the EU targets.

The development of the global e-SAF market is expected to accelerate from 2030 when the ReFuelEU mandates come into force. The failure to implement these requirements will come with penalties calculated based on the price of SAF. The EU will fine jet fuel suppliers at higher prices than the cost of SAF to ensure that the requirements are being fulfilled.[25] This includes non-EU airlines who depart from EU airports, as they also fall under the EU's SAF mandates.[26] Each member state will define their own quotas and penalties, details of which are not fully determined at the time of writing this report.

Outside of the EU, countries are working on developing SAF mandates as well, but except for the UK none of them include specific e-SAF targets.[27] Notable announcements for bio-based SAF have been made in the United States and Canada, China and Southeast Asia, and Latin America. Announced projects in China are expected to amount to 5 million tonnes (Mt) of supply in 2030, compared to 4 Mt in the EU and UK.[28] The US is focusing on HEFA and Alcohol-to-Jet from corn ethanol, expected to reach 5.6 Mt of supply by 2030.[29] Brazil is the largest player in Latin America, with most projects so far using soybean oil and tallow.[30]

This section showed that e-SAF represents a very small portion of the SAF market as of 2025, and will remain so until at least 2030 due to its high costs and dependence on other emerging industries – namely green hydrogen and CCUS. Moving forward, bio-based SAF is expected to start encountering increasingly stringent feedstock constraints, whereas e-SAF facilities will be well positioned to take advantage of the developing green hydrogen and CCUS industries. Stronger regulations and increasingly limited bio-based feedstocks are likely to drive e-SAF toward a key role in the EU's aviation fuel mix by 2050.

23 U.S. Department of Energy, 'Alternative Fuels Data Center'.

24 European Parliament and Council of the European Union, 'Directive 2023/2413 - Renewable Energy Directive'; European Parliament and Council of the European Union, 'Regulation (EU) 2023/2405 - ReFuelEU Aviation'.

25 Transport & Environment, 'Implementing the EU's e-SAF Mandate', T&E, 22 February 2024, https://www.transportenvironment.org/articles/implementing-the-eus-e-saf-mandate.

26 European Commission, 'FAQ on ReFuelEU Aviation', 2025, https://transport.ec.europa.eu/transport-modes/air/environment/refueleu-aviation/faq-refueleu-aviation_en.

27 SkyNRG, 'SAF Market Outlook 2025'.

28 SkyNRG, 'SAF Market Outlook 2025'.

29 SkyNRG, 'SAF Market Outlook 2025'.

30 SkyNRG, 'SAF Market Outlook 2025'.

3. The e-SAF supply chain in the Netherlands

Building on the technical and regulatory requirements behind the e-SAF supply chain explored in the previous section, the Dutch landscape combines a strong expected demand and emerging production capabilities along the e-SAF supply chain. These factors shape the collaboration opportunities available to the Netherlands, which are explored in the following section.

The Netherlands is a major demand centre for two reasons. First, it has a notable domestic aviation market. In 2024, more than 76 million passengers travelled through the five Dutch airports: Amsterdam Airport Schiphol, Rotterdam The Hague Airport, Eindhoven Airport, Maastricht Aachen Airport, and Groningen Airport Eelde.[31] Schiphol is by far the largest, with 66.8 million passengers out of the country-wide 76 million.[32] Schiphol and Maastricht Airport also handle air freight, with Asia representing the largest destination for cargo.[33] This translates to significant consumption of Jet A-1 kerosene. While exact numbers are unavailable, given that about ~85% of Dutch commercial flights and ~97% of cargo in 2023 went through Schiphol, and 3.27 million tonnes of jet fuel was used in the Netherlands as a whole in 2023, Schiphol likely consumed ~ 2.8-3.2 million tonnes of jet fuel in 2023.[34] Comparatively, Frankfurt Airport consumed ~ 4.3 million tonnes in 2024, and Charles de Gaulle consumed an estimated minimum of ~ 4.5 million tonnes in 2023, but likely more.[35]

Dutch airports have developed decarbonization strategies in addition to being bound to comply with the EU regulations, meaning that the domestic demand for e-SAF will continue to grow. Schiphol offers financial incentives for the blending of SAF since 2022, and Rotterdam Airport has committed itself to an 8% blending mandate by 2030, higher than the EU regulations require.[36] As such, the Netherlands is not just a major jet fuel demand centre, but also an emerging SAF/e-SAF consumer.

31 CBS Statistics Netherlands, '76 Million Airline Passengers in 2024, 6 Percent Fewer than in 2019', Statistics Netherlands, 7 February 2025, https://www.cbs.nl/en-gb/news/2025/06/76-million-airline-passengers-in-2024-6-percent-fewer-than-in-2019.

32 CBS Statistics Netherlands, 'Aviation; Monthly Figures of Dutch Airports', webpagina, Statistics Netherlands, 3 June 2025, https://www.cbs.nl/en-gb/figures/detail/37478ENG.

33 CBS Statistics Netherlands, '76 Million Airline Passengers in 2024, 6 Percent Fewer than in 2019'.

34 CBS Statistics Netherlands, 'Aviation; Monthly Figures of Dutch Airports'; CBS Statistics Netherlands, 'Hoeveel brandstof wordt in Nederland afgezet aan de luchtvaart?', webpagina, Centraal Bureau voor de Statistiek, 2024, https://www.cbs.nl/nl-nl/visualisaties/verkeer-en-vervoer/uitstoot-en-brandstofafzet/brandstofafzet-luchtvaart.

35 Fraport, 'Facts & Figures', Fraport AG, 2025, https://www.fraport.com/en/our-group/about-us/facts---figures.html; The U.S. Energy Information Administration, 'France Jet Fuel Consumption', TheGlobalEconomy.Com, 2023, https://www.theglobaleconomy.com/France/jet_fuel_consumption/; Get to Center, 'Biggest and Busiest Airports in France', 2022, https://gettocenter.com/airports/country/france; Statista Reasearch Department, 'Air Passenger Traffic in Metropolitan France', Statista, 2023, https://www.statista.com/statistics/746700/distribution-air-passenger-traffic-metropolitan-france/; Michele Majidi, 'French Airports: Freight Traffic Volume 2017', Statista, 2025, https://www.statista.com/statistics/746945/freight-traffic-volume-leading-metropolitan-french-airports/.

36 Carbon Click, 'The Future of Sustainable Aviation Fuel: A Path to Sustainable Skies', Carbon Click, 2025, https://www.carbonclick.com/news-views/the-future-of-sustainable-aviation-fuel-a-path-to-sustainable-skies; Pan American Finance, 'Netherlands SAF24 | Global Sustainable Aviation Fuel Report', 2025, https://panamericanfinance.com/insights/energy-transition/global-saf-report-2024/regional-markets-overview-saf24/netherlands-saf24/.

Second, the Netherlands is the largest European oil trade hub, serving not only its domestic market but also its neighbours, notably Germany and Belgium. The Netherlands is part of the ARA (Amsterdam-Rotterdam-Antwerp) trade hub and is closely connected to the ARRRA (Antwerp-Rotterdam-Rhine-Ruhr Area) chemical cluster.[37] It is also connected to CEPS, the Central Europe Pipeline System, the NATO military infrastructure connected to all the main airports in the region. CEPS introduced SAF into their infrastructure in 2023 and has been delivering blends to connected airports, albeit on a limited scale.[38] Technically, existing storage and distribution facilities can be relatively easily adapted to also blend e-SAF into the existing jet fuel infrastructure, although the administrative processes of achieving this remain challenging.[39] Apart from the physical infrastructure, the efficient customs and well-developed trade services in the Netherlands have been used for decades to secure affordable and accessible oil supplies for the Netherlands itself and the rest of Europe.

The existing knowledge base and facilities paired with a policy drive to decarbonization also attracts new investments in different supply chains, one of which being biofuels. The Port of Rotterdam is a leading cluster of biofuels in Europe, with several refineries producing biodiesel, bioethanol, HVO (hydrotreated vegetable oil) fuel, and bio-based SAF.[40] Neste has started producing bio-based SAF in Rotterdam since 2025 and its continued investments are expected to make this refinery the world's largest production plant for SAF.[41]

The expansion of the e-SAF market is also starting to take shape in the Netherlands. Flagship projects include Power2X and Advario, as well as Metafuels and Evos, working on the import of e-methanol to their planned facilities in Port of Rotterdam to produce e-SAF; and HyNetherlands, including Engie, EEW, and OCI, are working on an integrated supply chain from electrolyser to e-methanol in the province of Groningen (Table 1).[42]

In addition to the import, production, storage and distribution of e-methanol and e-SAF in the Netherlands, there are other capabilities that Dutch industry could leverage in cooperating with partners abroad (Table 1). They cover green hydrogen, e-methanol, carbon capture and utilisation (CCU), and e-SAF. Moreover, services such as certification, trade, project management and engineering, but also research and development (R&D) are key levers that can be used to support projects in other countries.

37 Irina Patrahau et al., *Energy Trade in the Netherlands: Past, Present and Future* (The Hague Centre For Strategic Studies, 2023), https://hcss.nl/wp-content/uploads/2023/01/Energy-trade-in-the-Netherlands-HCSS-2023.pdf.

38 European Union Aviation Safety Agency, 'Sustainable Aviation Fuels'.

39 Irina Patrahau et al., *The European Tank Storage Sector: 2050 and Beyond* (The Hague Centre for Strategic Studies, 2022), https://hcss.nl/wp-content/uploads/2022/05/European-Tank-Storage-2050-Beyond-2022-HCSS.pdf.

40 Port of Rotterdam and Rotterdam The Hague Airport, 'SAF and Hydrogen for Aviation Whitepaper', 2024, https://www.portofrotterdam.com/sites/default/files/2024-05/saf-hydrogen-aviation-por-rtha.pdf.

41 Neste Corporation, 'Neste Started Producing Sustainable Aviation Fuel (SAF) at Its Renewables Refinery in Rotterdam, the Netherlands', Neste, 9 April 2025, https://www.neste.com/news/neste-started-producing-sustainable-aviation-fuel-saf-at-its-renewables-refinery-in-rotterdam-the-netherlands.

42 Lisanne Kosters, 'Power2X and Advario to Develop World-Scale e-SAF Hub in the Port of Rotterdam', *Advario*, 16 October 2024, 2, https://advario.com/power2x-and-advario-to-develop-world-scale-e-saf-hub-in-the-port-of-rotterdam/; Port of Rotterdam, 'Metafuels and Evos Partner to Accelerate E-SAF Production in Rotterdam', Port of Rotterdam, 2025, https://www.portofrotterdam.com/en/news-and-press-releases/metafuels-and-evos-partner-accelerate-e-saf-production-rotterdam; Léon Dirrix, 'ENGIE, OCI, and EEW announce a partnership to develop a large-scale hydrogen-based value chain in the North of the Netherlands', EEW Energy from Waste, 9 May 2022, https://www.eew-energyfromwaste.com/de/newsroom/pressemitteilungen/artikel/engie-oci-and-eew-announce-a-partnership-to-develop-a-large-scale-hydrogen-based-value-chain-in-the-north-of-the-netherlands/; INERATEC, 'INERATEC and Zenith Work on Commercial Scale E-Fuel Plant in the Port of Amsterdam', INERATEC, 2023, https://www.ineratec.de/en/news/ineratec-and-zenith-work-commercial-scale-e-fuel-plant-port-amsterdam.

Table 1. Capabilities of Dutch industry along the e-SAF supply chain[43]

Part of e-SAF supply chain	Dutch capability	Examples of announced projects
Green hydrogen	Production	Hycc, Nouryon, Gasunie, Shell, Hydron Energy, HyPRO, Engie
	Import	SkyNRG, Evos
	Storage	Gasunie (HyStock)
	Transportation	Gasunie (Hynetwork)
e-Methanol	Production	Bright Renewables, HyGear
	Import	Green Marine Methanol
	Storage	EVOS, Vopak
	Transportation	FincoEnergies, LowLands Energy
Carbon	Carbon Capture and Utilisation (CCU)	SkyTree, Bright Renewables, Energy from Waste
e-SAF	Production	SkyNRG, Power2X, Metafuels
	Import	Advario, Power2X, Evos
	Storage	Advario, Chane, Evos
	Transportation	Advario
All	Project management and engineering	Power2X, SkyNRG, Sweco
All	Trade	Hyxchange
All	Certification	Hyxchange, Verticer
All	R&D	TNO

Note: When assessing capabilities in the import, storage and transportation of e-methanol, this table also includes capabilities in bio-methanol given that the main distinction is in the feedstock and not the properties of the fuel itself.

This section showed the evolution of the e-SAF sector in the Netherlands. To grow further, Dutch industry must build international partnerships and expand collaborative projects. The next section explores opportunities in seven countries across Europe, North America, South America, and the Middle East and North Africa.

[43] Joost Sandberg, 'H2eron - Toekomst met groene waterstof', HyCC, 2025, https://www.hycc.com/nl/projecten/h2eron; Hynetwork, 'Gasunie Starts Construction of National Hydrogen Network in the Netherlands', Hynetwork, 2022, https://www.hynetwork.nl/en/knowledge-base/article/gasunie-starts-construction-of-national-hydrogen-network-in-the-netherlands; Port of Rotterdam, 'The Hydrogen System Is Taking Shape', Port of Rotterdam, 2025, https://www.portofrotterdam.com/en/news-and-press-releases/hydrogen-system-taking-shape; Hydron Energy, 'Hydron Energy - Excellence in electrolysis', Hydron Energy, 2025, https://hydron-energy.com/; SkyNRG, 'Masdar Signs Agreement to Explore Exporting Green Hydrogen from Abu Dhabi to Europe', *SkyNRG*, 16 January 2023, https://skynrg.com/masdar-signs-agreement-to-explore-exporting-green-hydrogen-from-abu-dhabi-to-europe/; Groenvermogen NL, 'Kick-off HyPRO: "Removing Barriers for a Major Role of Hydrogen in the Energy Transition"', *GroenvermogenNL*, 6 February 2025, https://groenvermogennl.org/en/nieuws/kick-off-hypro-removing-barriers-for-a-major-role-of-hydrogen-in-the-energy-transition/; K.W. Wesselink, 'Benelux's First E-Methanol System Constructed by HoSt Group & University of Twente with €4 Million Subsidy', Universiteit Twente, 2024, https://www.utwente.nl/en/news/2024/5/1490936/beneluxs-first-e-methanol-system-constructed-by-host-group-university-of-twente-with-4-million-subsidy; Aida Čučuk, 'Green Marine and Vopak to Collaborate on Green Methanol Supply', *Offshore Energy*, 13 June 2024, https://www.offshore-energy.biz/green-marine-and-vopak-to-collaborate-on-green-methanol-supply/; EVOS, 'TankMatch and Evos Team up to Launch Green Methanol Bunkering Solutions', *EVOS*, 2024, https://www.evos.eu/tankmatch-and-evos-team-up-to-launch-green-methanol-bunkering-solutions/; Port of Amsterdam, 'FincoEnergies Ready to Supply Bio-Methanol to the Maritime Sector, Starting in Port of Amsterdam.', Port of Amsterdam, 11 July 2023, https://www.portofamsterdam.com/en/news/fincoenergies-ready-supply-bio-methanol-maritime-sector-starting-port-amsterdam; Evelina Lungu, 'LowLands Signs Biomethanol Deals with Shipping Firms', 18 March 2025, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2668799-lowlands-signs-biomethanol-deals-with-shipping-firms; Skytree, 'About Us: Engineering Advanced DAC Technology', 2025, https://skytree.tech/en-en/about-us; Kosters, 'Power2X and Advario to Develop World-Scale e-SAF Hub in the Port of Rotterdam'; Renske Peters, 'New SAF Unit 4 under Development', *Chane*, 13 September 2024, 4, https://chane.eu/chane-saf-unit-4/; SkyNRG, 'SAF Advisory', *SkyNRG*, 2024, https://skynrg.com/saf-advisory/; Sweco, 'Sweco Group - Sweco Supports VoltH2 in Design and Development of New Green Hydrogen Plant in the Netherlands', Sweco Group, 2024, https://www.swecogroup.com/corporate-news/sweco-supports-volth2-in-design-and-development-of-new-green-hydrogen-plant-in-the-netherlands/; Hyxchange, *The Future*, 2025, https://hyxchange.nl/; Ajsa Habibic, 'Europe's First Green Hydrogen Certificates Issued in the Netherlands', *Offshore Energy*, 25 October 2022, https://www.offshore-energy.biz/europe-first-green-hydrogen-certificates-issued-in-the-netherlands/; Verticer, 'Hydrogen', 2025, https://verticer.eu/en/for-business/producers/hydrogen/; TNO, 'Research Centre CO2-Free Hydrogen Production', TNO, 20 May 2025, https://www.tno.nl/en/technology-science/labs/research-centre-co2-free-hydrogen/.

4. Opportunities for Dutch industry in seven emerging e-SAF markets

This section analyses opportunities for collaboration in the e-SAF supply chain between Dutch industry and seven countries: France, Spain, Sweden, Canada, Brazil, Morocco and Saudi Arabia. This is a starting point, and the framework can be applied to other countries moving forward. Each country analysis is based on three indicators: (1) setup of the country's e-SAF sector; (2) the business environment in said country; and (3) geopolitical relations with the Netherlands. The rationale for choosing these indicators is explained below, while the data sources and the methodology used for assessing these indicators are included in Table 2.

Setup of the e-SAF sector

The first step to identifying opportunities for Dutch industry in a given country is to understand the domestic e-SAF sector. As the e-SAF market is strongly driven by regulation, the robustness and clarity of national ambitions in the e-SAF and other related sectors are key to understand the setup of the market and its growth potential in the short term. At the same time, mapping existing projects and analysing the configuration of capabilities between domestic and foreign partners gives an idea of what capability gaps are present in the country, that could potentially be filled by a Dutch company.

Business environment

A good understanding of the business environment is essential for decision-making, especially in newly emerging markets like e-SAF. The credit ratings, risk premium, and climate resilience provide indications about how challenging it is to invest into a given nation. Higher risks can result in higher interest rates, cost of equity, and capital expenditure and outlay, all of which impede project development. The absence of resilience measures to manage climate risks can make it difficult or more expensive for a project to maintain uninterrupted operations in times of climatic issues (e.g., droughts).

The stability of public institutions also partially concerns risk, as unpredictable government behaviour that obstructs or seizes private development is considered. Moreover, public institutions are of particular relevance to e-SAF because it concerns the effectiveness of government and regulation, a key driver of this market.

A healthy innovation environment and good infrastructure is also essential for new green investments. Innovation can facilitate the acquisition of human, knowledge, and financial capital. High-quality infrastructure can lead to lower overhead shipping expenses, improved reliability, and a higher capacity to dynamically respond to demand.

Geopolitical relations with the Netherlands

Global geopolitical tensions and security dynamics have led to more governmental involvement in markets through trade barriers, imposition of quotas, the weaponisation of supply chains, or nationalisation of private assets. Geopolitical due diligence becomes essential for the long-term stability of foreign investments. Strong diplomatic, economic and military relations point to a desire to encourage bilateral cooperation and facilitate closer ties. They also point to a reduced incentive for governments to use coercive means against each other.

Table 2. Methodology for case studies

Indicator		Data	Assessment
Setup of e-SAF sector	National ambitions	National strategies to produce and export e-SAF or related products (SAF or green hydrogen and derivatives)	The countries are grouped into four categories: – Existing e-SAF consumption mandate with focus on exports – Existing e-SAF consumption mandate with focus on domestic demand – No e-SAF consumption mandate with advantageous production conditions (green electricity, low energy costs, available biogenic carbon) – No e-SAF consumption mandate with other challenges It Is expected that the first category brings the highest opportunities for Dutch companies in the short term due to both urgency to act and interest in exports, while the second and third may be more interesting post-2030. Countries without e-SAF mandates and other challenges are less interesting in terms of opportunities.
	Capability gaps	Publicly available information about existing projects and the configuration of capabilities between domestic and international partners	Existing e-SAF projects in the country were mapped (see Annex 1). If several projects require an international company to support with the conversion of e-fuel into e-SAF, that is considered a potential gap to be filled by Dutch industry. Gaps include the production, import, storage, transportation of green hydrogen, e-methanol, CCUS, e-SAF; as well as project management and engineering, trade, certification, R&D. It also includes offtake.
Business environment	Sovereign credit ratings	Ratings from the big three credit rating agencies (Moody's, S&P, and Fitch)	The countries were given an ordinal rank based on their relative scores for each dimension. Then, an ordinal rank based on all six indicators was calculated as follows. See Annex 2 for complete scores. – The three highest ranked countries were assessed as having an optimal business environment, with a high degree of innovation, stable institutions, relatively low country risk, good infrastructure and climate resilience. – The fourth and fifth countries are assessed to have a good business environment, with some aspects like climate resilience or infrastructure relatively less good. – Finally, the sixth and seventh countries have a relatively risky business environment, with several aspects like public institutions or innovation ranking the lowest of the group. They are labelled 'with risk premium'.
	Country risk premium	NYU Stern's Country Default Spreads and Risk Premiums dataset	
	Public institutions	Worldwide Governance Indicators (World Bank)	
	Innovation	Global Innovation Index (World Intellectual Property Organisation)	
	Infrastructure	Logistics Performance Index (WorldBank)	
	Climate Resilience	Notre Dame Global Adaptation Initiative (University of Notre Dame)	
Geopolitical relations with the Netherlands	Diplomatic relations	Political relations and bilateral partnerships	The relations were qualitatively assessed and grouped into three categories: – Very good relations: strong political relations and cooperation, significant bilateral trade and investments, and strong alignment on security issues. – Good relations: political desire for cooperation, though less strong economic relations and neutral security ties – Neutral relations: limited existing political and economic cooperation and points of divergence on security issues
	Economic relations	Trade flows and bilateral foreign direct investments (FDI)	
	Security ties	Military alliances and alignment on security issues	

4.1. France

4.1.1. Setup of e-SAF sector

National ambitions: e-SAF mandate with focus on domestic demand

The French government has high ambitions for green hydrogen production. France considers hydrogen a strategic avenue for decarbonisation. It has freed approximately €9 billion to support the development of the sector.[44] It aims to have 4.5 GW production capacity by 2030 and 8 GW production capacity by 2035.[45] Part of this hydrogen could also be used for e-SAF production, depending on the development of both the hydrogen and e-SAF sector in France.[46]

Moreover, France aims to invest 300 million euro per year from 2024 to 2030 to support the development of clean aviation.[47] The expected capacity for French SAF production in 2030 stands at 500,000 Mt, which represents a significant part of the total European capacity.[48] This is mainly due to Air France-KLM signing significant offtake agreements and maintaining an internal SAF fuel blend target that exceeds the regulatory obliged percentage mandated by the EU.[49]

France is leading e-SAF developments. It is the country in the EU with the largest number of announced projects, aiming to produce the largest quantity of all countries (see Annex 1). All existing e-SAF projects are done by French companies. Flagship projects such as 'Take Kair' and 'KerEAUzen' also aim to produce fuels for Air France-KLM as the main customer.[50]

Capability gaps: Limited due to strong domestic supply chain

France's leading position in the e-SAF market is partly due to the relatively low electricity prices. This is related to the country's heavy reliance on nuclear energy. As of 2025, though, this is not an accepted pathway by the EU for the production of green hydrogen. France is also building its CCU industry. The government is developing its strategy for the carbon, capture, storage and utilisation industry, with plans to expand the capture of biogenic carbon to 12-20 Mt/CO_2 yearly after 2030, and direct air capture after 2040.[51] The first biogenic CCU facility was announced in 2025, focusing on a large-scale biomethane plant.[52]

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44 France Hydrogène, 'France Hydrogène accueille positivement la Stratégie Nationale Hydrogène révisée : enfin un cap clair pour la filière', *France Hydrogène*, 2025, https://www.france-hydrogene.org/press_release/france-hydrogene-accueille-positivement-la-strategie-nationale-hydrogene-revisee-en-fin-un-cap-clair-pour-la-filiere/.

45 France Hydrogène, 'France Hydrogène accueille positivement la Stratégie Nationale Hydrogène révisée'.

46 France Hydrogène, 'France Hydrogène accueille positivement la Stratégie Nationale Hydrogène révisée'.

47 Virginie Malicier et al., 'France to Invest Eur300 Million/Year in Clean Aviation over 2024-30', S&P Global Commodity Insights, 16 June 2023, https://www.spglobal.com/commodity-insights/en/news-research/latest-news/crude-oil/061623-france-to-invest-eur300-millionyear-in-clean-aviation-over-2024-30.

48 Virginie Malicier et al., 'France to Invest Eur300 Million/Year in Clean Aviation over 2024-30'.

49 Total Energies, 'Air France-KLM Ramps up Its SAF Offtake Agreement with TotalEnergies, Which Will Supply up to 1.5 Million Tons of More Sustainable Aviation Fuel over a 10-Year Period', TotalEnergies.Com, 2024, https://totalenergies.com/news/press-releases/air-france-klm-ramps-its-saf-offtake-agreement-totalenergies-which-will-supply.

50 Air France KLM, 'Air France-KLM Reaffirms Its Commitment to the Use of SAF', 2024, https://biodieselmagazine.com//articles/air-france-klm-reaffirms-its-commitment-to-the-use-of-saf.

51 'Déploiement de La Capture, Du Stockage et de La Valorisation Du Carbone (CCUS) En France', Ministere de L'Economie Des Finances et de La Souverainete Industrielle et Numerique, 2024, https://www.entreprises.gouv.fr/la-dge/actualites/deploiement-de-la-capture-du-stockage-et-de-la-valorisation-du-carbone-ccus-en.

52 Anthony Wright, 'Suez Launches Biogenic CO2 Recovery Unit in France', Gasworld, 8 July 2025, https://www.gasworld.com/story/suez-launches-biogenic-co2-recovery-unit-in-france/2161360.article/.

Based on its current ambitions and projects, the need for foreign e-SAF capabilities is relatively small in France. Of all the countries in the EU, France has the highest number of announced projects for e-SAF (see Annex 1). This means that in the short term there is relatively little scope for foreign businesses to start new projects in France. Moreover, Air France/KLM already has secured offtake agreements with TotalEnergies, DG Fuels and OMV, satisfying a large part of their e-SAF needs for 2030.[53]

4.1.2. **Business environment: Optimal**

France is a country with a generally stable and strong business environment, meaning that projects in the e-SAF sector could be made with a generally low level of risk. S&P and Fitch give France an AA- credit rating, positioning it below Canada but above Spain. France is backed by a robust and diversified economy, contributing to its general high rating. Financially, there is a small country risk premium associated with France (0.8%), which means that an investor would expect to earn a return on investment of 0.8% higher to compensate for the slightly larger risk perception of the country. For e-SAF projects, this might mean that capital costs could be slightly higher (depending on the source of funding), something to be factored into the total project costs.

The quality of French public institutions and infrastructure is high. France has a strong innovation ecosystem and its infrastructure is of high quality. France is also connected to the Netherlands via the CEPS pipeline, providing key infrastructure for jet fuel and (e-)SAF. It scores slightly lower than Canada and Sweden on infrastructure overall, but higher in competitively priced international shipments than the two. At the same time, major budget deficits and government debt, in combination with political fragmentation complicating France's ability to fiscally consolidate, leads it to achieve a significantly lower rating than Sweden and Canada.

The French business culture can be characterised by 'neo-dirigisme', which in practice means the French government tends to favour domestic companies in sectors they consider 'strategic'.[54] This seems to be confirmed by the fact that about 80% of all the partners in the 15 identified French e-SAF projects are domestic companies.

In terms of climate risks, which can negatively impact the business environment by economic or infrastructural disruption, France has a low vulnerability score and a high readiness score, making it highly resilient.

Based on France's good performance on above mentioned indicators, the overall business environment can be considered optimal.

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53 Total Energies, 'Air France-KLM Ramps up Its SAF Offtake Agreement with TotalEnergies, Which Will Supply up to 1.5 Million Tons of More Sustainable Aviation Fuel over a 10-Year Period'; Air France KLM, 'Air France-KLM Confirms Its Strategic Cooperation with SAF Producer DG Fuels by Investing in Their SAF Production Facility in the United States', 2023, https://www.airfranceklm.com/en/newsroom/air-france-klm-confirms-its-strategic-cooperation-saf-producer-dg-fuels-investing-their; OMV, 'OMV to Supply Air France-KLM with 2,000t Sustainable Aviation Fuel This Year', 2023, https://www.omv.com/en/media/press-releases/2023/230918-omv-to-supply-air-france-klm-with-2-000t-sustainable-aviation-fuel-this-year.

54 Matthieu Ansaloni and Andy Smith, 'The Neo-Dirigiste Production of French Capitalism since 1980: The View from Three Major Industries', *French Politics* 16, no. 2 (2018): 154–78, https://doi.org/10.1057/s41253-018-0061-1.

4.1.3. Geopolitical relations with the Netherlands: Very good

The Netherlands and France have strong political relations, which serves a stable base on which to develop e-SAF partnerships. Both countries are EU and NATO members, institutionally underpinning their partnership. Technological collaboration is a key component of their partnership, with both nations leading in fields like renewable energy technology, biotechnology, and advanced manufacturing. These efforts are supported by the 'Pact For Innovation and Sustainable Growth', signed by both parties in 2023.[55] France and the Netherlands have also released a joint statement calling for increased cooperation on achieving strategic autonomy on a European level.[56] Within this framework, collaboration to establish synthetic fuel supply chains to decarbonize aviation aligns with other bilateral and European ambitions.

The Netherlands and France maintain a strong and well-established trade relationship, which could be leveraged to establish new ties along the e-SAF supply chain. The Netherlands exports high-value goods to France, including electronics, machinery, and agricultural products, while France sends automobiles, luxury items, and pharmaceuticals to the Dutch market.[57] Investment between the two countries is substantial: With €106 billion in foreign direct investment stock in 2022, the Netherlands ranked as France's third-largest investor.[58] This means that there are little barriers for effective investment of Dutch businesses in France, simplifying any future e-SAF projects in France.

Furthermore, France and the Netherlands are closely aligned from a security perspective, they both support the 'European Intervention Initiative' as a means to tackle security challenges in areas like the Sahel and the Indo-Pacific. Furthermore, the Netherlands and France have also issued multiple joint declarations and renewed statements of intent on security, defence, and geopolitical issues.[59] Regarding migration and asylum policies, both countries are collaborating to establish a European strategy that upholds both solidarity and responsibility.

4.1.4. Conclusion: Opportunities for Dutch industry

In comparison to the other six countries, the opportunities for Dutch companies in France are relatively limited. France has strong national ambitions in the hydrogen and (e-)SAF sector, but the efforts so far have been focused on domestic producers and offtakers. The business outlook and the geopolitical relations between the Netherlands and France are good. The lack of clear capability gaps in the French e-SAF supply chain limit the scope of short-term business opportunities for Dutch companies in France itself. Nonetheless, France could be an essential knowledge partner to the Netherlands, as the French market seems to already be more developed than the Dutch one, in addition to it becoming a key partner in the regional development of an e-SAF ecosystem in Northwestern Europe.

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55 Government of France, 'France and the Netherlands Sign a Pact for Innovation and Sustainable Growth', *Presse - Ministère des Finances*, 13 April 2023, https://presse.economie.gouv.fr/13042023-france-and-the-netherlands-sign-a-pact-for-innovation-and-sustainable-growth/.

56 Government of the Netherlands, 'Joint declaration – Government Consultations Netherlands', diplomatieke_verklaring, Ministerie van Algemene Zaken, 12 April 2023, https://www.government.nl/documents/diplomatic-statements/2023/04/12/joint-declaration---government-consultations-netherlands---france-12-april-2023.

57 The Observatory of Economic Complexity, 'France (FRA) and Netherlands (NLD) Trade', The Observatory of Economic Complexity, 2025, https://oec.world/en/profile/bilateral-country/fra/partner/nld.

58 Ministère de l'Europe et des Affaires étrangères, 'France and Netherlands', France Diplomacy - Ministry for Europe and Foreign Affairs, 2023, https://www.diplomatie.gouv.fr/en/country-files/netherlands/france-and-netherlands-65052/.

59 Government of the Netherlands, 'Joint declaration – Government Consultations Netherlands', diplomatieke_verklaring, Ministerie van Algemene Zaken, 12 April 2023, https://www.government.nl/documents/diplomatic-statements/2023/04/12/joint-declaration---government-consultations-netherlands---france-12-april-2023.

4.2. Spain

4.2.1. Setup of e-SAF sector

National ambitions: High goals for hydrogen, less ambitious on e-SAF

The Spanish government has set ambitious goals for a future hydrogen industry. In 2023, Spain tripled its target for hydrogen-producing electrolysers in 2030 to 12 GW.[60] Moreover the Spanish government has positioned itself as a future hydrogen exporter.[61]

Spanish airlines Iberia and Vueling will, at least from 2030, have a certain level of demand for (e-)SAF. These airlines have committed to use 10% SAF in 2030.[62] Given the e-SAF submandates of the EU, these airlines and other non-Spanish ones refuelling in Spain will have to make use of e-SAF. Simultaneously, several airlines have already signed agreements to purchase the fuel, highlighting the sector's strong commitment to decarbonizing its activities.[63] The International Airlines Group (IAG) – a British-Spanish company – have committed to offtake 28,000 tonnes of e-SAF from energy company Repsol.[64]

This e-SAF will be partly serviced by the companies Holcim, Ignis P2X and Exolum, which have agreed to build an e-SAF plant that would use CO_2 from cement production and convert it to e-SAF. This plant should produce around 100,000 tonnes of e-SAF per annum.[65] Besides this, some smaller, pilot-scale projects are being developed for e-SAF (see Annex 1).

Capability gaps: e-SAF sector underdeveloped

Spain has an attractive position in the upstream e-SAF supply chain due to its ambitious hydrogen strategy based on strong renewable energy potential and relatively low costs.[66] The country has several projects on biogenic CCU underway, focused primarily on its biomass plants.[67]

In contrast to the large ambitions on hydrogen, the downstream e-fuel sector, including e-SAF, remains relatively underdeveloped. The large Spanish renewables company Iberdrola is currently considering building a hydrogen (and possibly an e-SAF) plant in a consortium with other companies, with the aim of exporting these commodities to other parts of the world,

60 Peter Collins, 'Hydrogen Europe', *Hydrogen Europe*, 24 September 2024, https://hydrogeneurope.eu/spain-trebles-2030-green-h2-target-to-12gw-in-updated-national-climate-plan/.

61 Green Hydrogen Organisation, 'Spain', Green Hydrogen Organisation, 2022, http://gh2.org/countries/spain.

62 PricewaterhouseCoopers, 'A Flight Path to Net Zero: Assessing Spain's SAF Capacity', PwC, 2024, https://www.pwc.com/gx/en/about/case-studies/iberia-assesses-saf-capacity.html.

63 RIC Energy, 'RIC Energy Aims to Lead the Production of Sustainable Aviation Fuel (e-SAF) in Spain', *RIC ENERGY*, 7 February 2025, https://ric.energy/en/ric-energy-aims-to-lead-the-production-of-sustainable-aviation-fuel-e-saf-in-spain/.

64 Repsol, 'IAG and Repsol Agree the Largest Purchase of SAF in Spain', Repsol, 2024, https://www.repsol.com/en/press-room/press-releases/2024/iag-and-repsol-agree-the-largest-purchase-of-saf-in-spain/index.cshtml.

65 Edward Laity, 'Eco2Fly to Produce 100,000 Tonnes of Hydrogen-Based e-SAF from Cement Production Emissions', H2 View, 8 April 2025, 2, https://www.h2-view.com/story/eco2fly-to-produce-100000-tonnes-of-hydrogen-based-e-saf-from-cement-production-emissions/2124321.article/.

66 'Spain', IEA, accessed 29 August 2025, https://www.iea.org/countries/spain.

67 Anthony Wright, 'Spanish E-Methanol Project Taps Biogenic CO2 and Green Hydrogen', Gasworld, 21 May 2025, https://www.gasworld.com/story/spanish-e-methanol-project-taps-biogenic-co2-and-green-hydrogen/2156400.article/; 'CARBUROS METÁLICOS AND ENSO (BIOELÉCTRICA DE GARRAY) SIGN AN AGREEMENT TO CAPTURE AND RECYCLE GREEN CO2 IN SORIA (SPAIN)', CO2IntBio, 2021, http://www.lifeco2intbio.eu/en/node/77.

such as the Netherlands.[68] Furthermore, the Spanish energy company Moeve has hydrogen and SAF plants but currently lacks a confirmed large-scale e-fuel project.[69] This lack of downstream production capabilities indicates that a possible need could be fulfilled by Dutch companies.

4.2.2. **Business environment: Good**

The economic outlook in Spain is generally strong, albeit a bit less stable than Sweden, France and Canada. While there is some variation in Spain's credit ratings, receiving a Baa1 from Moody's, an A- from Fitch, and an A from S&P, Spain's Eurozone membership, good governance indicators, and positive growth prospects are widely cited as their major assets.

However, Spain does face a high government debt with limited confidence for its consolidation, leading it to stand above Morocco but below Saudi Arabia in terms of credit. Spain has a country risk premium of 2.13%. This effectively means that investors are expected to receive a higher return on investment in Spain than in for example Canada. This can have implications for capital costs of e-SAF producers in Spain.

In terms of public institutions, Spain performs well, closely trailing France and ahead of Saudi Arabia. Relative to the other countries studied, Spain lands in the middle of the cohort with regard to the innovation ecosystem, behind Canada but ahead of Saudi Arabia. Spain has high quality infrastructure, sharing the highest score in competitively priced international shipments with France, but falling behind Sweden and Canada owing primarily to poorer performing customs service. e-SAF businesses should take these vulnerabilities into account when investing in Spain.

With regard to climate risk, Spain has a low vulnerability score and a high readiness score, making it resilient to potential climatic hazards.

Overall, Spain is a country with a relatively strong business outlook. However, in terms of credit risk, public institutions and climate resilience Spain ranks below Sweden, France and Canada on most indicators. As a result, Spain's business environment is rated as Good.

4.2.3. **Geopolitical relations with the Netherlands: Very good**

The Netherlands and Spain have strong, institutionally embedded political relations. Both are part of NATO, the European Union, the Council of Europe, the European Intervention Initiative, share the same currency, and are seeking to deepen political cooperation having signed a 2022 MoU on political consultations.[70] Building upon their national expertise, the Netherlands and Spain also collaborate on agricultural technology through knowledge sharing and

68 Interview - Iberdrola

69 Marwa Rashad, 'Spain's Moeve Set to Start Work on Green Hydrogen Plant This Year', Environment, *Reuters*, 29 January 2025, https://www.reuters.com/business/environment/spains-moeve-set-start-work-green-hydrogen-plant-this-year-2025-01-29/; Darueber BV, 'Topsoe to Provide Technology for Cepsa's 2G Biofuels Plant in Spain', chemXplore, 16 April 2024, https://chemxplore.com/news/topsoe-technology-supplier-cepsa-2g-biofuels-plant-palos-de-la-frontera-spain.

70 Government of the Netherlands, 'Memorandum of Understanding between Spain and the Netherlands on political consultations', diplomatieke_verklaring, Ministerie van Algemene Zaken, 20 October 2022, https://doi.org/10/20/memorandum-of-understanding-spain-netherlands-on-political-consultations.

co-creation, and bilateral collaboration between universities, institutions, and area specific accelerators.[71]

Spain and the Netherlands have a strong, but varied, trade relationship. While the Netherlands mostly exports electrical equipment, machinery, and optical, photo, technical, and medical devices to Spain, a major component of Spanish exports to the Netherlands consists of food such as vegetables, fruits, and nuts, as well as fuels and oils.[72] Despite having very different focuses for their export markets, Spain and the Netherlands have signed agreements for strategic cooperation, green hydrogen supply chains, and e-SAF production involving both private and public sectors.[73] Major Spanish actors in the Dutch-Spanish e-fuel collaboration are Iberdrola, Moeve, the port of Algeciras, and the port of Bilbao. These established relationships show that there is scope for structural cooperation between Dutch and Spanish e-SAF businesses.

Due to the deep cooperation between the Netherlands and Spain in the political and economic sphere, the relationship between the countries is rated as Very Good.

4.2.4. **Conclusion: Opportunities for Dutch industry**

Spain holds significant potential for Dutch e-SAF businesses. The strategic goal of Spain includes the export of hydrogen and its derivatives. This means that there is a good opportunity for Dutch companies with a strong knowledge base to help develop the e-SAF sector in Spain. Types of activities that could be supported are the building of downstream facilities in Spain or the transport or storage of e-SAF for further use. An example of this type of cooperation – in other green fuel supply chains – was the agreement in 2023 between the Netherlands and Spain to import hydrogen from the Spanish city Puertollano to the Netherlands.[74] More recently, Spanish renewable energy company Magnon and Dutch Power2X have agreed to cooperate on establishing an e-methanol plant in Puertollano.[75] These type of collaborations could also be explored for e-SAF.

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71 Ministerie van Landbouw, 'Spain: Knowledge Exchange and Bilateral Collaboration Can Drive Innovation in the Food Transition', nieuwsbericht, Ministerie van Landbouw, Visserij, Voedselzekerheid en Natuur, 12 May 2025, https://www.agroberichtenbuitenland.nl/actueel/nieuws/2025/05/12/spain-knowledge-exchange-and-bilateral-collaboration-can-drive-innovation-in-the-food-transition.

72 Trading Economics, 'Netherlands Exports to Spain', 2025, https://tradingeconomics.com/netherlands/exports/spain; Trading Economics, 'Spain Exports to Netherlands', 2025, https://tradingeconomics.com/spain/exports/netherlands.

73 Government of the Netherlands, 'Joint Statement on Reinforcing Spanish-Dutch Strategic European Cooperation', diplomatieke_verklaring, Ministerie van Algemene Zaken, 18 April 2024, https://www.government.nl/documents/diplomatic-statements/2024/04/18/joint-statement-on-reinforcing-spanish-dutch-strategic-european-cooperation; Port of Rotterdam, 'Concrete Agreements on Green Hydrogen from Spain to the Netherlands', 2023, https://www.portofrotterdam.com/en/news-and-press-releases/concrete-agreements-on-green-hydrogen-from-spain-to-the-netherlands; Aida Čučuk, 'New Agreements to Solidify Spain and Netherlands' Hydrogen Connection', *Offshore Energy*, 19 April 2024, https://www.offshore-energy.biz/new-agreements-to-solidify-spain-and-netherlands-hydrogen-connection/.

74 'The Netherlands: A Global Hub for Hydrogen Import, Transport and Storage', Tno.Nl/En, 20 May 2025, https://www.tno.nl/en/newsroom/insights/2023/08/netherlands-global-hub-hydrogen/.

75 Aida Čučuk, 'New Alliance Targets E-Methanol Development in Puertollano, Spain', *Offshore Energy*, 22 May 2025, https://www.offshore-energy.biz/new-alliance-targets-e-methanol-development-in-puertollano-spain/.

4.3. Sweden

4.3.1. Setup of e-SAF sector

National ambitions: Strategic focus on future e-SAF production with focus on exports

Sweden has emerged as an early adopter of SAF blends at (smaller) airports and airlines. The small Trollhättan-Vänersborg Airport in South Sweden currently offers only a SAF blend to airplanes, based on a 30-40% mix of SAF and conventional jet fuel.[76] Moreover, the regional Swedish aviation company Vastflyg committed itself in 2023 to only using SAF blends on their flights.[77]

Several (e-)SAF projects are currently taking off, positioning Sweden as an important country in the development of (e-)SAF in Europe and offering opportunities for Dutch companies. Both of the announced e-SAF projects in Sweden are done in collaboration with foreign companies. Swedish electricity providers work with Norwegian and Dutch e-fuel providers. Early 2025, Norsk e-Fuel, Prime Capital and RES announced they will develop a 80,000 tonnes e-SAF production plant in the Swedish municipality of Ånge.[78] In September 2024, another plant in Skellefteå (in cooperation with Dutch company SkyNRG) has been announced to produce 100,000 tonnes of e-SAF.[79] This points to business opportunities for Dutch companies to provide expertise and project management skills in the production of e-SAF.

However, setbacks have also occurred, with the HySkies project with Shell being cancelled after Shell pulled back from the project.[80] Vattenfall, a large energy producer in Sweden has indicated that the e-SAF market still suffers from hesitant attitudes in the industry and will only fully mature in the 2030s.[81]

With regards to offtake agreements, there is still room for improvement. The Scandinavian Airlines System (SAS) is an active participant in project SkyPower, an initiative that aims to accelerate the transition to SAF usage in the aviation sector. Within that context, SAS emphasised the need for a more decisive government commitment to e-SAF and the introduction of financial incentives to bridge the transition years.[82] Moreover, Swedavia, a Swedish airport operator, also offers SEK 40 million in incentives for airlines refuelling with SAF at their airports.[83]

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76 Neste Corporation, 'Neste Enables Swedish Trollhättan-Vänersborg Airport and Västflyg Airline to Become the World's Firsts to Use Sustainable Aviation Fuel on All Flights', Neste, 8 June 2023, https://www.neste.com/news/neste-enables-swedish-trollhaettan-vaenersborg-airport-and-vaestflyg-airline-to-become-the-worlds-firsts-to-use-sustainable-aviation-fuel-on-all-flights.

77 David Kaminski-Morrow, 'Swedish Carrier Vastflyg to Use Sustainable Fuel Exclusively on Network', Flight Global, 2023, https://www.flightglobal.com/airlines/swedish-carrier-vastflyg-to-use-sustainable-fuel-exclusively-on-network/153652.article.

78 Edward Laity, '80,000 Tonne SAF Plant Planned in Sweden by Norsk e-Fuel, Prime Capital, RES', H2 View, 13 February 2025, https://www.h2-view.com/story/80000-tonne-saf-plant-planned-in-sweden-by-norsk-e-fuel-prime-capital-res/2121515.article/.

79 Alan Sherrard, 'Skellefteå Kraft Unveils SkyKraft eSAF Plans', Bioenergy International, 17 September 2024, https://bioenergyinternational.com/skelleftea-kraft-unveils-skykraft-esaf-plans/.

80 Polly Martin, 'Shell Exits EU-Backed, Green Hydrogen-Based Aviation Fuel Project', Hydrogeninsight.Com, 9 July 2024, https://www.hydrogeninsight.com/transport/shell-exits-eu-backed-green-hydrogen-based-aviation-fuel-project/2-1-1674752.

81 Vattenfall Media Relations, 'Hesitant Electrofuel Market for the Aviation Industry', Vattenfall, 2024, https://group.vattenfall.com/press-and-media/newsroom/2024/hesitant-electrofuel-market-for-the-aviation-industry.

82 SAS, 'SAS Calls for Policy Action to Unlock E-SAF Potential in Europe', SAS, 2025, https://www.sasgroup.net/newsroom/press-releases/2025/sas-calls-for-policy-action-to-unlock-e-saf-potential-in-europe/.

83 Swedavia Airports, 'SEK 40 Million Set aside in 2024 for Swedavia's SAF Incentive Programme towards Climate Transition in the Aviation Industry for the Second Year in a Row', Swedavia Airports, 2024, https://www.swedavia.com/about-swedavia/swedaviasnewsroom/2024/sek-40-million-set-aside-in-2024-for-swedavias-saf-incentive-programme-towards-climate-transition-in-the-aviation-industry-for-the-second-year-in-a-row/.

Capability gaps: e-SAF production and offtake

Sweden has ideal production conditions for e-SAF. It has abundant green electricity due to the abundance of hydro and nuclear power in its electricity mix.[84] This makes the production of green hydrogen as well as other electricity-intensive processes like carbon utilisation and the production of e-SAF and its precursors advantageous. Moreover, the Swedish government has acknowledged the high potential of biogenic carbon capture and utilisation in its climate action plan, and significant cross-industry efforts are being made to develop a competitive biogenic CCU industry.[85] Stockholm became in 2025 the first city worldwide to start capturing biogenic carbon from the atmosphere.[86] Its main sources are biomass residues like wood chips, branches, forestry and the pulp and paper industry.[87]

Swedish companies are active in starting up production facilities for e-SAF, although existing projects are done in collaboration with foreign companies. Moreover, domestic offtakers are not sufficient to absorb this upcoming supplies. As a result, Swedish companies seek the export of (e-SAF) products to stimulate the supply base. This brings notable opportunities for Dutch companies.

4.3.2. **Business environment: Optimal**

Sweden is the only country examined with a perfect credit score across Moody's, Fitch, and S&P, owing to its robust and advanced economy, strong governance, and a resilient banking sector. Due to its high scores in all these business-related domains, Sweden has no risk premium associated with it, making it a highly attractive destination for investments in, among others, e-fuels and e-SAF projects.

Sweden's top performance in public institutions arises from its effective governance, high levels of accountability, control of corruption, regulatory quality, and rule of law. Sweden's innovation system is exceptionally strong due to of having the highest ranked business sophistication and infrastructure, the second highest knowledge and technology outputs and the third highest human capital and research in the world. Sweden shares the highest infrastructure score with Canada.

In terms of climate risk, Sweden has a low vulnerability score and the highest readiness score, making it the most resilient out of the countries examined.

Based on these factors, Sweden is one of the least challenging locations for Dutch e-SAF companies to do business. Across all metrics examined, Sweden comes first or holds a shared first when it comes to its business environment.

84 'Sweden', IEA, 2024, https://www.iea.org/countries/sweden.

85 Fossil Free Sweden, *Strategy for Fossil Free Competitiveness Biogenic Carbon Capture* (2024), https://fossilfrittsverige.se/wp-content/uploads/2024/10/Strategy-for-fossil-free-competitiveness-biogenic-carbon-capture.pdf.

86 'Stockholm World's First City to Start Capture and Remove Biogenic CO2 from the Atmosphere', *IEA Bioenergy*, 2025, https://www.ieabioenergy.com/blog/publications/stockholm-worlds-first-city-to-start-capture-and-remove-biogenic-co2-from-the-atmosphere/.

87 'Stockholm World's First City to Start Capture and Remove Biogenic CO2 from the Atmosphere'.

4.3.3. **Geopolitical relations with the Netherlands: Very good**

The Netherlands and Sweden have excellent political relations. Sweden and the Netherlands are both part of the European Union, the Council of Europe, the European Intervention Initiative, and the Netherlands was a strong proponent of supporting Swedish accession into NATO in 2022.[88] The Netherlands and Sweden also signed a statement of intent in 2022 to enhance defence collaboration, and work closely on defence innovation, intelligence exchange, and cyber security.[89] Alongside security collaboration, Sweden and the Netherlands also work closely on agrifood, resilient cities, and high-tech such as quantum computing, AI, and deeptech.[90]

Sweden and the Netherlands have a strong and sophisticated trade relationship, creating a robust basis for e-SAF investment. The chief Swedish exports to the Netherlands consist of vehicles, fuels, and machinery.[91] Dutch exports to Sweden include of machinery, electrical equipment, and fuels, indicating that there is a high degree of specialised trade occurring.[92] This is in line with the Dutch characterisation of their relationship: "Innovating Together," on green energy, life sciences and smart transport, including sustainable fuel shipping corridors.[93] Specifically, this manifests itself in a focus on the hydrogen revolution and a memorandum of understanding signed between the Port of Gothenburg and the Port of Rotterdam.[94]

4.3.4. **Conclusion: Opportunities for Dutch industry**

As shown by Sweden's relatively advanced position in the e-SAF production landscape and existing collaboration with European partners, there are notable opportunities for Dutch companies to step into the production of e-fuels/e-SAF and export it. Moreover, the country lacks a large enough offtake base. As a result, opportunities exist in linking Swedish production centres to demand in the Netherlands or in other neighbouring countries through the Netherlands' energy hub function.

The business environment in Sweden is excellent, and the geopolitical relations between the Netherlands and Sweden are good. Sweden is ideally suited for e-SAF production due to its ecosystem, energy costs and infrastructure. Nevertheless, the shelved HySkies project also reflects broader uncertainty in the e-SAF market.

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88 Tweede Kamer, 'Goedkeuring van de op 5 juli 2022 te Brussel tot stand gekomen Protocollen bij het Noord-Atlantisch Verdrag betreffende de toetreding van de Republiek Finland en het Koninkrijk Zweden', 2022, https://www.tweedekamer.nl/kamerstukken/wetsvoorstellen/detail?id=2022Z14517&dossier=36162; Kingdom of the Netherlands, 'Security - Sweden', Sweden, 2024, https://www.netherlandsandyou.nl/web/sweden/themes/security.

89 Insight EU Monitoring, 'Sweden and the Netherlands to Enhance Defence Cooperation', 2022, https://ieu-monitoring.com/editorial/sweden-and-the-netherlands-to-enhance-defence-cooperation/390900?utm_source=ieu-portal; Kingdom of the Netherlands, 'Security - Sweden'.

90 Kingdom of the Netherlands, 'Themes - Sweden', 2023, https://www.netherlandsandyou.nl/web/sweden/themes.

91 Trading Economics, 'Sweden Exports to Netherlands', 2025, https://tradingeconomics.com/sweden/exports/netherlands.

92 Trading Economics, 'Netherlands Exports to Sweden', 2025, https://tradingeconomics.com/netherlands/exports/sweden.

93 Government of the Netherlands, 'Sweden and the Netherlands: innovating together', webpage, Ministerie van Algemene Zaken, 13 October 2022, https://www.government.nl/latest/weblogs/meet-the-ambassadors/2022/state-visit-sweden-netherlands.

94 Kingdom of the Netherlands, 'Climate and Energy - Sweden', Sweden, 2023, https://www.netherlandsandyou.nl/web/sweden/themes/climate-and-energy.

4.4. Canada

4.4.1. Setup of e-SAF sector

National ambitions: Significant SAF goals and research, but no e-SAF mandates

The development of the SAF industry in Canada is shaped by the Aviation Action Plan, launched in 2022, to provide a roadmap for the future of air travel. In this plan, Canada set a benchmark of 10% SAF use in 2030.[95] At the time of writing Canada does not have any mandates around e-SAF, even though its domestic green hydrogen sector is growing. In March 2024, Canada signed an agreement with Germany to establish a hydrogen corridor, highlighting Canada's potential as a global hydrogen supplier.[96]

In terms of SAF consumer offtake, Air Canada agreed to procure 60,000 tons of biomass-derived SAF from Finnish company Neste, starting from the end of 2024.[97] The Dutch company Advario is involved through the shipping of the SAF to the end location.[98]

Canada is seeing notable R&D initiatives around SAF and e-SAF. The SAF+ consortium is developing a technology solution to produce e-SAF from industry emissions.[99] Furthermore, Airbus Canada established a testing centre for the use of SAF in 2023.[100] A promising startup – called Aeon Blue – is developing a technology that would use seawater as a feedstock for e-SAF. The development of this technique is still in the pilot phase.[101] Other innovative solutions for e-SAF production include Carbon Engineering Air-to-Fuel technology and Greenfield Global inc. which aims to use forestry waste and convert it to SAF.[102]

Capability gaps: e-SAF production & offtake, carbon capture and utilisation

Canada has a promising, yet underdeveloped (e-)SAF sector. Currently, the lack of governmental mandates and offtake agreements hamper the development of e-SAF in Canada. The production conditions for e-fuels are very attractive, including vast renewable energy, green hydrogen production, and biogenic carbon. Canada is one of the largest players in the carbon management sector, with one-seventh of the world's large scale carbon projects found in

95 Fayaz Hussain, 'What's up with SAF in Canada, Eh?', *SAF Investor*, 2024, https://www.safinvestor.com/opinion/146069/whats-up-with-saf-in-canada-eh/.

96 Natural Resources Canada, 'Memorandum of Understanding: The Advancement of the Canada-Germany Hydrogen Alliance', 15 March 2024, https://natural-resources.canada.ca/climate-change/memorandum-understanding-advancement-canada-germany-hydrogen-alliance.

97 Neste Corporation, 'Neste and Air Canada Sign Agreement for the Supply of 60,000 Tons of Neste MY Sustainable Aviation Fuel – the First Time Neste's SAF Is Supplied to Canada', Neste, 12 November 2024, https://neste.com/news/neste-and-air-canada-sign-agreement-for-the-supply-of-60-000-tons-of-neste-my-sustainable-aviation-fuel-the-first-time-neste-s-saf-is-supplied-to-canada.

98 Lisanne Kosters, 'Advario Singapore Supports the Supply of Neste's SAF to Air Canada', *Advario*, 31 January 2025, https://advario.com/Advario-Singapore

99 Government of Canada, 'Production of Sustainable Aviation Fuel from Flue Gas–Captured CO2 and Low-Carbon Hydrogen', 2024, https://natural-resources.canada.ca/funding-partnerships/production-sustainable-aviation-fuel-flue-gas-captured-co2-low-carbon-hydrogen.

100 Agustin Miguens, 'Airbus, Pratt & Whitney and SAF+ Consortium to collaborate on sustainable fuels development in Quebec', Aviacionline, 2023, https://www.aviacionline.com/airbus-pratt-whitney-and-saf-consortium-to-collaborate-on-sustainable-fuels-development-in-quebec.

101 Dirk Singer, 'How a Canadian Sibling Duo Are Promising Cost-Competitive e-SAF by 2031', 17 November 2024, https://green.simpliflying.com/p/aeon-blue-canadian-sibling-duo-saf-efuels.

102 Carbon Engineering, 'AIR TO FUELS™ Technology', *Carbon Engineering*, 2023, https://carbonengineering.com/air-to-fuels/; Erin Krueger, 'Canada Funds SAF, Renewable Diesel and Bioenergy Projects', 2025, https://biomassmagazine.com//articles/canada-funds-saf-renewable-diesel-and-bioenergy-projects.

the country.[103] Still, bio-CCU infrastructure is relatively underdeveloped in the eastern part of Canada, notably the centres most likely to collaborate with the Netherlands due to geographical proximity. As such, Canada could collaborate with Dutch companies in the e-fuel and carbon supply chains, as well as use the Dutch market as an offtaker due to the small size of its domestic market.

4.4.2. **Business environment: Optimal**

Canada is a very safe investment location for Dutch e-SAF businesses. Canada has a near perfect credit rating, receiving top ratings from Moody's and S&P, and achieving the second best AA+ rating from Fitch. Similarly to Sweden, Canada's robust advanced economy, strong governance, and resilient banking sector are major assets. Apart from Sweden, Canada is the only country analysed in this paper that has no risk premium associated with it.

Challenges in government debt and the housing sector cause Fitch to rate Canada lower. Canada follows closely behind Sweden in government effectiveness and legal transparency, but outperforms it when it comes to political stability. Canada has a strong innovation ecosystem, trailing behind France and leading Spain. Canada shares the top infrastructure score with Sweden, with efficient customs, logistics, and tracking & tracing.

In terms of climate risk, Canada has the lowest vulnerability score and a high readiness score, making it the second most resilient country analysed in this report, after Sweden.

Overall, Canada has a strong business environment, underpinned by high credit ratings, no country risk premium, strong institutions, robust climate resilience, and good infrastructure. As such, the business environment is rated as Optimal.

4.4.3. **Geopolitical relations with the Netherlands: Very good**

There are no significant geopolitical barriers between the Netherlands and Canada for e-SAF businesses. Dutch-Canadian political relations are underpinned by the EU-Canada Strategic Partnership Agreement, which promotes broad cooperation based on shared values.[104] Their strong ties also stem from historical connections, such as Canada's role in liberating the Netherlands during World War II and hosting the Dutch royal family in exile.[105] Contemporarily, The Royal Netherlands Air Force has been participating in the Canadian International Training Program under an international air force partnership.[106] Furthermore, Canada signed a strategic defence and security partnership with the EU, enabling operational, industrial, and institutional security cooperation.[107] Frequent high-level visits and collaboration in organisations like NATO, the UN, and the ICC further reinforce this relationship. The strength of this political

103 Natural Resources Canada, 'Canada's Carbon Management Strategy', 18 September 2023, https://natural-resources.canada.ca/energy-sources/carbon-management/canada-s-carbon-management-strategy.

104 European Union External Action, 'EU-Canada Strategic Partnership Agreement', EEAS, 2017, https://www.eeas.europa.eu/node/13529_en.

105 Government of Canada, 'Canada-Netherlands Relations', GAC, 2025, https://www.international.gc.ca/country-pays/netherlands-pays_bas/relations.aspx?lang=eng.

106 Government of Canada, 'Growing Skills: Canadian and Dutch Air Force Partnership', 14 May 2025, https://www.canada.ca/en/department-national-defence/maple-leaf/defence/2025/05/growing-skills-canadian-dutch-air-force-partnership.html.

107 Murray Brewster, 'Canada Signs Deal Deepening European Defence and Security Partnership', *CBC News*, 23 June 2025, https://www.cbc.ca/news/politics/canada-rearm-europe-deal-1.7567162.

relationship is also underscored in official statements; the Canadian Ministry of Foreign Affairs stated that "The Netherlands is a strong international partner and ally for Canada."[108]

Canada and the Netherlands maintain a robust economic relationship, largely shaped by the Canada-European Union Comprehensive Economic and Trade Agreement (CETA).[109] In 2024, Canadian exports of goods to the Netherlands totalled $7.1 billion (USD), while Dutch goods exports to Canada reached $4.6 billion. Trade in services for the same year stood at $2.3 billion from Canada to the Netherlands and $2.9 billion in the opposite direction.[110] Foreign direct investment (FDI) also reflects this strong connection: Canadian FDI in the Netherlands amounted to $80.6 billion, and Dutch FDI in Canada reached $182.8 billion in 2024.[111] In addition, the Netherlands has recently prioritised expanding international cooperation in the areas of knowledge and innovation investments, with Canada included in the initiative's pilot phase.[112]

Based on this assessment, the geopolitical relations between the Netherlands and Canada are rated as Very good.

4.4.4. Conclusion: Opportunities for Dutch industry

Canada is ideally suited for e-SAF production. The abundance of energy, raw materials and space provide ample opportunity for businesses to expand the e-SAF market. However, the regulatory framework supporting the scale up of e-SAF in Canada is not as strong as in the EU, leading to lower levels of ambition and more business uncertainty. So far, the investments in e-SAF have lagged behind the possibilities, both in terms of e-fuel production and carbon utilisation. This could be an opportunity for Dutch companies to expand their presence in Canada. The establishment of the hydrogen corridor with Germany also indicates that Canada is open to a role as a global hydrogen provider. In short, this means that Dutch companies could make concrete investments to produce e-methanol or e-SAF in Canada, and/or serve as hydrogen offtakers through exports to the Netherlands.

108 Government of Canada, 'Canada-Netherlands Relations'.

109 European Commission, 'EU-Canada Comprehensive Economic and Trade Agreement (CETA)', European Commission, 10 October 2024, https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/canada/eu-canada-agreement_en.

110 Government of Canada, 'Canada-Netherlands Relations'.

111 Government of Canada, 'Canada-Netherlands Relations'.

112 Ministerie van Buitenlandse Zaken, 'Netherlands and Canada strengthen cooperation in science, technology and innovation', nieuwsbericht, Ministerie van Algemene Zaken, 14 June 2024, https://www.government.nl/latest/news/2024/06/14/netherlands-and-canada-strengthen-cooperation-in-science-technology-and-innovation.

4.5. Morocco

4.5.1. Setup of e-SAF sector

National ambitions: Large plans for hydrogen, less focus on e-SAF

Morocco intends to establish itself as a large hydrogen producer. Morocco's hydrogen market is explicitly geared towards exports: the country aims to become a preferred supplier of green hydrogen to Europe.[113] The exports would amount to 10 TWh in 2030, while 4 TWh would be for domestic use.[114] The Moroccan government has approved six projects worth USD 32.5 billion aimed at expanding the hydrogen production capacity.[115]

Despite this, there are few dedicated e-SAF projects in Morocco. One example of such a project is the Janassim Project, in which a subsidiary of MGH Energy is planning to build a synthetic fuel plant with a production capacity of 500,000 tonnes per year (both e-methanol and e-SAF) in the Western Sahara region.[116] Nevertheless, some analysts suggest that Morocco currently lacks sufficiently large carbon sources that could be used as a feedstock for e-SAF.[117]

Capability gaps: e-SAF sector underdeveloped, lacking domestic knowledge

Morocco has considerable ambitions in the sphere of green fuels. Nevertheless, its e-SAF market is underdeveloped, with only two publicly known e-SAF projects. One of the projects is led by a French business, the other one by a Swiss company. This indicates that Morocco currently does not have domestic companies that have started e-SAF production projects at scale, and that this is a capability gap in Morocco. The country also has an underdeveloped CCU industry, although biogenic carbon could be sourced in its cement industry, the largest carbon emitter in the country.[118]

4.5.2. Business environment: With risk premium

Morocco has a relatively low credit rating, ranking quite far behind Spain and slightly leading Brazil. While Morocco has good macroeconomic policy, strong creditor support, and manageable (but high) debt, weak governance and development indicators signal increased risks for investors. Due to all of these factors Morocco falls in the highest category of investor country risk, facing a 3.34% risk premium.

Morocco performs poor on governance and development indicators, and its precarious growth prospects maintain its relatively low rating. This poor performance on governance

113 Gwénaëlle Deboutte, 'Morocco Allocates Land for Green Hydrogen Projects', *Pv Magazine International*, 21 March 2024, https://www.pv-magazine.com/2024/03/21/morocco-allocates-land-for-green-hydrogen-projects/.

114 Johan Bruneau and Zineb Tariki, 'Hydrogen Law, Regulations & Strategy in Morocco', CMS, 2024, https://cms.law/en/int/expert-guides/cms-expert-guide-to-hydrogen/morocco.

115 Sergio Matalucci, 'The Hydrogen Stream: Morocco Approves $32.5 Billion of Green Hydrogen Projects', *Pv Magazine International*, 7 March 2025, https://www.pv-magazine.com/2025/03/07/the-hydrogen-stream-morocco-approves-six-green-hydrogen-project-for-32-5-billion/.

116 MGH Energy, 'On the Way to Low-Carbon Transport', MGH ENERGY, 2025, https://mgh-energy.com/en/.

117 Transport & Environment, 'Europe-Asia Green Corridors', T&E, 11 April 2025, https://www.transportenvironment.org/articles/europe-asia-green-corridors.

118 Ali Hasanbeigi and Cecilia Springer, *Industrial Decarbonization Roadmap Framework for the Cement and Steel Industry Morocco (A White Paper)* (UNIDO & Global Efficiency Intelligence, 2023), https://downloads.unido.org/ot/32/71/32713219/UNIDO%20Morocco%20industrial%20decarbonization%20roadmap.pdf.

indicators also results in a low score for public institutions, particularly when it comes to control of corruption, causing Morocco to rank behind Saudi Arabia but above Brazil. When it comes to the innovation ecosystem, Morocco ranks the lowest out of the cohort countries, largely due to poor R&D and business sophistication, driven by a lack of knowledge workers. Morocco also ranks the lowest on infrastructure, with significant issues in efficiency of customs and border clearance, shipments arriving in within scheduled or expected delivery time, and tracking and tracing systems.

In terms of climate, Morocco has a moderate vulnerability and readiness score, making it fairly resilient globally. When compared to the other six analysed countries, Morocco is positioned as the second least resilient country after Brazil.

For e-SAF businesses, investing in Morocco carries a slightly heightened risk premium, possibly impacting business continuity, regulatory support and capital costs. This means that Morocco's business environment is classified 'With risk premium'.

4.5.3. **Geopolitical relations with the Netherlands: Good**

The partnership between the Netherlands and Morocco focuses on key areas such as climate change adaptation, water management, agriculture, energy, and sustainable development. Recent diplomatic efforts have emphasised combating global terrorism, encouraging cultural exchanges, and promoting investments in innovation and sustainable practices.[119] Morocco and the EU are working to strengthen cooperation in justice and security, including talks on a new extradition treaty.[120] Bilaterally, the Netherlands and Morocco signed two military cooperation treaties in 2013.[121] While tensions remain between the EU (and therefore the Netherlands) and Morocco over migration and the instability in the Western Sahara region, continued dialogue and the EU-Morocco Association Agreement provide a strong framework to address these issues.[122]

Morocco's economic outlook for 2025 is optimistic, with a projected GDP growth of 3.9%, fuelled by strong performances in the services and export sectors.[123] Although challenges remain, including inflation and drought-related impacts on agriculture, Morocco's economic resilience is supported by substantial foreign direct investment and public investment.[124] The EU plays a vital role in Morocco's economic progress, being the largest trade partner of Morocco and cooperating under different financial support schemes and through the European Neighbourhood Policy.[125]

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119 Tweede Kamer, 'Actieplan Nederland Marokko', Text, 2022, https://www.tweedekamer.nl/kamerstukken/brieven_regering/detail.

120 Kingdom of the Netherlands, 'Agreement between the Kingdom of the Netherlands and the Kingdom of Morocco on Extradition', webpagina, Ministerie van Buitenlandse Zaken, 2023, https://verdragenbank.overheid.nl/en/Treaty/Details/013975.

121 Kingdom of the Netherlands, 'Verdrag tussen het Koninkrijk der Nederlanden en het Koninkrijk Marokko betreffende de status van strijdkrachten', verdrag, 21 May 2013, https://wetten.overheid.nl/BWBV0006173/2013-05-21.

122 Irene Fernández-Molina, 'Morocco-EU Relations: Navigating Sovereignty Concerns and Growing Interdependence', *ISPI*, 2024, https://www.ispionline.it/en/publication/morocco-eu-relations-navigating-sovereignty-concerns-and-growing-interdependence-181487.

123 IMF, 'Morocco and the IMF', IMF, 2025, https://www.imf.org/en/Countries/MAR.

124 OECD, 'OECD Investment Policy Reviews: Morocco 2024 (Abridged Version)', OECD, 4 November 2024, https://www.oecd.org/en/publications/oecd-investment-policy-reviews-morocco-2024-abridged-version_bc0c1f25-en.html.

125 European Commission, 'EU Trade Relations with Morocco', European Commission, 14 March 2025, https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/morocco_en.

Within the MENA region, Morocco is viewed as one of the more stable countries, although the dispute over the Western Sahara, its strained relationship with Algeria and climate threats could lead to geopolitical disruption.[126] Additionally, one of the current e-SAF projects (Janassim) is located in the Western Sahara region. An escalation of regional hostilities could threaten the viability of the project.

Overall, the geopolitical relations between the Netherlands and Morocco can be classified as Good.

4.5.4. Conclusion: Opportunities for Dutch industry

Morocco's large ambitions to become a hydrogen exporter provide opportunities for Dutch companies to become active in downstream sectors. An example could be the establishment of an e-methanol or e-SAF plant in Morocco. This could open up opportunities for Dutch companies to provide import/distribution of e-methanol or e-SAF products from Morocco to the Netherlands. Furthermore, the expertise and project management skills of Dutch companies could be leveraged to help develop downstream sectors in Morocco.

However, the risks in the Moroccan business environment should be taken into account when making an investment decision, since the governmental, infrastructure and innovation indicators reflect possible challenges for Dutch companies trying to establish themselves in Morocco.

4.6. Brazil

4.6.1. Setup of e-SAF sector

National ambitions: Strong focus on hydrogen and SAF, possible future potential for e-SAF

Although Brazil has a considerable role to play in the alternative fuels sector, it is not in the vanguard of e-SAF production. Brazil is ambitious with regards to its future role as a hydrogen producer. In its National Hydrogen Program, Brazil aims to become a key low-carbon hydrogen producer by 2030.[127] Next to this hydrogen ambition, Brazil has set a general target of 10% SAF usage in 2037, notably later than the targets of the EU.[128] The Brazilian government freed up 1.1 billion dollar in financing for the development of local SAF production.[129] Furthermore, Brazil has provided producer credits for SAF production under the RenovaBio policy.[130]

126 Youssef Amrani, 'Morocco: A Singular Path in a Troubled Region', *Elcano Royal Institute*, 2016, https://www.realinstitutoelcano.org/en/commentaries/morocco-a-singular-path-in-a-troubled-region/.

127 Serhat Demirkol, 'Brazil's National Hydrogen Program Propels the Nation Towards Energy Transition Leadership', *Brazilian NR*, 13 January 2024, https://braziliannr.com/2024/01/13/brazils-national-hydrogen-program-propels-the-nation-towards-energy-transition-leadership/.

128 João Curi, 'Brazil SAF Industry Set to Take off in 2027', Argus, 2025, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2674362-brazil-saf-industry-set-to-take-off-in-2027.

129 ESG-nieuws, 'Brazilië's $1.1 miljard push voor duurzame vliegtuigbrandstof', *ESG News*, 23 August 2024, https://esgnews.com/nl/Brazili%C3%AB-1-1-miljard-push-voor-duurzame-vliegtuigbrandstof/.

130 The Brazilian Development Bank, 'BNDES Creates Program with an Incentive Rate to Stimulate Reduction of CO2 Emissions in the Fuel Sector', 2021, https://www.bndes.gov.br/SiteBNDES/bndes/bndes_en/conteudos/noticia/BNDES-creates-program-with-an-incentive-rate-to-stimulate-reduction-of-CO2-emissions-in-the-fuel-sector/.

Most importantly, Brazil's SAF industry is based on sugarcane-based ethanol and alcohol-to-jet processes. This aligns with its broader biofuel industry, the second largest in the world, which relies on the same feedstock. Moreover, the Chinese company Envision is investing 1 billion dollar in Brazil to develop SAF from sugarcane.[131] BP is also planning to use existing ethanol processing plants and convert (part of) the operations towards other end products such as SAF.[132]

Next to these conventional SAF projects, Brazil also has potential for e-SAF production from green hydrogen and biogenic carbon, given its large agricultural sector and the waste it produces. This potential has not been leveraged yet given that the cost of producing e-SAF would be significantly higher than that of ethanol-based SAF, which is dominant in the Brazilian market.

From the demand side, Brazilian airline Gol was the first South American country offering customers to offset their carbon emissions via SAF usage, starting in 2024.[133]

Capability gaps: e-SAF production and offtake

Possibly due to its focus on the traditional SAF production from ethanol, there has been less attention for the e-SAF production pathway in Brazil.[134] There is one announced project for e-SAF in Brazil, which is still in its pre-feasibility phase.[135] Just like Canada, Brazil's fundamentals for e-SAF are highly attractive. Brazil is one of the most promising countries for biogenic carbon capture in the world due to its large biomass industry.[136] There is limited domestic interest from consumers for this derivative due to its high prices. Moreover, if Brazil made a shift towards e-SAF mandates or other government support, it would need companies with the required knowledge to execute these projects.

4.6.2. Business environment: With risk premium

Investing in Brazil carries a slightly heightened risk premium compared to the other analysed countries, possibly impacting business continuity, regulatory support and capital costs for Dutch e-SAF businesses. Brazil has the lowest credit score out of all countries examined. Brazil has a relatively high country risk premium of 3.34%, shared with Morocco.

While Brazil does have a large, diverse, and resilient economy, its weak growth potential, poor performance on governance indicators, major budget deficits, high and rising debt, and

131 Sara Aquino, 'Envision to Invest US$1 Billion in Brazil to Produce Sustainable Aviation Fuel (SAF)', *CPG Click Petroleo e Gas*, 12 May 2025, https://en.clickpetroleoegas.com.br/envision-will-invest-us-1-billion-in-brazil-to-produce-sustainable-aviation-fuel-saf-sima00/.

132 'BP Plans Foray into 2G Ethanol, Sustainable Jet Fuel with Brazil Base | Reuters', https://www.reuters.com/sustainability/bp-plans-foray-into-2g-ethanol-sustainable-jet-fuel-with-brazil-base-2024-06-21/.

133 Gabriel Araujo, 'Brazil's Gol, Vibra Complete First SAF "book-and-Claim" in Latin America', Climate & Energy, *Reuters*, 18 June 2024, https://www.reuters.com/sustainability/climate-energy/brazils-gol-vibra-complete-first-saf-book-and-claim-latin-america-2024-06-18/.

134 Carla Aranha, 'Raízen Intends to Produce Sustainable Aviation Fuel in 3 Years', CZ App, 2024, https://www.czapp.com/analyst-insights/raizen-intends-to-produce-sustainable-aviation-fuel-in-3-years/; Roberto Samora and Marcelo Teixeira, 'BP Plans Foray into 2G Ethanol, Sustainable Jet Fuel with Brazil Base', Sustainability, *Reuters*, 21 June 2024, https://www.reuters.com/sustainability/bp-plans-foray-into-2g-ethanol-sustainable-jet-fuel-with-brazil-base-2024-06-21/.

135 Sempen, 'Fueling the Future', Sempen, 2024, https://sempen.com/en.

136 Tjerk Lap et al., 'BECCS as Climate Mitigation Option in a Brazilian Low Carbon Energy System: Estimating Potential and Effect of Gigatonne Scale CO2 Storage', *International Journal of Greenhouse Gas Control* 128 (September 2023): 103945, https://doi.org/10.1016/j.ijggc.2023.103945.

low confidence and prospects for fiscal balancing continue to hold Brazil back. Brazil also holds the lowest score in public institutions. Brazil's struggle to address crime and economic issues, caused by it's generally less effective and adaptable leadership is likely to blame for its overall lower performance. In innovation, Brazil closely trails Saudi Arabia and leads Morocco, performing well on R&D, knowledge absorption and application, and intangible asset output. Brazil closely trails Saudi Arabia and leads Morocco in infrastructure, facing significant difficulties in the efficiency of customs and border clearance.

With regard to climate, Brazil has a moderate vulnerability score and a low readiness score, creating some resiliency challenges. . Compared the other case study countries, Brazil has the lowest climate resiliency, although current vulnerabilities are still manageable.

Due to these factors, Brazil's business environment is classified 'With risk premium'.

4.6.3. **Geopolitical relations with the Netherlands: Good**

The Netherlands and Brazil have good, albeit pragmatic political relations. EU's (and the Dutch) overall influence in Brazil's foreign economic policy should not be overestimated. Brazil tends to prioritise maintaining strategic autonomy by fostering relationships with all major global economic powers, including the United States, China, and India.[137] While the Netherlands and Brazil did sign a defence cooperation agreement in 2011,[138] during Bolsonaro's tenure, Brazil distanced itself from Europe by limiting cooperation on issues like climate change, for example in the Amazon rainforest. Lula's return to power in 2022 improved political and economic ties with Europe, particularly in environmental collaboration. However, Lula's neutral stance on the Russo-Ukraine war illustrates the aforementioned pragmatism in the political realm.

The Netherlands' economic relationship with Brazil is shaped by strategic interests. Brazil is viewed not only as an important economic partner but also as a key ally in addressing climate change and, more recently, in developing the hydrogen industry.[139] A notable example is the Port of Rotterdam, which plays a central role in this emerging collaboration, having recently signed a cooperation agreement on hydrogen with Brazil's Port of Pecém.[140] This special economic connection is further reflected in investment figures: in 2024, the Netherlands was Brazil's largest holder of FDI stock, at 23.2% of the country's total FDI stock.[141]

The experience of substantial commodity trade flows between the Netherlands and Brazil implies that larger volumes of e-SAF trade between the two countries should be possible. The Netherlands and Brazil have a strong trade relation. Trade between the Netherlands and Brazil primarily centres on agricultural and other primary products, with Brazil standing out as

137 Oliver Stuenkel, 'Brazil's Foreign Policy Strategy after the 2022 Elections', *Elcano Royal Institute*, 2022, https://www.realinstitutoelcano.org/en/analyses/brazil-foreign-policy-strategy-after-the-2022-elections/.

138 Kingdom of the Netherlands, 'Agreement between the Kingdom of the Netherlands and the Government of the Federative Republic of Brazil on Cooperation in Defence Related Matters', webpagina, Ministerie van Buitenlandse Zaken, 7 December 2011, https://treatydatabase.overheid.nl/en/Treaty/Details/012589.

139 Kingdom of the Netherlands, 'Energy - Brazil - NAY', Brazil, 2023, https://www.netherlandsandyou.nl/web/brazil/themes/energy-transition.

140 Port of Rotterdam, '#WHS2023: Ports of Rotterdam and Pecém (Brazil) Join Brazilian-Dutch Cooperation', 2023, https://www.portofrotterdam.com/en/news-and-press-releases/ports-of-rotterdam-and-pecem-brazil-join-brazilian-dutch-cooperation.

141 Santander, 'Foreign Investment in Brazil', Santander Trade, 2025, https://santandertrade.com/en/portal/establish-overseas/brazil/foreign-investment.

the largest trading partner of the Netherlands in South America.[142] The EU is working to ratify a free trade agreement with Brazil through the broader Association Agreement negotiations with Mercosur, which also includes Argentina, Uruguay, and Paraguay.[143]

Despite the political pragmatism, economically both countries are aligned. Therefore, the geopolitical relationship between the Netherlands and Brazil is classified as Good.

4.6.4. Conclusion: Opportunities for Dutch industry

The Brazilian government signals commitment to the development of the alternative fuel industry and the decarbonisation of aviation. Due to the biofuel industry's dominant focus on ethanol as feedstock, the emerging SAF projects are likewise focused on ethanol. This poses questions as to whether e-SAF will be able to successfully establish itself in the country. This situation might change if the Brazilian government were to mandate a minimum percentage of e-SAF in the total SAF production, but there are no signs of such legislation being developed and released. The business environment in Brazil has certain risks in terms of public institutions, and efficiency of infrastructure. Furthermore, the relationship between Brazil and the Netherlands is good, but also pragmatic.

For Dutch companies this would mean that in the short term, Brazil could an interesting partner for hydrogen imports, but less so for concrete e-SAF projects. In the longer term, stronger global e-SAF mandates could open up business opportunities in Brazil. Still, the mentioned risk factors should be taken into account when deciding to invest in Brazil or partner up with Brazilian companies.

4.7. Kingdom of Saudi Arabia

4.7.1. Setup of e-SAF sector

National ambitions: Large ambitions on hydrogen, e-SAF sector underdeveloped

The Kingdom of Saudi Arabia (KSA) has large ambitions in the future hydrogen market. This is supported by the $8.4 billion NEOM Green Hydrogen Project, which is nearing completion as of June 2025.[144] The US-based Air Products already has secured a 30-year offtake agreement for the green ammonia produced within the NEOM project.[145] Most of the projects are still mainly geared towards hydrogen and green ammonia production.

142 CBS Statistics Netherlands, 'Netherlands Is EU's Largest Importer of Goods from Mercosur Countries', webpagina, Statistics Netherlands, 28 March 2025, https://www.cbs.nl/en-gb/news/2025/13/netherlands-is-eu-s-largest-importer-of-goods-from-mercosur-countries.

143 European Commission, 'EU-Mercosur Agreement', European Commission, 6 December 2024, https://policy.trade.ec.europa.eu/eu-trade-relationships-country-and-region/countries-and-regions/mercosur/eu-mercosur-agreement_en.

144 Naida Hakirevic Prevljak, 'World's "largest" Green Hydrogen Plant Construction Reaches 80% Completion', *Offshore Energy*, 2 June 2025, https://www.offshore-energy.biz/worlds-largest-green-hydrogen-plant-construction-reaches-80-completion/.

145 NEOM, 'NEOM Green Hydrogen Company Completes Financial Close at a Total Investment Value of USD 8.4 Billion in the World's Largest Carbon-Free Green Hydrogen Plant', NEOM, 2023, https://www.neom.com/en-us/newsroom/neom-green-hydrogen-investment.

The development of (e-)SAF is part of the KSA's 'Vision 2030', a policy document that outlines the strategic vision of the KSA in the near future.[146] This includes both bio-derived SAF and e-SAF. For SAF, Saudi Aramco, French energy company TotalEnergies and the Saudi Investment Recycling Company (SIRC) have announced they are working together to research possibilities of developing SAF production jointly. They are focusing on HEFA, based on used cooking oil and animal fats.[147]

There are also developments in the e-SAF sector. At the end of 2024, the Norwegian company Nordic Electrofuel signed a Memorandum of Understanding (MoU) with the KSA to produce e-SAF in the port of Jubail.[148] This deal was supported by Jump, a financing and consulting platform based in Luxembourg.[149] Still, this project seems to be focused on the domestic/regional market as it does not use biogenic carbon, making it harder to comply with EU RFNBO standards after 2040. It aims to eventually use DAC technologies, which could make it eligible for the European market in the long term as well.[150]

Capability gaps: Biogenic carbon

In the green hydrogen sector, Saudi Arabia does not have notable capability gaps other than a potential for exports to the Netherlands (most likely in the form of ammonia).

E-SAF, and generally RFNBOs, are not a priority for Saudi Arabia due to the lack of biogenic carbon sources within the country. Saudi Arabia could use captured CO_2 emissions from the fossil industry as feedstock for e-SAF, but after 2040 the EU legislation may not consider captured emissions as legitimate sources of e-SAF.[151] This hampers the immediate viability of EU-approved e-SAF. DAC technology is still highly costly, but the levelling of costs in the coming decade would support Saudi Arabia's potential as an RFNBO e-fuel supplier. Furthermore, the only e-SAF project in Saudi Arabia is being led by a Norwegian company, highlighting the potential for foreign companies and their expertise to get involved in e-SAF projects in Saudi Arabia.

4.7.2. Business environment: Good

Saudi Arabia has a strong credit rating, closely trailing France and leading Spain. Low public deficits and government debt drive Saudi Arabia's performance, however, its oil dependence, relatively poor performance on world bank governance indicators, and geopolitical vulnerability constitute significant risks holding it back from higher ratings. Just like France, Saudi Arabia has a slight risk premium of 0.8%.

146 Misha Simonovska, 'The State of SAF in Africa and the Middle East: 2024 Recap', *Fastmarkets*, 9 January 2025, https://www.fastmarkets.com/insights/the-state-of-saf-in-africa-and-the-middle-east-2024-recap/.

147 Fayaz Hussain, 'Aramco, TotalEnergies and SIRC to Explore SAF Production in Saudi Arabia', *SAF Investor*, 2024, https://www.safinvestor.com/news/146547/aramco/.

148 Stefan Krumpelmann, 'Nordic Electrofuel Expands E-SAF Plans to Middle East', 18 December 2024, https://www.argusmedia.com/en/news-and-insights/latest-market-news/2639730-nordic-electrofuel-expands-e-saf-plans-to-middle-east.

149 JUMP, 'JUMP LUX For You', 2025, https://jumpluxforyou.com/.

150 Nordic Electrofuel, 'Making E-SAF in Saudi Arabia – Royal Commission, Nordic Electrofuel and Jump Reach Milestone for Ramp-up of e-Fuel Production', 2024, https://nordicelectrofuel.no/wp-content/uploads/2024/12/20241210-Press-Release-final.pdf.

151 Brook, 'Sustainable Aviation'.

When it comes to public institutions Saudi Arabia trails Spain and leads Morocco. While Saudi Arabia scores well on metrics of governance, regulation, law, and corruption, it is significantly held back by its poor political stability/absence of violence, and especially voice and accountability scores. Saudi Arabia performs relatively poorly in its innovation ecosystem, struggling with knowledge labour, absorption, and output, as well as in non-tangible outputs, leading it to fall significantly behind Spain but ahead of Brazil. In infrastructure Saudi Arabia is behind France and Spain, but slightly ahead of Brazil, while facing similar difficulties in the efficiency of customs and border clearance.

Furthermore, Saudi Arabia is aiming in its 'Vision 2030' to increase 'Saudization', which among other things translates to a requirement to hire a certain percentage of locals in regional business.[152] This does not exclude cooperation with Saudi businesses or the government and should be borne in mind.

In terms of climate Saudi Arabia has a moderate vulnerability score and a high readiness score, making it fairly resilient. Compared to the other case study countries, Saudi Arabia falls between Spain and Morocco.

Saudi Arabia is a relatively stable location for business and thus for possible e-SAF investments, underpinned by strong financial fundamental. Investments in Saudi Arabia should however come with the understanding that its innovation ecosystem and knowledge-based labour markets are still underdeveloped. As a result, the business environment of Saudi Arabia is classified as Good.

4.7.3. **Geopolitical relations with the Netherlands: Good**

Politically, the Netherlands and the KSA have improved relations over the past few years, marked by a visit by then prime minister Mark Rutte in 2024 and the bilateral signing of 27 agreements and MoUs on environmental, water, and agricultural technologies in 2025.[153] However, there is a history of tension between the two states. Back in 2014, Saudi Arabia considered trade sanctions against the Netherlands due to controversial political messaging about Islam from Dutch politician Geert Wilders.[154] In 2016 and 2018, the Netherlands put in place arms embargoes against Saudi Arabia due to their involvement and actions in Yemen.[155]

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152 Sabina Ali, 'The Multi-Dimensional Impact of Saudization', Hudson McKenzie Insights, 2025, https://www.hudsonmckenzie.com/insights/the-multi-dimensional-impact-of-saudization-in-saudi-arabia.

153 ANP, 'The Tweede Kamer Urges Members of the Cabinet Not to Travel to World Cup in Saudi Arabia', NL Times, 16 February 2024, https://nltimes.nl/2024/02/16/tweede-kamer-urges-members-cabinet-travel-world-cup-saudi-arabia; Saudi Gazette, 'Saudi Arabia and Netherlands Sign Agreements with Investments Exceeding SR428 Million', SAUDI ARABIA, *Saudi Gazette*, 12 June 2025, http://www.saudigazette.com.sa/article/652631/SAUDI-ARABIA/Saudi-Arabia-and-Netherlands-sign-agreements-with-investments-exceeding-SR428-million-nbsp; Janet Kanters, 'Saudi Arabia and the Netherlands Sign Agreements on Greenhouse and Agricultural Technologies', *New AG International*, 16 June 2025, http://www.newaginternational.com/agribusiness/saudi-arabia-and-the-netherlands-sign-agreements-to-modernize-agricultural-technologies/.

154 Reuters, 'Netherlands: Saudi Arabia May Curb Trade Ties over Wilders' Anti-Islam Slogans', Energy, *Reuters*, 17 May 2014, https://www.reuters.com/article/business/energy/netherlands-saudi-arabia-may-curb-trade-ties-over-wilders-anti-islam-slogans-idUSL6N0O306S/.

155 Reuters, 'Dutch Parliament Votes to Ban Weapon Exports to Saudi Arabia', World, *Reuters*, 15 March 2016, https://www.reuters.com/article/world/dutch-parliament-votes-to-ban-weapon-exports-to-saudi-arabia-idUSKCN0WH2U3/; EurAsian Times Desk, 'Netherlands Imposes Arms Embargo on Saudi Arabia For Role in Yemen War', *Eurasian Times*, 30 November 2018, https://www.eurasiantimes.com/netherlands-imposes-arms-embargo-on-saudi-arabia-for-role-in-yemen-war/.

These restrictions were later lifted in 2023.[156]In 2022 it was discovered that an Anti-Iran TV channel based in the Netherlands had received funding from the Saudi Arabian intelligence services and was linked to terrorist activities.[157] As such, while the trajectory of Dutch – Saudi Arabian relations is positive, there is a history of tensions that ought be kept in mind.

The Netherlands and Saudi Arabia have an active trade relationship largely centred around oil. Saudi Arabia's top export to the Netherlands is crude oil, while refined oil is the Netherlands' top export to Saudi Arabia.[158] Aside from the oil trade, the Netherlands exports machinery, reactors, boilers, pharmaceutical products, and optical, photo, technical, and medical apparatus.[159] While Saudi Arabian exports are still dominated by crude oil, it also exports various commodities, organic chemicals, and aluminium to the Netherlands.[160] Aside from general trade practices, the Netherlands has signed an MoU with Saudi Arabia on energy cooperation, including on renewable energy, clean hydrogen, and supply chain development.[161] At the EU level, there is a strategic partnership with Saudi Arabia, and in 2024 the European Commission held exploratory energy transition talks with Saudi Arabia.[162]

Despite a complex history, the geopolitical relationship between the Netherlands and Saudi Arabia is good and improving.

4.7.4. Conclusion: Opportunities for Dutch industry

Saudi Arabia is mostly focused on green hydrogen and green ammonia. For Dutch companies, this means that the most direct business opportunities are located in the supply chain before e-methanol, such as hydrogen production and transport. The e-SAF industry in Saudi Arabia, by way of the project in Jubail, might still see significant growth if the government prioritises this specific technology. Given that the Saudi Arabia Vision 2030 explicitly mentions SAF as a policy priority, Dutch companies might find a willing partner in businesses in Saudi Arabia.

Saudi Arabia scores moderately good on the business environment indicators. However, the geopolitical relation with the Netherlands has shown signs of tensions in the past years, something to keep into account. Overall, the Kingdom of Saudi Arabia could be an important partner for Dutch e-SAF businesses, but this will most likely be through channels of hydrogen or ammonia imports in the short term. If DAC is implemented in the longer term, this could still make KSA an attractive location for the production of e-methanol and e-SAF.

156 Reuters, 'Dutch Government Lifts Curbs on Arms Deliveries to Turkey, Saudi Arabia, UAE', Europe, *Reuters*, 21 July 2023, https://www.reuters.com/world/europe/dutch-government-lifts-curbs-arms-deliveries-turkey-saudi-arabia-uae-2023-07-21/.

157 NL Times, *Saudi Arabia Backed Anti-Iran TV Channel in Netherlands Tied to Terror Convictions: Report*, 9 February 2022, https://nltimes.nl/2022/02/09/saudi-arabia-backed-anti-iran-tv-channel-netherlands-tied-terror-convictions-report.

158 The Observatory of Economic Complexity, 'Saudi Arabia (SAU) and Netherlands (NLD) Trade', The Observatory of Economic Complexity, 2025, https://oec.world/en/profile/bilateral-country/sau/partner/nld.

159 Trading Economics, 'Netherlands Exports to Saudi Arabia', 2025, https://tradingeconomics.com/netherlands/exports/saudi-arabia.

160 Trading Economics, 'Saudi Arabia Exports to Netherlands', 2025, https://tradingeconomics.com/saudi-arabia/exports/netherlands.

161 Government of the Netherlands, 'Memorandum of Understanding between the Kingdom of Saudi Arabia and Netherlands', Ministerie van Algemene Zaken, 11 May 2023, https://www.rijksoverheid.nl/documenten/convenanten/2023/05/11/memorandum-of-understanding-between-the-kingdom-of-saudi-arabia-and-the-netherlands.

162 European Commission, 'GCC: EU Unveils Strategic Partnership with the Gulf', 2022, https://ec.europa.eu/commission/presscorner/detail/en/ip_22_3165; European Commission, 'Commission and Saudi Arabia Discuss Energy Transition', 2024, https://ec.europa.eu/commission/presscorner/detail/en/read_24_2341.

5. Conclusions and recommendations

This report investigated the opportunities that Dutch industry could have to get involved in the e-SAF supply chain in seven countries: France, Spain, Sweden, Canada, Morocco, Brazil and KSA.

As of 2025, the e-SAF market remains underdeveloped compared to bio-based fuels, though rapid growth is expected toward 2030–2035 in response to tightening EU regulations. To meet the mandated supply requirements by 2030, projects must reach Final Investment Decision (FID) imminently to allow time for construction and ramp-up. However, none of the 40 currently announced large-scale e-SAF projects have reached FID, posing a serious risk to the fulfilment of both EU-wide and national decarbonisation targets.[163]

The Netherlands is well positioned in this emerging landscape, with strong capabilities on both the demand side, as a major energy hub and jet fuel consumer; and the supply side, through both production and import infrastructure.

Within the EU, countries are advancing quickly due to regulatory pressure, while non-EU countries still lack clear mandates for e-fuels or e-SAF. Given the immaturity of the global e-SAF market, companies are highly selective, choosing to invest only in locations that offer favourable conditions—such as abundant green hydrogen, low energy costs, reliable carbon infrastructure, and strong connectivity to the EU market. Moreover, notable capabilities like trade and certification have not been identified in any of the countries given that the industry itself is still in an early stage, bringing opportunities for Dutch companies to be early movers and support projects when reaching final investment decisions.

Based on this, seven recommendations have been developed for the Dutch government and industry. Given the importance of regulation in the emerging e-SAF supply chain, governmental support is recommended in opening avenues for collaboration and supporting relationship development.

Country-based recommendations

1. **Set up the e-SAF supply chain within the European Union**

   The adoption of e-SAF is driven by EU regulations, which are unique in the world. This means that there is no higher urgency for this market to emerge than in EU countries. On the flip side, it also means that non-EU countries have little incentive to step into the new market if even projects in the EU struggle to reach Final Investment Decision (FID).

[163] Transport & Environment, 'Spotlight on E-SAF', T&E, 2025, https://www.transportenvironment.org/topics/planes/saf-observatory/spotlight-on-e-kerosene.

Therefore, the e-SAF supply chain should be built first in the EU. Sweden, Spain and France are promising candidates for collaboration with the Netherlands.

1.1. **Prioritise collaboration with Sweden and Spain to develop concrete project collaboration plans.** These relatively mature and regulatory aligned markets offer opportunities along the supply chain. In the collaboration with Spain, the focus should be placed on the import of green hydrogen and/or e-methanol to the Netherlands, where it would be converted into e-SAF. In Sweden the business case is very strong for a full production site that can deliver e-SAF as an end product to the Dutch market. As both Sweden and Spain can benefit from a larger demand centre, collaborating with the Netherlands as the energy hub of Northwestern Europe would also open up more markets, in addition to the Dutch one.

1.2. **Exchange ideas and facilitate interaction with French counterparts and develop collaborative ideas for export to the Netherlands.** France has the highest number of announced e-SAF projects out of the analysed countries. Capabilities along the e-SAF supply chain are present and much of the domestic market will be fulfilled through announced projects, but alternative new projects for export may be explored, with Dutch companies potentially being able to play a role.

2. **Work with Canadian counterparts on an import corridor**

The Dutch government, companies and research institutes should seek collaboration with Canadian counterparts in knowledge exchange and to explore what a Canadian-Dutch e-SAF corridor could look like. Canada has a rich R&D sector in e-SAF, from research, to testing centres and new technologies developed by start-ups. This brings opportunities for Dutch research institutes to deepen R&D collaboration with Canadian actors. At the same time, Canada's e-SAF sector is relatively underdeveloped despite highly attractive production conditions – renewable energy, low prices, abundant biogenic carbon, growing green hydrogen sector. As Canada does not have e-SAF mandates, a facility in Canada would rely on a European customer in the first instance. Alignment on regulation, mandates and certification between Canada and the EU would make it easier for Dutch industry to invest in e-SAF in Canada. In this context, opportunities should be explored about what a Canadian-Dutch e-SAF corridor could look like.

3. **Align regulation, standards and certification schemes with Brazil and Morocco**

The Dutch government should engage with Brazil and Morocco as high potential partners to find mutually beneficial collaboration pathways even if immediate opportunities may be limited. Brazil and Morocco are attractive markets that may require further governmental and market-based exchanges to create concrete collaboration options for the production of e-methanol and/or e-SAF. In both countries, domestic capabilities for green hydrogen are growing, making them potential partners for the import of green hydrogen to the Netherlands. At the same time, it gives opportunities for Dutch companies to step into the two markets to produce e-methanol or e-SAF. There are opportunities for Dutch companies to step in, though the regulatory frameworks, domestic priorities and certification may require some further alignment due to the complex business environment, country risk and climate resilience.

4. **In the short term, engage with KSA on green hydrogen, not necessarily e-SAF**

   The Dutch government should focus on cooperation on green hydrogen with the KSA given the country's lack of domestic focus on producing e-fuels for the European market. Saudi Arabia is a strong player in the emerging green hydrogen market, but so far it does not have concrete plans or ambitions to serve the EU e-SAF market. The existing e-SAF projects are being built for other consumers. As such, Dutch companies should look at Saudi Arabia for the first part of the e-SAF supply chain, notably the production of green hydrogen. In the long term, the price levelling for Direct Air Capture (DAC) may bring opportunities for Saudi Arabia, but today it remains the most expensive type of e-SAF to produce.

Recommendations applicable to all countries

5. **Work on streamlining regulations along the e-SAF supply chains with non-EU countries and multilateral certification institutions.**

   As the regulatory drive is pivotal to the e-SAF market development and the EU regulations are the strictest and most detailed in the world, alignment on regulations and certification with other countries can be of significant help for Dutch companies. The more countries that adopt domestic targets, the more 'de-risked' the investments in those markets, given the diversification of possible offtake agreements. Moreover, the Dutch government and the EU should push for the methanol-to-jet production pathway to be certified internationally (e.g., ASTM) to increase business certainty in this emerging market.

6. **Act as a 'match maker' between Dutch companies and potential partners already operating in the country of interest**.

   In most contexts, Dutch companies would have to identify partners active in a part of the supply chain in a country. In order to accelerate relationship building, organising trade missions and match making events would be beneficial, especially in countries outside of the EU with different regulatory frameworks and complex business environments.

7. **Promote cross-border R&D collaboration, learning collaboration and start-up to scale-up support for companies.**

   Knowledge sharing between countries, for example by countries like France that have progressed further in project planning, can help accelerate e-SAF development and contribute to a faster maturing of the e-SAF market globally. It is also a first step toward the concrete development and scaling of joint projects. Platforms like *GroenvermogenNL* that aim at the expansion of the green hydrogen market in the Netherlands and *Luchtvaart in transitie,* focused on the decarbonization of the aviation sector, could take the lead on the Dutch side. This can be paired with subsidy programmes under development at the Ministry of Infrastructure and Water Management for the production of e-SAF in the Netherlands. These will be accessible in 2026 for pre-FID and capital expenditure (CAPEX).

Annex 1. Overview of e-SAF projects in the seven countries

Country	Project	Production Capacity (kt/year)	Expected Finalisation
France	Le Havre Engie 'kerEAUzen' [1]	70	2028
France	Verso Rouen [1] [2]	81	2029
France	Hynovera Hy2gen [1]	32	2029
France	H2V Fos-sur-Mer [1] [2] [3]	80-100	2029
France	Elyse Fos-sur-Mer [1] [2]	50-100	2030
France	ReUze Engie Infinium [1] [2] [3]	75	2030
France	Saint-Nazaire 'Take Kair' [1] [2] [3]	37.5	2030
France	Verso Limousin [1] [2] [3]	81-150	2030
France	MGH Occitanie [1] [2]	35	2031
France	H2V Dunkirk [1] [2]	75-100	2032
France	Verso Chavelor 'Ep'Hyne' [1] [2]	81	2030s
France	Verso Tartas 'RYAM' [1] [2]	81	2030s
France	HyLann Project (Suspended) [1] [2]	70	Unknown
Spain	Enegas Pilot [1] [2]	1.2	2026
Spain	Synhelion Mostoles [1] [2]	0.3	2027
Spain	Greenalia P2X Breogan [1] [2] [3]	15 (75:25 assumed)	2027
Spain	Enegas Industrial [1] [2]	12	2029
Spain	Solarig Teruel [1] [2] [3]	14	2031
Spain	Ignis P2X Villaluenga Sagra [1] [2]	100	2031
Spain	Solarig Garray [1] [2] [3]	9	2033
Spain	RIC energy (3 projects) [1] [2] [3]	60-150	Unknown
Sweden	Biorefinery Östrand [1] [2]	92.5-120	2029
Sweden	SkyNRG x Skellefteå Kraft [1]	100	2030
Sweden	RES Alby [1] [2]	60.6	2032
Brazil	HIF Port of Açu (e-methanol) [1]	800	Unknown
Brazil	Project Grosso [1]	45	Unknown
Saudi Arabia	HIDC [1] [2] (synthetic methanol)	4380	2027
Saudi Arabia	Jubail [1]	300	2029
Morocco	MGH Project Janassim [1] [2] [3]	75-500	2030
Morocco	Synhelion [1] [2]	25	Unknown
Canada	ParaChem industrial pilot [1] [2]	< 0.5	2021
Canada	Merritt [1]	103	Unknown
Canada	Dimensional Energy x Boeing [1]	151.416	Unknown

Note that this table is based on open source information including official information about these projects. At the time of writing, none of these projects have reached a Final Investment Decision, meaning that the information is still subject to change. Moreover, if a project is announced as e-SAF, it is included in the table. This does not mean that every project is RFNBO compliant.

Annex 2. **Business environment indicators**

Ranking of each country on business indicators

Ranking Overview	Sweden	Canada	France	Spain	Saudi Arabia	Brazil	Morocco
Sovereign Credit Ratings	1st	2nd	3rd	5th	4th	7th	6th
Public Institutions	1st	2nd	3rd	4th	5th	7th	6th
Innovation	1st	3rd	2nd	4th	5th	6th	7th
Infrastructure	1st	1st	3rd	3rd	5th	6th	7th
Climate Resilience	1st	2nd	3rd	4th	5th	6th	7th
Country Risk Premium	1st	1st	3rd	5th	3rd	6th	6th
Ordinal Rank	1st	2nd	3rd	5th	4th	6th	7th

Sovereign Credit Ratings

Sovereigns Ratings List (2025)	Spain	Sweden	France	Canada	Brazil	Morocco	Saudi Arabia
Moody's	Baa1	Aaa	Aa3	Aaa	Ba1	Ba1	Aa3
SP	A	AAA	AA-	AAA	BB	BB+	A+
Fitch	A-	AAA	AA-	AA+	BB-	BB+	A+
Quantified Average (0-100)	70.00	100.00	85.00	98.33	45.00	50.00	81.67

Sovereign Credit Ratings scoring index

Moody's	SP	Fitch	NumRank
Aaa	AAA	AAA	100.00
Aa1	AA+	AA+	95.00
Aa2	AA	AA	90.00
Aa3	AA-	AA-	85.00
A1	A+	A+	80.00
A2	A	A	75.00
A3	A-	A-	70.00
Baa1	BBB+	BBB+	65.00
Baa2	BBB	BBB	60.00
Baa3	BBB-	BBB-	55.00
Ba1	BB+	BB+	50.00
Ba2	BB	BB	45.00
Ba3	BB-	BB-	40.00
B1	B+	B+	35.00
B2	B	B	30.00
B3	B-	B-	25.00
Caa1	CCC+	CCC+	20.00
Caa2	CCC	CCC	15.00
Caa3	CCC-	CCC-	10.00
Ca	CC	CC	5.00
	C	C	5.00
C	D	D	0.00

Indicators for Public Institutions

Worldwide Governance Indicators (2023)	Spain	Sweden	France	Canada	Brazil	Morocco	Saudi Arabia
Voice and accountability	87.75%	97.06%	86.76%	95.10%	59.80%	34.31%	8.82%
Political stability and absence of violence/ terrorism	54.98%	73.46%	55.92%	76.30%	28.44%	29.86%	39.81%
Government effectiveness	76.89%	94.81%	83.02%	91.98%	32.08%	50.00%	78.77%
Regulatory quality	74.53%	95.28%	85.38%	94.81%	40.09%	50.94%	68.87%
Rule of law	78.30%	93.40%	84.91%	90.09%	41.98%	48.58%	62.74%
Control of corruption	71.70%	97.64%	83.96%	94.81%	34.43%	33.02%	66.51%
Average	74.03%	91.94%	79.99%	90.52%	39.47%	41.12%	54.25%

Indicators for Innovation

Global Innovation Index (2024)	Spain	Sweden	France	Canada	Brazil	Morocco	Saudi Arabia
Institutions	56.2	76.3	67.5	78.2	31.8	43.5	64.9
Human capital and research	47.3	62.7	54.4	58.4	33.9	26.7	43.4
Infrastructure	56.3	67.2	54.9	54.7	45.5	33.9	46.1
Market sophistication	44.8	61.3	60.9	67.2	38.2	27.5	48.7
Business sophistication	41.8	74.1	55.5	56.8	36.2	14.2	23.7
Knowledge and technology outputs	36.4	63.7	43.6	41.4	24.5	20.5	20.6
Creative outputs	44.8	57.8	60.8	44.1	32.3	36.4	24.4
Average Score	44.9	64.5	55.4	52.9	32.7	28.8	33.9
Rank (out of 133)	28	2	12	14	50	66	47

Indicators for Infrastructure

Connecting to Compete (2023)	Spain	Sweden	France	Canada	Brazil	Morocco (2018)	Saudi Arabia
Customs Score	3.6	4	3.7	4	2.9	2.3	3
Infrastructure Score	3.8	4.2	3.8	4.3	3.2	2.4	3.6
International Shipments Score	3.7	3.4	3.7	3.6	2.9	2.6	3.3
Logistics Quality and Competence Score	3.9	4.2	3.8	4.2	3.3	2.5	3.3
Timeliness Score	4.2	4.2	4.1	4.1	3.5	2.9	3.6
Tracking and Tracing Score	4.1	4.1	4	4.1	3.2	2.5	3.5
Logistics Performance Index (Overall Score)	3.9	4	3.9	4	3.2	2.54	3.4
Logistics Performance Index (Rank out of 139)	13	7	13	7	51	109	38

Indicators for Climate Resilience

ND-Gain Index (2023)	Spain	Sweden	France	Canada	Brazil	Morocco	Saudi Arabia
Score	60.1	71.1	67.2	68.5	47.2	50.7	57.9

Indicators for Country Risk Premium

NYU Economic Data (2025)	Spain	Sweden	France	Canada	Brazil	Morocco	Saudi Arabia
Country Risk Premium	2.13%	0.00%	0.80%	0.00%	3.34%	3.34%	0.80%

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