



Shaping Europe's eSAF industry in Rotterdam

A socio-economic impact analysis for the
production and supply of eSAF by eFuels
Rotterdam



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Power2X | Rotterdam, June 2026

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Project: 1007876

This research was commissioned by Power2X and executed by Ecorys.
Power2X provided technical input and contextual expertise to support the analysis.

“

Synthetic fuels from eFuels Rotterdam are precisely the kind of innovations I advocated for in my report. This is an investment that will make the Netherlands more relevant, more sustainable, and more competitive, while positioning us to play a key role in the aviation industry of tomorrow.

Peter Wennink
Independent government advisor,
former CEO ASML

”

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Shaping Europe's eSAF Industry in Rotterdam

Economic and societal impact of eFuels Rotterdam (eFR)

The EU's 2030 eSAF mandate is approaching, but without timely investment decisions, Europe risks importing the fuel it could be producing. The Netherlands is well positioned to lead with the refining base, port infrastructure and chemical cluster needed to anchor the value chain. This Ecorys study examines the economic, climate and strategic impact of the multi-billion eFuels Rotterdam project, set to become one of Europe's largest eSAF facilities.



~€1.3B

Annual contribution to Dutch GDP

includes direct, indirect and induced value



Up to 6,400FTE

Recurring jobs supported

includes direct, indirect and induced jobs



~11,000FTE

Initial construction jobs supported

includes direct and indirect jobs



~550-750k

tonnes CO₂ avoided per year

realising societal benefits of ~€200 million in 2030, ramping up to ~€600 million in 2050



~2GW

Reduced grid pressure

Equal to a third of offshore wind project IJmuiden Ver



Supports eSAF mandate compliance

eFuels Rotterdam can deliver a significant percentage of the EU's mandated volume in the early phase of mandates (2030 - 2032) and the vast majority of the Dutch mandated volumes until 2039



Anchors chemical cluster in Rotterdam

First step in creating a domestic (renewable) methanol hub in the Port of Rotterdam, contributing to the retention of chemical cluster



Strengthens energy security

Reduces long-term reliance on imported kerosene through diversification of supply and domestic production assets

~750 kton Methanol per year

Renewable Methanol

eFuels Rotterdam

~250 kton eSAF per year

European Aviation sector

Schiphol



Increases innovation and competitiveness

Stimulates the development of a synthetic fuel cluster in Rotterdam, and strengthens investor confidence through scale, learning and replication effects



Provides access to low cost global and European methanol

Through diversified sourcing of renewable methanol from locations with advantaged power prices, eFuels Rotterdam avoids competing with scarce Dutch grid capacity for electrification of homes, industry, and mobility

Foreword

The Netherlands faces major economic and geopolitical challenges. The energy transition, international competition and growing strategic dependencies directly affect our prosperity and industrial base.

Entrepreneurship is crucial, especially now. Businesses drive innovation, growth and employment, while providing solutions to societal challenges. However, this requires the right conditions: a strong investment climate, reliable infrastructure and clear public policy choices.

Our economy depends on strong ecosystems in which businesses, research institutions, infrastructure providers and government reinforce one another. Brainport Eindhoven demonstrates what targeted collaboration can achieve. The same is true, at least to the same extent, of Rotterdam. For decades, the port has been a major energy, refining, chemicals and logistics hub for both the Netherlands and Europe. This position is well established, but it must be renewed for the economy of tomorrow, centred on clean molecules, sustainable carbon, synthetic fuels and high-value industrial supply chains.

The eFuels Rotterdam project, developed by Power2X, is a concrete example of this. With an investment of more than €2 billion and planned annual production of approximately 250,000 tonnes of eSAF, the project demonstrates how Rotterdam can build on its existing strengths to produce the aviation fuels and molecules of the future. It will create opportunities for suppliers, maintenance companies, engineers, logistics providers and the wider petrochemical industry in the port.

Renewable methanol plays a key role in this process. It connects renewable energy, carbon, chemicals and fuels, enabling high-value products such as eSAF to be produced in Rotterdam. This makes eSAF important not only for decarbonising aviation, but also as a first tangible market for a broader value chain of sustainable molecules.

This report by Ecorys examines what the eFuels Rotterdam project, developed by Power2X, could mean for the Dutch economy and employment. Rotterdam has everything it needs to lead the clean-molecules economy. That is something to be proud of. However, this position cannot be taken for granted. We must now follow through. What we fail to build today, we will not only have to import in the future. We will also allow value, jobs and industrial strength to be created elsewhere.



Coen van Oostrom
VNO-NCW - President



Executive Summary

The Netherlands has built its industrial prosperity on fossil molecules, from the refining clusters of Rotterdam to the petrochemical industry that supports European value chains. As the energy transition accelerates, the next generation of industrial activity will be built on clean molecules: renewable fuels, green hydrogen, and synthetic feedstocks.

The Netherlands is well positioned for this transition. With its port infrastructure, established refining expertise, and extensive logistics networks, the Port of Rotterdam is emerging as an anchor for Europe's clean molecule economy.

This transition is not limited to fuels: it also creates pathways for the existing petrochemical cluster to move from fossil feedstocks towards renewable carbon, including methanol-based routes into olefins, synthetic fuels and chemical intermediates.

Aviation is one of the sectors where this opportunity is most visible and most immediate. As part of the EU's Fit for 55 package, which translates climate ambitions into legally binding emissions reduction targets across sectors, the ReFuelEU Aviation regulation requires fuel suppliers and airlines to gradually increase the use of Sustainable Aviation Fuels (SAF), including a dedicated mandate for synthetic eSAF. These requirements take effect from 2030 and increase over time. Meeting them will require large-scale production capacity. The Netherlands has the infrastructure, industrial base, and expertise needed to help meet these targets and

build the new value chains that support them.

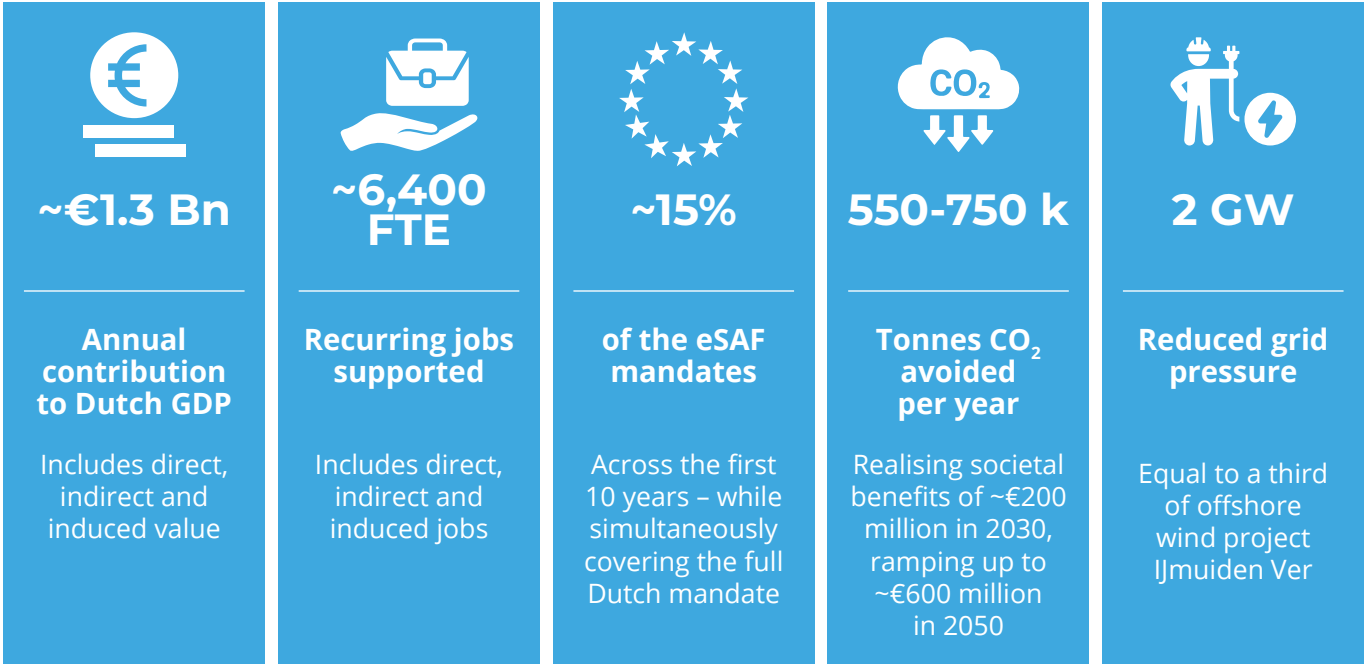
The Netherlands and Europe face growing energy security challenges. Europe remains heavily dependent on imported jet fuel and imported crude oil. Around one-third of jet fuel is imported directly, while much of the remaining supply is refined domestically from imported crude. European refining capacity is under pressure and is expected to decline further over time¹.

Against a backdrop of geopolitical tensions, including the war in Ukraine, instability in the Middle East, and shifting US trade policy, dependence on imported fossil fuels creates an increasing strategic vulnerability. Expanding domestic eSAF production will help diversify fuel supply, strengthen resilience, and improve long-term energy security.

Securing early eSAF investment in the Netherlands supports energy transition and climate objectives, as well as broader economic and strategic industrial goals. It will generate GDP and employment, anchor knowledge-intensive activity in Dutch industrial clusters, and strengthen domestic fuel supply.

This study assesses the socio-economic impact of Power2X's eFuels Rotterdam (eFR) project, a planned facility in the Port of Rotterdam that will convert imported renewable methanol into approximately **250 kt of eSAF per year**. With investment over **€2 billion**, eFR is currently one of the largest planned eSAF production facilities in Europe.

Figure 1 Socio-economic impact in key figures



1 Wood Mackenzie (2024): [Assessing refineries at risk of closing](#)

What eFuels Rotterdam Delivers

Figure 1 illustrates that eFR is an economic and energy system asset for both the Netherlands and the Port of Rotterdam, while supporting energy transition and climate objectives.

Why eFR matters

- Contributes to the Dutch economy:** eFR will contribute approximately €1.3 billion annually to Dutch GDP, encompassing direct, indirect, and induced economic value.
- Supports jobs in the Netherlands:** The project supports up to 6,400 jobs, in addition to approximately 11,000 construction-related Full-Time Equivalent (FTE)-years during the realisation phase.
- Supports compliance with eSAF mandates:** Over the first ten years of the ReFuelEU mandate (through 2039), eFuels Rotterdam is capable of supplying an average of ~15% of the mandated European eSAF demand, while covering the roughly Dutch mandate obligation until 2039.
- Anchors the Rotterdam chemicals cluster:** The project represents a first step towards establishing a domestic renewable methanol hub in the Port of Rotterdam, helping to attract a new wave of chemical sector investment.
- Strengthens energy security:** eFR will reduce long-term reliance on imported kerosene by diversifying supply sources and expanding domestic production capacity.
- Provides access to competitively sourced renewable methanol:** By sourcing renewable methanol from regions with cost-competitive renewable power in the early phase, eFR avoids competing for scarce Dutch grid capacity needed for the electrification of homes, industry, and mobility. Producing equivalent upstream volumes domestically would require around 2 GW of additional renewable electricity capacity, alongside CO₂ sourcing, grid infrastructure, system balancing, land use and permitting. Imports therefore provide a bridge while Dutch and EU renewable methanol production scale over time.

- Increases innovation and competitiveness:** The project will stimulate the development of a synthetic fuels cluster in Rotterdam and strengthen investor confidence through scale, learning effects, and future replication. It will also create demand for a broad ecosystem of contractors, suppliers and service providers, helping to retain and renew the industrial capabilities that underpin the Port of Rotterdam's long-term competitiveness.

Background

Climate change remains a defining global challenge, increasingly intertwined with energy security and economic resilience. The Dutch government and the European Commission have committed to ambitious climate targets. The scale-up of Sustainable Aviation Fuels (SAF), and particularly synthetic Sustainable Aviation Fuels (eSAF), will be crucial for decarbonising the aviation sector. European regulations such as ReFuelEU Aviation, part of the Fit for 55 package, mandate a gradual increase in the use of SAF in aviation. This creates both challenges and opportunities for the Netherlands. Dutch climate and aviation policies emphasise the need to increase the use of SAF, including eSAF, towards 2030 and beyond. The National SAF Roadmap (2025–2035) and related policy documents outline an ambitious pathway focused on expanding production capacity and fostering innovation across the entire eSAF value chain.

Beyond emissions reduction, the Netherlands also possesses strategic industrial capabilities, including a strong refining sector. As Europe's energy gateway, Rotterdam has a refining capacity of 1.3 million barrels per day and favourable logistics infrastructure. More than 1,500 km of pipelines connect the Port of Rotterdam to the European mainland, while the Rhine waterway is the Netherlands' second-largest export route². Currently, 95% of Europe's jet fuel depends on imports. Of this, roughly one-third is imported directly, while two-thirds is produced domestically using imported crude oil³. This dependence leaves Europe vulnerable to geopolitical conflict and market disruption. The 2026 Middle East conflict triggered the most severe oil supply disruption on record, exposing the structural risks associated with Europe's dependence on imported energy. The combined effects of the closure of the Strait of Hormuz and targeted strikes on Gulf production and export infrastructure drove global oil prices sharply higher. Europe's ability to secure alternative supplies was further constrained by competing global demand, as redirected shipments were absorbed by Asian markets facing acute shortfalls of their own.

2 HCSS (2026): [No fuel no fight](#)

3 T&E (2026): [eSAF made in Europe – A source of jobs, growth and energy security](#)

The economic dimension of this transition is equally pressing for Rotterdam and the Netherlands. In 2025, the Port of Rotterdam contributed €29.6 billion, approximately 2.9%, of Dutch GDP, and supported nearly 200,000 direct and indirect jobs⁴. This economic significance rests heavily on the port's role as Europe's energy and industrial gateway, a position now under structural pressure as refining capacity declines and the chemical industry contracts. This pressure reflects a combination of structurally high European energy costs, weaker refining margins and tightening environmental decarbonisation requirements that raise the cost of operating older European assets. Across Europe, chemical plant closures have increased sixfold since 2022, representing approximately 9% of European production capacity and the direct loss of 20,000 jobs⁵. Preserving and renewing this industrial base requires attracting the next generation of energy investments to Rotterdam, including clean molecules, synthetic fuels, and the associated value chains. Whether this happens will depend on the investment climate.

Across both Europe and the Netherlands, the industrial investment climate is under growing pressure from a combination of structural barriers. These include

comparatively high energy prices, which encourage strategic industries to relocate elsewhere, electricity grid congestion that delays new connections, and slow or inconsistent licensing and regulatory processes⁶. As a result, many industrial companies are postponing or cancelling investment decisions, or relocating activities outside the Netherlands and Europe⁸.

When industrial companies delay or relocate investments, this disrupts the broader industrial ecosystem in which they operate. Such decisions weaken upstream and downstream value chains, as suppliers, service providers, and dependent sectors face reduced demand, constrained supply, and heightened uncertainty. Conversely, attracting investment generates economic value through increased gross domestic product (GDP) and employment. In doing so, it stimulates broader economic development while strengthening the knowledge position of both the Netherlands and Europe.

eFuels Rotterdam – Power2X

Power2X is developing the eFuels Rotterdam (eFR) project (see Figure 2), one of the largest planned eSAF production facilities in Europe, located in the Port of

Rotterdam. eFR is designed as a large-scale conversion and distribution hub, connecting global renewable methanol supply with European fuel synthesis and aviation markets. This approach enables industrial-scale deployment while maintaining flexibility in feedstock sourcing and integration with existing infrastructure.

As a result, the project is not reliant on a single co-located upstream production configuration, such as a fully integrated site where renewable power generation, electrolysis, CO₂ capture, and fuel synthesis are all developed at one location. Once operational, eFR is expected to produce approximately 250,000 tonnes of eSAF annually. At this scale, the facility's output would be equivalent to approximately 15% of the

cumulative EU eSAF mandate during the first decade of implementation, representing a higher share in the early years and a lower share as mandate requirements increase over time. Put simply, the facility could supply the entire Dutch mandated eSAF demand through 2039.

The project is being developed in partnership with Advio and Honeywell UOP. The eFuels Rotterdam project is currently one of the largest eSAF facilities under development in Europe⁹. The facility will connect to existing jet fuel logistics and distribution infrastructure, including a connection to the Central Europe Pipeline System (CEPS)¹⁰, enabling the delivery of blended eSAF to major civil airports across Europe.

Figure 2 Impression of eFR facility



Scope of this study

Assess the socio-economic impact of the eFR Power2X facility and demonstrate its value in the context of the strategic positioning of both the Netherlands and the European Union, including its wider system effects.

To describe the socio-economic impact of eFR, this study distinguishes between several economic impacts and spillover effects. These impacts form a layered structure in which both the geographical origin and the directness of value creation gradually shift. The impacts range from immediate, on-site economic value creation to broader national spillovers that materialise over time and across multiple domains.

- **Direct impact:** The direct impact forms the foundational layer. These are the monetised economic contributions that stem directly from eFR's activities at the project site. They include value added generated within the Netherlands, including taxes paid, employment at eFR, exports generated, and capital investments (CapEx).
- **Indirect impact:** A second layer of impact arises from eFR's relationships with Dutch suppliers. These are the monetised economic contributions generated through the supply chain. Because eFR procures materials, services, and technologies from companies in the Netherlands, these suppliers experience increased demand and corresponding value creation.

- **Induced impact:** A third layer of impact is generated through employee spending. These are the monetised economic contributions arising from the broader consumption effects of eFR employees. Staff working at eFR spend their income on housing, energy, retail, hospitality, recreation, and other goods and services across the economy.
- **Spillover effects:** The broadest and longest-term layer consists of spillover effects. These are contributions that are not directly monetised, but which generate significant societal value. Such effects may include accelerating innovation, strengthening strategic autonomy, and contributing to emissions reduction, thereby supporting the transition towards a more resilient and sustainable economy.

Reading guide

Chapter 1 describes the methodology used to assess the socio-economic impact of eFR. Chapters 2 and 3 present the outcomes of the study, covering the monetised economic impact and the broader societal impact of eFR respectively.

4 OECD (2025) :[OECD Economic Surveys: Netherlands 2025](#)

5 Cefic (2026): [European Chemical Closures & Investments Radar 2022-2025](#)

6 Wennink (2025) [The Route to future prosperity: A strong Netherlands in a relevant Europe](#)

7 EY (2025) [Het Nederlandse investeringsklimaat staat onder druk](#)

8 E.g. Shell and BP halted the construction of their planned biofuels plants in Rotterdam. Shell (2025). [Shell will not restart construction of Rotterdam biofuels plant](#) & Reuters (2025). [BP abandons plans to build Rotterdam biofuels plant](#).

9 T&E (2026) [Spotlight on eSAF: eSAF projects around the world](#)

10 Central European Pipeline System [CEPS](#)



01

Methodology

This study applies a two-step methodology to assess the socio-economic impact of eFR. The first step consists of an economic impact analysis used to quantify the direct, indirect and induced economic impacts of eFR on the Dutch economy. The second step consists of a spillover analysis examining the broader societal impacts of eFR on sustainability, energy security and competitiveness.

This chapter first provides an overview of the methodologies applied, their limitations, and their implications for the results.

1.1 Economic impact analysis

An important dimension of a business's impact is its contribution to the economy. Economic impact analysis aims to quantify how a business contributes to economic activity. As outlined in the introduction, the analysis distinguishes between three types of impact:

- **Direct impact:** A business generates economic value because it sells products or services that customers value.
- **Indirect impact:** A business also enables suppliers to generate economic value by purchasing goods and services from them, thereby supporting continued economic activity within the supply chain.
- **Induced impact:** A business additionally enables employees to purchase goods and services required by their households. This supports economic activity among businesses providing consumer goods and services.

A business also enables governments to provide public goods and services through the payment of taxes. However, this economic value is typically attributed to government rather than to the business itself.

The economic impact of a business or industry is always defined relative to a geographical area. This may be a region within a country, such as Scotland in the UK, a country itself, the European Union, or even the global economy. Generally, the larger the geographical scope, the larger the estimated economic impact.

However, broader geographic scopes may also reduce the relevance of the findings for more localised stakeholders. In this study, the economic impact of the eFR facility is assessed for the Netherlands.

The strength of a country's economy is commonly measured using gross domestic product (GDP). GDP can be calculated as the difference between national output and the cost of imports. National output is defined as the total sales of all final goods and services. GDP can also be calculated as the sum of all value added generated by domestic businesses. In this context, value added refers to the difference between the sales value of goods and services and the cost of purchased inputs.

Accordingly, while business sales contribute to national output, value added contributes directly to GDP. In addition, businesses redistribute revenues through wages paid to employees. The economic analysis in this study therefore focuses on eFR's contribution to GDP and employment, including direct, indirect and induced effects.

Because eFR is not yet operational, its future economic impact must be estimated. The direct contribution of eFR is based on a combination of confidential financial data and literature relating to the costs and impacts of comparable facilities. The actual economic impact of eFR will depend on future market conditions and prices. Therefore, this study presents several scenarios based on different assumptions regarding the economic impact of eFR on the Dutch economy.

The analysis first estimates the contribution of eFR to Dutch GDP. Its contribution to employment is then estimated by dividing value added by the labour productivity of the relevant industries. The three forms of economic impact are described in more detail below.

Direct value added

At the business level, direct value added is defined as the difference between the value of sales and the value of purchases. The main components of value added are:

- Taxes minus subsidies
- Labour costs (employee remuneration)
- Operational surplus (returns to investors, including profits or losses)



The principal taxes considered in this study are corporate income tax and real estate tax. Value added tax (VAT) is attributed to final consumers and is therefore excluded from the analysis. For the purposes of this study, Power2X is not assumed to receive subsidies.

Labour costs are estimated using expected employment requirements, expressed in FTEs, provided by Power2X and multiplied by estimates of average labour costs derived from statistical data.

Operational surplus is estimated as the difference between total revenues and total costs. These estimates are based on capacity data provided by Power2X, supplemented with literature on financial performance and cross-checked against confidential financial information provided by Power2X for plausibility.

Indirect value added

Indirect value added is estimated by tracing the impact of domestic purchases through the upstream supply chain. Purchases from businesses located outside the Netherlands are treated as imports and are therefore excluded from the Dutch indirect value added. Similarly, downstream impacts arising from domestic sales are excluded to avoid double counting.

The estimation of indirect value added is based on input-output tables published annually by the Dutch Central Bureau of Statistics (CBS). At the time of this study, the most recent available tables were from 2024¹¹.

The core block of an input-output table consists of the aggregate values of all interindustry purchases (and sales) within a national economy. The estimation of the indirect value is derived from an analysis of this core block. Indirect value added can then be compared with direct value added to calculate the so-called Type I multiplier: $\text{= (direct + indirect value) / direct value}$. This multiplier can be used to estimate the impact of new investments or changes in supply. Although it may be tempting to compare multipliers across industries because they appear scale-independent, this can be misleading. A high multiplier may indicate either high indirect value creation or a relatively low direct value. Tax exemptions, subsidies and financial losses may reduce direct value added and thereby increase the multiplier.

Consequently, when comparing businesses or industries with similar supplier structures, only the composition of suppliers rather than the absolute multiplier values should be considered comparable.

Further methodological details regarding the estimation of indirect value added are provided in Annex A.

Induced value added

Induced value added generated through employee consumption is estimated by adding labour costs and household consumption expenditure to the input-output framework. This increases the feedback effects within the economy and results in a higher estimate of indirect economic activity.

The difference between indirect value added excluding household consumption and indirect value added including household consumption is defined as induced value added.

The corresponding Type II multiplier is calculated as: $\text{= (direct + indirect + induced value)/(direct value)}$.

Further methodological details regarding the estimation of induced value added are provided in Annex A.

Direct, indirect and induced employment

Direct employment refers to the number of full-time equivalent employees that Power2X expects to hire for eFR.

Indirect employment arises because Dutch suppliers require additional labour to meet increased demand generated by eFR. This is estimated by dividing indirect value added by the labour productivity of the relevant supplier industries. The Dutch Central Bureau of Statistics publishes labour productivity statistics corresponding to the same industry classifications used in the input-output tables.

A similar approach is applied to estimate employment effects associated with induced value added arising from employee consumption expenditure.

1.2 Spillover analysis

The operations of eFR generate not only direct economic value captured through conventional impact analysis, but also broader societal value contributing to a more resilient, competitive and sustainable socio-economic system. These spillover impacts reflect wider societal and system-level effects that fall outside the scope of direct economic measurement.

The spillover analysis is structured along a framework with two main pillars that describe the most important societal high-level contributions of eFR (see below). The framework is used to identify and specify the relevant spillover impacts that underlie these contributions. By linking research questions to the corresponding contributions, we created a basis for the qualitative and, when possible, quantitative assessment of the spillover impacts.

- Contribution of eFR to strategic positioning, including:**
- A. Contribution to policy targets
 - B. Energy security and strategic autonomy
 - C. Acceleration of the EU's emerging eFuel industry and competitiveness

- Contribution of eFR to wider system effects, including:**
- A. Cluster dependency effects among companies linked to the eFR facility
 - B. Wider energy system effects.



11 CBS (2025). [Tabellensets Nationale rekeningen 2024](#).

The analysis is primarily qualitative and based on a structured review of policy documents, academic literature and sector studies, including EU and national policy frameworks, strategic reports on energy security and competitiveness, and literature relating to e-fuels, aviation and power-to-X systems.

Spillover impacts are identified by first establishing the core societal contributions of eFR and then assessing how these translate into broader system-level effects. Where feasible, qualitative findings are supported by quantitative indicators, such as relative scale or avoided system pressure.

Climate-related spillover effects are additionally monetised using established shadow carbon prices to estimate the indicative societal value of avoided CO₂ emissions.

1.3 Limitations

The findings of this study should be interpreted within a number of methodological limitations. Five limitations relate to the economic impact analysis and four relate to the spillover analysis. These reflect the inherent challenges associated with assessing a large-scale and innovative facility that is not yet operational.

Economic impact analysis

This chapter analyses the economic impact of eFR on the Dutch economy. The analysis distinguishes between two phases: the initial construction phase and the long-term operational phase. Within each phase, it separates the direct contribution of the project itself, the indirect contribution generated through Dutch suppliers, and the induced contribution arising from employee spending in the wider economy.

The analysis begins by reviewing multiplier evidence from comparable industries in the literature, providing the methodological benchmark for the assessment that follows. These insights inform the subsequent quantification of the direct, indirect and induced impacts of eFR on value added and employment.

The chapter concludes with a sensitivity analysis based on alternative assumptions relating to prices, import and export shares of feedstock and products, and a summary of the key findings regarding the overall economic contribution of eFR. The economic impact of eFR depends on several uncertain factors. The most significant uncertainties affecting direct, indirect and induced economic value are future prices of feedstock (renewable methanol) and eSAF.

In addition, the geographic scope strongly affects estimates of indirect and induced value added. The study assumes that renewable methanol is imported from outside the Netherlands. The greater the share of imported renewable methanol, the greater the economic leakage from the Dutch economy. Conversely, the more eSAF is sold internationally, the less expenditure on eSAF displaces spending on other Dutch goods and services, thereby increasing eFR's contribution to the Dutch economy.

To assess the sensitivity of the results to these assumptions, Section 2.3 presents a sensitivity analysis covering future prices and geographic scope assumptions.

Another limitation is that eFR represents a highly specific facility that does not correspond closely to the average industrial activities represented in Dutch input-output statistics. For example, the oil refining category includes both large-scale refinery operations, such as Shell Pernis, and manufacturers of greases and waxes. The latter are significantly less capital-intensive and therefore reduce average industry labour productivity figures.

The only sectors in Dutch statistics with annual labour productivity levels comparable to eFR, estimated at approximately €2.4 million per full-time employee, are gas extraction and tobacco manufacturing, with labour productivity levels of approximately €1.6 million and €4.8 million respectively. Consequently, eFR is not readily comparable with most conventional industrial sectors.

A further limitation of input-output analysis relates specifically to induced value added and induced employment. Input-output tables contain separate rows and columns for employee wages and household consumption. However, households share the same import and export structures as businesses, despite households generally spending relatively limited amounts abroad outside tourism and travel.

For industries that primarily buy and sell domestically, this distinction has limited impact. However, because a large share of eFR's costs and revenues originate internationally, the contrast between household and industrial spending patterns becomes significant. Therefore, induced multipliers for eFR are estimated using average induced multipliers from the gas extraction and tobacco sectors, owing to their relatively similar labour productivity profiles.

Finally, indirect value added may arise both upstream and downstream within value chains. To avoid double counting, this study consistently allocates indirect value added only upstream, to suppliers rather than buyers.

For example, pipeline transportation fees are paid by fuel suppliers transporting fuel to airports and airlines. The indirect value generated through these transport services is therefore attributed to fuel suppliers rather than to eFR itself. Similarly, indirect value generated through taxation is attributed to government. Induced value generated through employee consumption is, however, attributed to the employer and classified as induced value added.

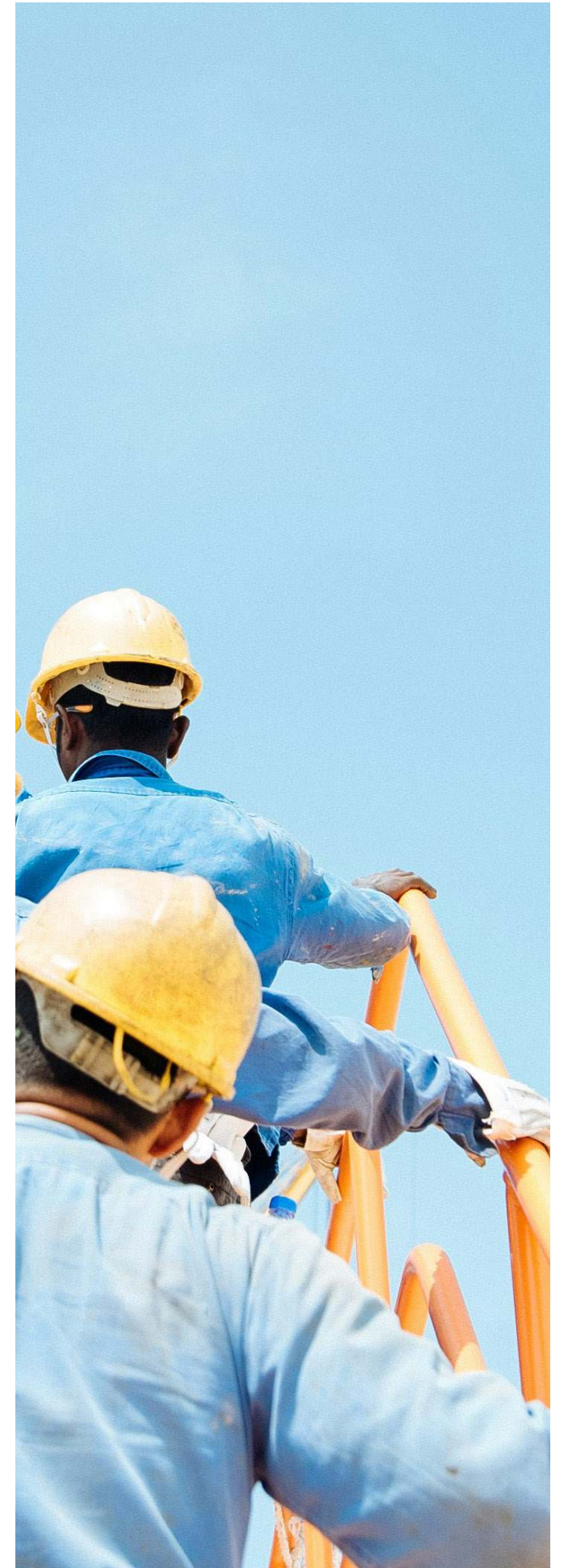
Spillover analysis

The spillover analysis is subject to limitations associated with its qualitative and exploratory nature. Because spillover effects relate to broader societal and system-level effects that are not directly observable, the analysis relies on a structured framework, literature review and expert judgement. As a result, identifying and attributing spillover effects involves an element of subjectivity.

The analysis does not constitute a formal 'social cost-benefit analysis'. The findings should therefore be interpreted as directional and complementary insights rather than precise or exhaustive estimates of the societal value.

Where possible, spillover effects are quantified to provide objective indicators of societal impact, including the monetisation of climate effects using shadow carbon prices. However, quantification is only applied where suitable indicators and data are available. Certain spillover effects, such as innovation and knowledge development, are inherently difficult to quantify and are therefore assessed qualitatively.

Finally, the spillover analysis reflects the policy and market context at the time of the study. Several identified spillover effects therefore depend on the continuation of current EU and Dutch policy frameworks and prevailing market conditions. Future policy or market developments may affect both the relevance and magnitude of these impacts.



An aerial photograph of a large red oil tanker ship docked at a pier. A long, white loading arm extends from the pier over the dark blue water towards the ship. The ship's deck is visible, showing various structures and a green circular logo with a white 'H' on its side. The water is a deep teal color.

02

Economic impact assessment

The analysis begins with a review of multiplier evidence from the literature, providing a benchmark for industries with comparable characteristics. As discussed in the methodology chapter, multipliers are commonly calculated for three indicators: GDP, output, and employment.

Output measures the total value of everything a facility produces and sells, including purchased inputs such as feedstock, energy, and services. GDP, or value added, is the narrower measure that remains once these input costs are subtracted, capturing wages, taxes, and profits that accrue to the domestic economy.

A Type I multiplier adds indirect effects through domestic supply chains to direct value added, while a Type II multiplier additionally incorporates induced effects arising from employee consumption.

Multipliers vary between industries and over time, reflecting differences in value chain position, capital intensity, and import and export shares. The benchmark review shows that GDP and output multipliers are broadly similar across the industries examined (Figure 2.1 and Table 2.1). Employment multipliers, by contrast, are considerably higher in heavy industries because these sectors are more capital-intensive and require fewer workers to generate equivalent levels of value added.

These benchmark ranges provide a reference point for interpreting the multipliers estimated for eFR. This is particularly relevant because commercial-scale eSAF production is still an emerging industry for

which established multiplier values do not yet exist. The closest comparators identified in the literature, namely oil refining and industrial gases, reflect only part of eFR’s operational characteristics and therefore cannot be applied directly.

Differences between benchmark and eFR multipliers are also influenced by several eFR-specific features, including high labour productivity, supply chain composition, and the large share of production expected to be exported to other European countries.

Understanding these differences is as important as the multiplier values themselves. The following sections therefore set out the assumptions and methodological reasoning transparently, including a sensitivity analysis showing how results change under alternative assumptions.

purchases from Dutch suppliers, and through induced effects generated by employee spending across the wider economy. Each subsection therefore discusses the assumptions and data used to estimate direct (A), indirect (B), and induced (C) value added.

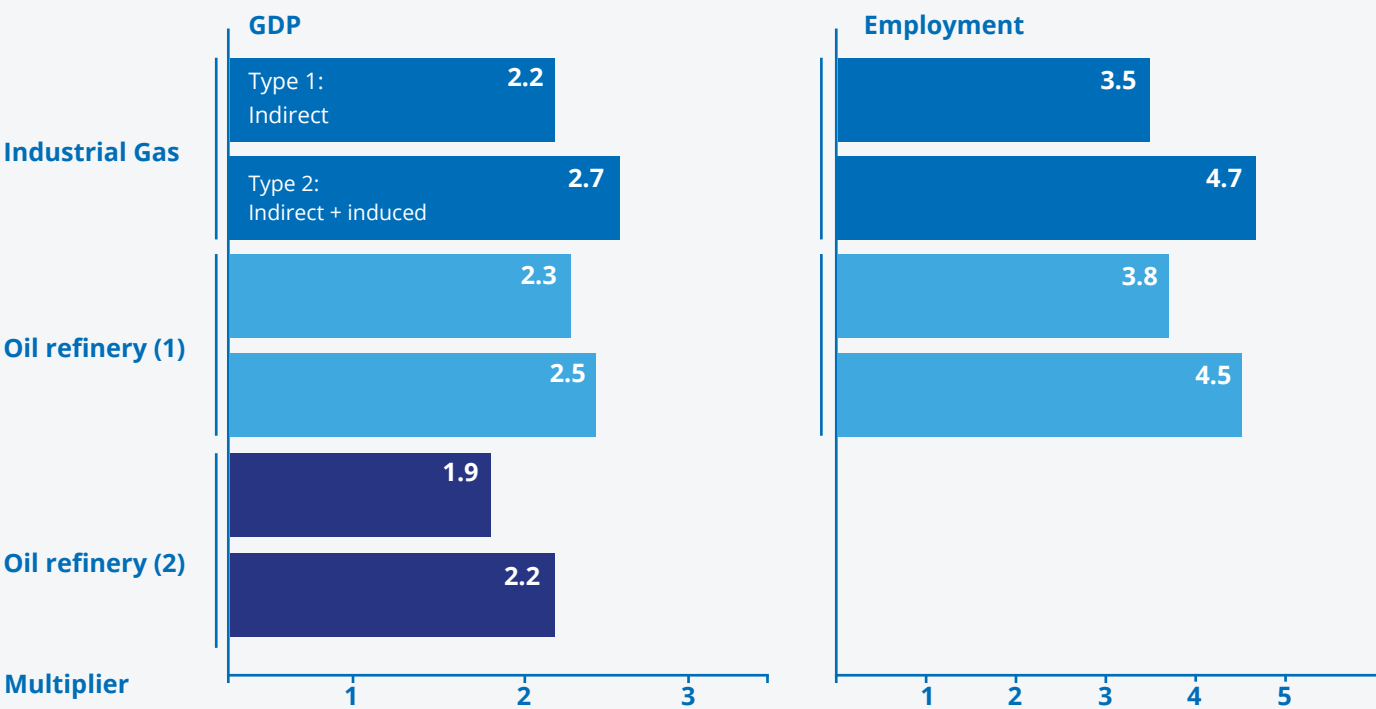
The construction phase is estimated to generate approximately **EUR 1.4 billion** in Dutch value added over a period of **three to four years**. Once operational, the production phase is estimated to generate approximately **EUR 1.3 billion in value added annually**.

The remainder of this section explains how these estimates are derived and which factors drive them. To preserve commercial confidentiality, direct and indirect value added are presented as a combined figure rather than reported separately.

Table 2.1 Summary of multipliers in the selected industries

	Indirect multiplier (Type I)	Indirect + induced multiplier (Type II)
Value added	1.9 - 2.3	2.2 - 2.7
Output	2.0 - 2.1	2.4
Employment	3.5 - 3.8	4.5 - 4.7

Figure 2.1 Industrial operational multipliers in the literature including direct impact



1. Industrial gases: [frontier economics, ETR \(2025\)](#) The Role of the European Industrial Gases Sector for the European Economy
2. Oil refineries (1): [Ecorys \(2019\)](#) Het belang van de raffinagesector voor Nederland (The significance of oil refineries for the NL)
3. Oil refineries (2): calculations for this study

2.1 Value added impact

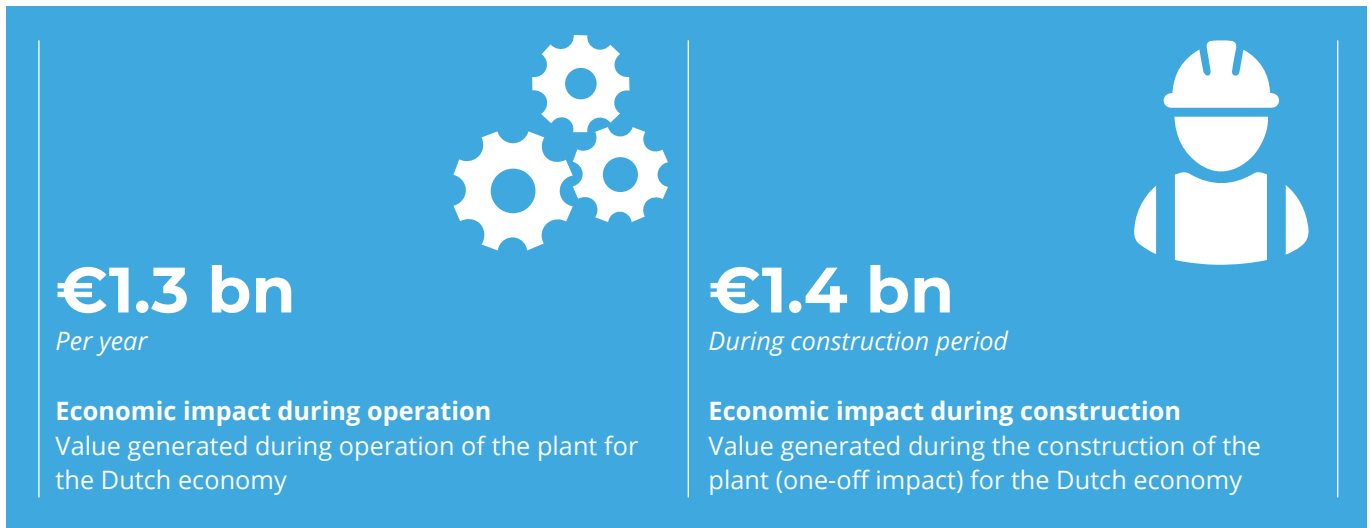
This section quantifies the contribution of eFR to Dutch GDP through value added. Value added is generated across **two distinct phases**.

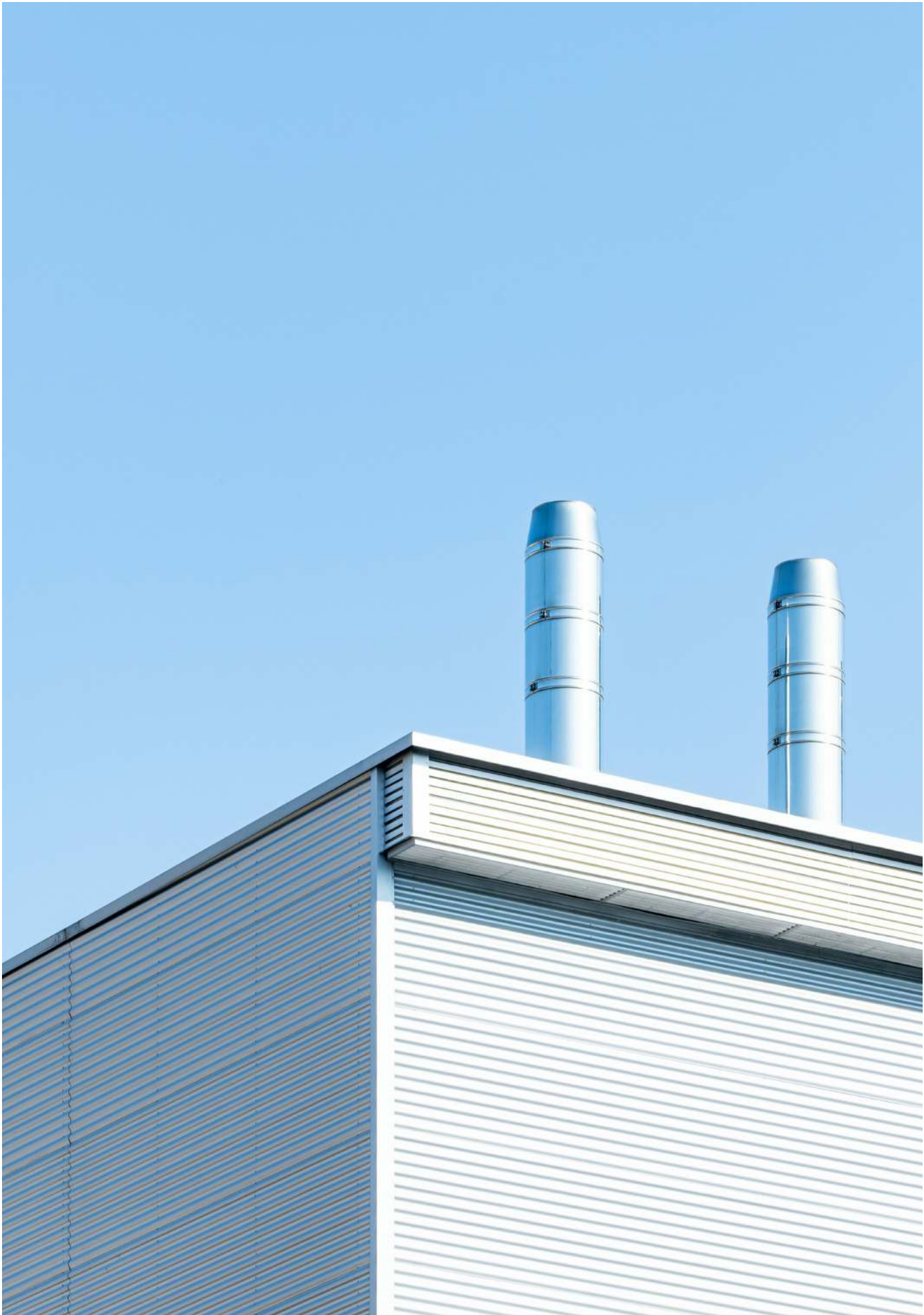
The first phase concerns the construction of the facility, during which capital expenditure on engineering, **construction** and machinery generates economic activity within the Dutch economy. The second phase concerns facility operations, during which the **production** and sale of eSAF generate recurring annual economic contributions.

Within each phase, value added arises directly through eFR’s own activities, indirectly through

First, eFR generates direct value added through the difference between product revenues and operating costs. Second, expenditures on electricity, maintenance, warehousing, financial services and other suppliers generate indirect value added across the Dutch supply chain. Third, wages paid to eFR employees support additional consumer spending within the wider economy, captured as induced value added.

Figure 2.2 Value added in each of the project phases





The analysis below first sets out the revenue and cost assumptions used to estimate direct operational value added before explaining how these expenditures generate indirect and induced effects through the input-output model.

A. Direct value added

The direct value added generated through the operation of eFR is defined as the difference between sales revenues and operational costs. It consists of labour costs, taxes minus subsidies, and operational surplus, including depreciation and profit margin. The following subsections describe the assumptions used to estimate revenues and costs. The direct operational value added forms part of the combined direct and indirect annual production value added estimated at approximately **EUR 1.3 billion** per operational year.

Sales revenues

The eFR production facility is planned to produce 250 kton of eSAF annually, alongside smaller volumes of eDiesel and eNaphtha. Based on 2025 market data, estimated sales prices are EUR 7,520 per tonne for eSAF, EUR 2,100 per tonne for eDiesel, and EUR 1,900 per tonne for eNaphtha¹². It should be noted that EASA presents a range of production prices for eSAF that include ‘reasonable’ profit margins, and that price estimates vary across the literature. For synthetic aviation fuels produced from industrial CO₂, EASA reports a price range between EUR 6,710 and EUR 8,420 per tonne, with EUR 7,520 representing the weighted average value applied in this study.

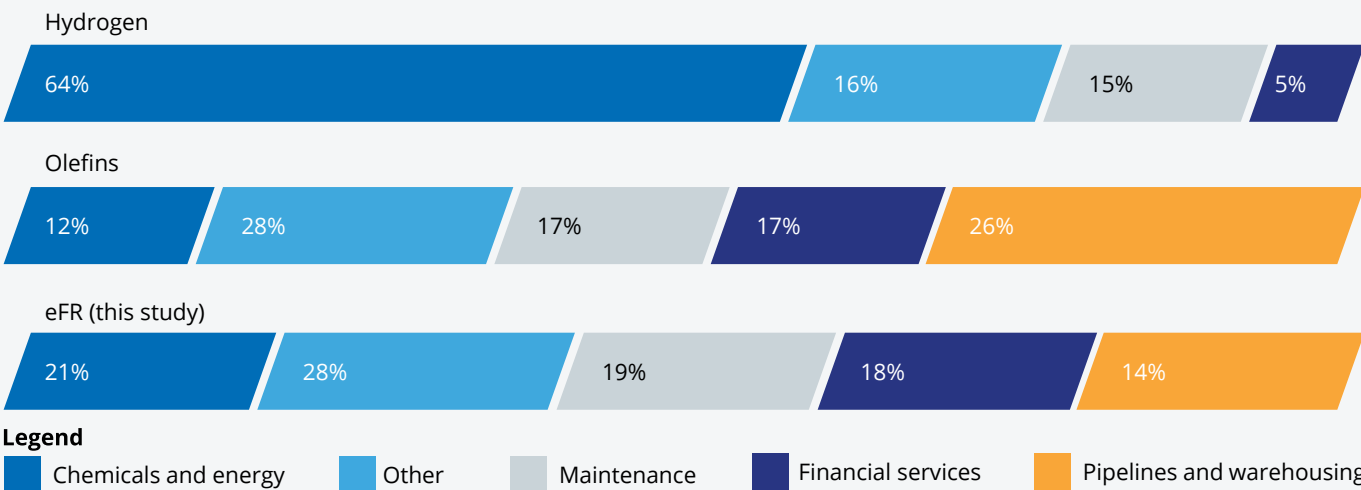
Operational costs

Given the absence of operational cost data for a fully commercial-scale eFR facility, the analysis draws on relevant literature relating to technologically comparable plants.

Two comparative studies are used to identify the principal cost categories and their allocation across supplier industries. Gupta et al¹³ provides a detailed breakdown of supplier industries for a hydrogen plant, while Chen et al.¹⁴ presents engineering-based cost estimates for a methanol-to-olefins plant.

By scaling, harmonising and combining insights from these studies, a comprehensive and internally consistent cost structure for eFR has been developed. This includes assumptions relating to plant size, prices, exchange rates, purchasing power and inflation adjustments. Figure 2.3 presents the high-level cost structures of both the hydrogen and methanol-to-olefins plants alongside the estimated cost structure for eFR. Annex B provides a broader overview of the comparative studies used in the assessment.

Figure 2.3 High-level structure of domestic supply costs



12 eSAF: EASA (February 2026), 2025 [Aviation Fuels Reference Prices for RefuelEU Aviation](#) eDiesel: Autodoc Blog (2025), [hvo100-diesel-brandstof-wat-is-het-wat-kost-een-ij-ter-voordelen-en-nadelen](#) eNaphtha (2026): ICIS (2025), [INSIGHT: EU Regulatory certainty needed to boost bio-naphtha and pyrolysis oil growth](#)
13 Gupta et al. (2023) Macroeconomic analysis of a new green hydrogen industry using Input-Output analysis: [The case of Switzerland](#)
14 Chen, Y.-H., W. Hsieh, H. Chang and C.-D. Ho (2021), [Design and economic analysis of industrial-scale methanol-to-olefins plants](#)

While most cost estimates for the eFR facility are based on literature, some cost estimates are specific to eFR. The overview below presents the assumptions for different costs:

- **Machine maintenance** - As one of the first facilities of its kind, eFR is assumed to incur relatively high maintenance costs. Machine maintenance is therefore estimated at 14% of operational costs, compared with approximately 9–10% in comparable literature sources.
- **Operating supplies** - Operating supplies, primarily chemical reactants, are assumed to be lower than for a methanol-to-olefins plant because eFR focuses predominantly on a single primary product, eSAF, rather than multiple outputs.
- **Energy** - Annual electricity consumption is estimated at 250 GWh. At an assumed electricity price of EUR 0.13 per kWh for green electricity supplied to small businesses, annual electricity costs are estimated at approximately EUR 33 million. Wholesale electricity prices were not used because of the high degree of uncertainty associated with future market developments.
- **Pipeline fees** - Airports pay fees for use of the Central Europe Pipeline System (CEPS). The eFR facility would be located at the former Aluchemie site, within five kilometres of both the central Botlek terminals and CEPS infrastructure. At estimated transport fees of EUR 1.5–5 per tonne per 100 km, annual pipeline transport costs for eFR are expected to amount to no more than several hundred thousand euros.
- **Warehousing** - Warehousing costs depend primarily on the storage capacity required for renewable methanol. The eSAF facility is estimated to require approximately 750 ktonnes of renewable methanol annually. In 2024, annual rental costs for large fuel storage tanks ranged between USD 100 and USD 300 per m³. Methanol has a density of approximately 0.791 tonnes per m³, implying estimated storage costs of between USD 126 and USD 379 per tonne annually.

According to the Methanol Institute, methanol bunker storage costs in Rotterdam are approximately USD 250 per tonne. Assuming storage capacity sufficient to secure eight weeks of supply, approximately 115 ktonnes of storage capacity would be required:
 $(8 / 52) \times 750 = 115$ ktonnes

At USD 250 per tonne, this implies annual storage costs of approximately USD 29 million, conservatively rounded to EUR 29 million per year.

- **Financial services** - Power2X is expected to finance a substantial share of the project through debt financing. According to the ECB, the average interest rate for a business loan exceeding EUR 1 million with a ten-year maturity and floating rate was 3.72% in 2025, compared with 5.3% in 2023.

Chen et al. assume a plant lifetime of 20 years for a methanol-to-olefins facility, although loans may have shorter maturities while plant operations continue for longer through ongoing maintenance. Taking these factors into account, annual interest payments are estimated at approximately EUR 100 million.

Given the scale of the financing requirement, it is assumed that a Dutch lead-arranger bank would retain approximately 20% of the financing exposure on its own balance sheet. Consequently, only 20% of interest payments are allocated to Dutch financial services.

- **Renewable methanol feedstock import** - A 2024 Chinese study reports renewable methanol production costs ranging from CNY 4,167 to CNY 10,250 per tonne.¹⁵ The upper bound corresponds to approximately EUR 1,300 per tonne. Assuming annual EU inflation of approximately 2.5%, this translates into a conservative current estimate of around EUR 1,400 per tonne.

At an annual feedstock requirement of 750 ktonnes, total annual renewable methanol feedstock costs are therefore estimated at:

$$750 \times 1,400 / 1,000 = \text{EUR } 1,050 \text{ million per year}$$

- **Import transport and insurance costs** - According to OECD, transport and insurance costs for international trade between the Netherlands and exporters located in India or China amount to approximately 5% of trade value.¹⁶ Applying the percentage to annual feedstock imports of EUR 1,050 million results in estimated annual transport and insurance costs of approximately EUR 53 million.



15 Li P, Lin J, Yu Z, et al. (2024), Feasibility study of renewable methanol production: [A substitution pathway from blue to green](https://doi.org/10.23919/IEE.2024.0013), *IEE*, 2024, 3(2): 75-81, <https://doi.org/10.23919/IEE.2024.0013>

16 OECD (n.d.). Exploring transport and insurance costs of merchandise trade: [The OECD-ITC Dashboard](https://www.oecd.org/trade/itc/).

- **Labour cost** - Power2X has provided workforce estimates in full-time equivalents (Table 2.2). Based on data from Eurostat’s structural earnings survey, the average annual gross wage per eFR employee comes to €64,637. According to Eurostat’s harmonised index of consumer prices, the average price level in 2022 was 90.37% of the price level in 2025 in the Netherlands. In the Dutch manufacturing industry, employer social security contributions averaged €13,535 per employee. Actual wages are expected to be higher due to the plant’s 24/7 shift structure.

B. Indirect value added

Indirect value added generated during eFR operations arises through expenditures on suppliers and services across the supply chain. The principal supplying industries were identified in the previous subsection on operational costs. Applying the input-output methodology described in Section 2.1 generates estimates of the contribution of these supplier industries to the indirect value added associated with eFR.

By dividing indirect value added by direct value added, multiplier values can be calculated (Table 2.3). The multiplier values presented in Table 2.3 exclude direct value added from the numerator.

Electricity supply, methanol reforming patents, warehousing services provided by Advario storage facilities, and machinery maintenance are among the largest contributors to indirect value added. Financial services also represent a significant contributor because of the substantial capital financing requirements associated with eFR.

For comparison purposes, the analysis also presents multiplier contributions for conventional oil refineries. Relative to oil refineries, financial services, intellectual property and machinery maintenance contribute more strongly to eFR, reflecting the technological novelty of commercial-scale eSAF production.

By contrast, oil refineries generate larger indirect contributions from gas extraction and intra-sector transactions because conventional oil refining typically involves multiple processing stages conducted across different facilities, whereas eFR is designed to produce eSAF from renewable methanol within a single integrated plant.

A major factor underlying the relatively high indirect value multiplier estimated for eFR is that approximately 80% of eSAF production is expected to be exported outside the Netherlands. Multipliers generally increase with export intensity and decrease with import intensity, resulting in a comparatively high indirect contribution to Dutch GDP.

C. Induced value added

The induced value added during the operation of eFR is generated through employee spending. The industries contributing to induced value are broadly the same as those for the wider economy. Workers at eFR are not expected to spend their earnings on fundamentally different goods and services from other workers, with expenditure mainly directed towards retail, housing, restaurants, financial services and similar sectors.

Consumer spending on imported goods and services is typically limited, for example to holidays abroad and some online purchases. By contrast, for eFR, the purchase of renewable methanol accounts for close to 80% of total costs and is expected to be imported. Therefore, induced value multipliers from other high-productivity sectors with primarily domestic sales are used. These sectors are less affected by a limitation of standard input-output analysis, which assumes that workers have the same import and export patterns as the sector in which they work.

For eFR, labour productivity is estimated at EUR 2.4 million per full-time worker, which lies between the labour productivity of gas extraction (EUR 1.6 million) and tobacco manufacturing (EUR 4.8 million). The induced value multipliers for these sectors are 0.14 and 0.02 respectively. An induced value multiplier of 0.10 is therefore assumed for eFR.

Table 2.2 eFR estimated manpower needs (full-time equivalents)

	Operator	Administrative	Total
FTE Total [-]	170	30	200
Average annual wage 2022 [€]	68,135	44,793	64,637
Average labour cost 2025 [€]			78,172

Table 2.3 Indirect value added multipliers (excluding direct value added)

Sectors supplying to eFR	Contribution indirect value multiplier eFR	Contribution indirect value multiplier oil refineries
Electricity, gas, steam and air conditioning supply	0.24	0.09
Financial service activities, except insurance and pension funding	0.20	0.09
Scientific research and development	0.18	0.00
Warehousing and support activities for transportation	0.18	0.15
Repair and installation of machinery and equipment	0.14	0.01
Activities of head offices; management consultancy activities	0.08	0.04
Employment activities	0.07	0.05
Office administrative and other business support activities	0.07	0.00
Legal and accounting activities	0.07	0.01
Real estate services excluding imputed rents	0.04	0.01
Activities auxiliary to financial services and insurance activities	0.03	0.01
Manufacture of chemicals and chemical products	0.03	0.03
Wholesale trade, except of motor vehicles and motorcycles	0.01	0.03
Extraction of crude petroleum and natural gas	0.00	0.08
Manufacture of coke and refined petroleum products	0.00	0.08
Other NL sectors	0.36	0.19
Total	1.71	0.87

Source: calculations Ecorys, based on 2024 input-output tables CBS, Power2X and desk research on supply needs and labour productivity



The **induced value** added of eFR is estimated at **EUR 48 million annually**, based on the assumed multiplier of 0.10. For comparison, the induced multiplier for the Dutch oil refinery sector is estimated at 0.32.

2.1.2 Construction phase

The construction of eFR represents a one-off stimulus to the Dutch economy, spread over a three- to four-year period. During this phase, value added arises directly through capital expenditure captured by Dutch construction firms and machinery suppliers, and indirectly through purchases made by those suppliers from their own Dutch supply chains. Together, the direct and indirect contributions amount to approximately EUR 1.4 billion in Dutch value added over the construction period. The subsections below explain how each component is estimated.

A. Direct value added

Power2X is expected to invest over EUR 2 billion in the eSAF plant and associated storage tanks. Approximately one third of this investment relates to construction works, while two thirds relates to machinery and equipment.

Not all of this expenditure flows into the Dutch economy. Approximately one third of total capital expenditure is expected to be captured by Dutch suppliers, while the remainder is expected to be spent abroad on specialised equipment and engineering services.

B. Indirect value added

The indirect value added generated by the initial investment in the eFR plant arises through expenditure on suppliers during the development phase. The investment cost breakdown is less detailed at the level of supplying industries, which is expected given that expenditure is dominated by construction services and machinery.

As an approximation, all investment costs are therefore allocated to construction and machinery manufacturing. Within the input-output tables, machinery manufacturing is treated as a single industry,

whereas construction services are divided into three separate categories. As investment data are not available at this level of detail, a weighted aggregate multiplier has been calculated based on an assumed distribution of capital expenditure across these supplier categories.

Excluding direct value added, the indirect multipliers for construction services are 1.52, 1.14 and 0.67 for building construction, civil engineering and specialised construction activities respectively. Assuming that 80% of construction costs relate to specialised activities, with the remaining 20% split equally between building construction and civil engineering, the resulting average construction multiplier is 0.80 (excluding direct value added, see Table 2.4).

For machinery manufacturing, the indirect value added multiplier is 0.43, excluding direct value added. Accordingly, the indirect value multipliers used for the initial investment in eFR are 0.80 for construction and 0.43 for machinery.

Applying these multipliers to capital expenditure estimates generates the indirect value added impact. This indirect contribution forms part of the combined **direct and indirect value added**, which totals **EUR 1.4 billion**.

C. Induced value added

Thousands of labour-year equivalents are expected to work on site to prepare the location, construct the storage tanks and buildings, and install the required machinery. These workers will spend their earnings throughout the wider economy.

However, induced value is allocated to employers, which in this case are construction service providers and machinery manufacturers rather than Power2X. Consequently, **no capex-induced value** is allocated directly to the initial investment of the eFR project.

Table 2.4 Estimation of eFR construction capex multiplier (excluding direct value added)

	Building construction	Civil engineering	Specialised construction	Weighted average
Indirect multiplier	1.52	1.14	0.67	0.80
Share in eFR construction	10%	10%	80%	100%

2.2 Employment impact

This section presents the employment impact of eFR on the Dutch economy. The analysis distinguishes between structural employment during the operational phase and temporary employment during construction.

During the operational phase, eFR is estimated to support approximately **4,000 to 6,400** full-time equivalent (FTE) **jobs across the Dutch economy**, depending primarily on the share of eSAF sold outside the Netherlands. This includes 200 direct jobs at eFR, indirect employment across Dutch suppliers and service providers, and induced employment generated through consumer spending by eFR employees.

The upper end of the range reflects the baseline assumption that 80% of eSAF is exported, under which indirect employment reaches 6,009 full-time Equivalent (FTE) and induced employment reaches 222 FTE.

The construction phase is treated separately because it represents a temporary employment effect rather than recurring structural employment.

2.2.1 Structural employment during the production phase (operation)

A. Direct employment

Direct employment refers to the workforce required for the operation of eFR. As discussed in Section 2.1, and used in estimating labour costs, eFR expects to employ **200 full-time equivalent workers**. These 200 positions are considered structural jobs associated with the operation of eFR. The direct employment estimate was provided by Power2X.

B. Indirect employment

Indirect employment represents the employment generated at suppliers and service providers due to the demand created by eFR. The indirect employment impact is calculated by dividing the indirect added value by the labour productivity of the various suppliers.

Table 2.5 presents the indirect employment of eFR. The total indirect employment of eFR consists of up to 6,009 jobs in full-time equivalents.

Indirect employment refers to jobs generated among suppliers and service providers as a result of demand created by eFR. The indirect employment impact is estimated by dividing indirect value added by the labour productivity of supplying industries.

The indirect employment multiplier of 30 is relatively high because of the combination of high labour productivity and the assumption that 80% of eSAF production is exported.

As discussed above, eFR labour productivity of EUR 2.4 million per full-time worker is higher than that of the oil refinery industry average of EUR 430,000. However, the refinery industry includes lower-productivity activities such as the production of greases and waxes.

Although Dutch statistics do not provide this level of detail, Canadian data suggest that labour productivity in oil distillation is approximately eight times higher than in petroleum product manufacturing and around 75% above the industry average.¹⁷ Therefore, labour productivity for a distillation plant such as Shell Pernis is also likely to exceed the refinery sector average, at an estimated EUR 750,000 per full-time worker. The employment multiplier for oil distillation would therefore also be expected to exceed the industry average of 4.5 (see Section 2.1).

Export assumptions also significantly affect indirect value and employment outcomes. If the export share of eSAF were 50% rather than 80%, the employment multiplier would decrease to 12.0. If there were no exports, the multiplier would fall further to 6.0.

C. Induced employment

Induced employment refers to jobs generated across the wider economy through spending by employees involved in operating eFR.

The induced employment impact is estimated by dividing induced value added by the labour productivity of the industries in which employees spend their earnings.

Induced employment associated with eFR is estimated at **222 full-time equivalent jobs**.

As with induced value added, induced employment is also influenced by the export share of eSAF. To estimate the multiplier for eFR, induced employment multipliers for the gas extraction and tobacco sectors were used for the same reasons described for induced value added, namely high productivity and predominantly domestic sales. Excluding direct employment, the respective multipliers are 1.56 and 0.66, resulting in an average multiplier of 1.11.

Table 2.5 Indirect employment (full-time equivalents) excluding direct employment

Sectors supplying to eFR	Labour productivity	Contribution to eFR value	Contribution to eFR multiplier
Scientific research and development	109,545	801	4.01
Employment activities	57,692	611	3.05
Repair and installation of machinery and equipment	110,500	608	3.04
Office administrative and other business support activities	61,396	570	2.85
Warehousing and support activities for transportation	167,421	507	2.54
Legal and accounting activities	92,379	351	1.76
Financial service activities, except insurance and pension funding	285,726	339	1.70
Specialised construction activities	77,841	261	1.31
Activities of head offices; management consultancy activities	170,717	220	1.10
Electricity, gas, steam and air conditioning supply	612,861	186	0.93
Computer programming, consultancy and related activities	117,515	146	0.73
Manufacture of metal products, except machinery, equipment	110,180	123	0.61
Insurance and pension funding, except compulsory social security	238,368	122	0.61
Construction of buildings	76,131	107	0.54
Activities auxiliary to financial services and insurance activities	152,351	106	0.53
Other NL sectors	112,727	949	4.74
Total eFR	2,400,000	6,009	30.04

17 Statistics Canada (2025). [Labour productivity and related measures by business sector industry](#).

2.2.2 Employment during construction of the plant

The €2+ billion investment by Power2X translates into a substantial, time-bound stimulus to the Dutch economy during the 3–4-year construction phase. For an industrial project of this type and scale, a significant share of CAPEX is expected to be captured by Dutch suppliers, primarily through EPC contractors, civil and structural works, mechanical and electrical installation, piping, instrumentation, and engineering services. This is estimated to generate a one-off stimulus of up to approximately 11,000 FTEs across the construction period, averaging up to 3,000 FTEs per year.

The direct employment impact is estimated by dividing construction and machinery CAPEX by labour productivity in the relevant industries. The indirect employment impact is estimated by applying sector-specific indirect employment multipliers to the direct employment generated in these industries. Induced impacts are attributed to employee spending rather than eFR itself. Therefore, no induced employment impact is estimated for CAPEX expenditure.

The development of a large-scale eSAF facility requires a workforce with a broad range of skills and generates one-off employment across several disciplines, including:

Electrical, mechanical, civil and process engineering required for plant design.

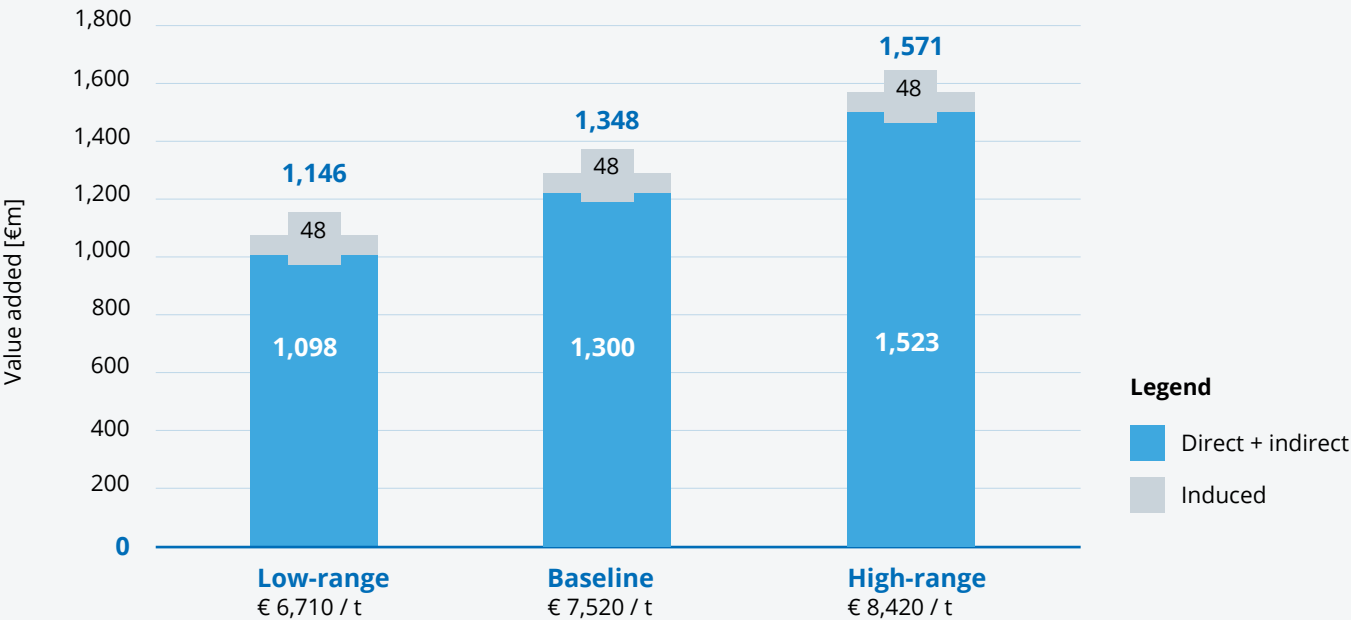
Construction and enabling activities such as welding, fabrication, construction management, and health and safety functions required to deliver the project.

2.3 Sensitivity analysis

The objective of the sensitivity analysis is to examine how changes in uncertain parameters affect results under different scenarios. Although construction costs associated with the initial eFR investment are also uncertain due to volatility in material costs, the analysis focuses on the sensitivity of economic value estimates during the operational phase of eSAF production.

The economic value of eFR depends on uncertain prices and on the geographical scope of the project. Variations in prices influence direct value added, while changes in geographical scope influence indirect value added. Employment is assumed to be less uncertain and therefore remains fixed at 200 full-time equivalents across all scenarios. Consequently, induced impacts remain unchanged throughout the sensitivity analysis.

Figure 2.4 Economic value added (x EUR mln) under various eSAF price assumptions



eSAF price

The baseline scenario assumes an eSAF price of EUR 7,520 per tonne. This reflects a weighted average of cost estimates ranging from EUR 6,710 to EUR 8,420 provided by EASA¹⁸. However, there is uncertainty regarding whether Power2X will be able to achieve this average sales price by 2030–2035. Therefore, an alternative pricing scenario based on the EASA range was analysed to assess impacts on direct value creation. Depending on the sales price achieved, total annual economic value added would range between EUR 1,146 million and EUR 1,571 million (Figure 2.4).

Renewable Methanol price

The baseline scenario assumes a renewable methanol price of EUR 1,400 per tonne. However, the price of renewable methanol also remains uncertain towards 2030–2035. The Methanol Institute (2024) projected prices to increase from EUR 2,238 per tonne in 2025 to EUR 2,405 in 2030, before declining to EUR 1,330 in 2034 following the expiry of the ETS reward factor¹⁹. Gerstein et al. (2026)²⁰ reported 'levelised cost estimates from the literature ranging from EUR 608 to EUR 2,710 per tonne for renewable methanol^{21 22}. Literature estimates of 2030 import prices range from EUR 380 per tonne from Chile to EUR 715 per tonne from Morocco.

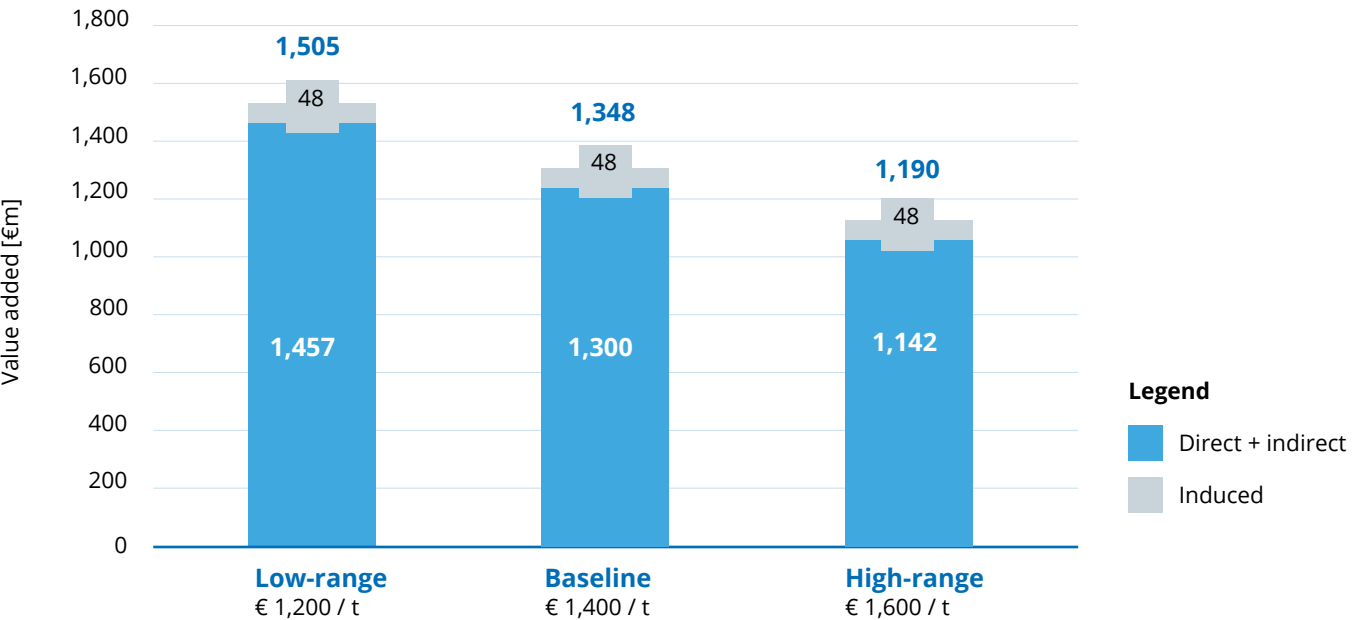
To assess uncertainty, two alternative assumptions were analysed: an import price of EUR 1,200 per tonne and EUR 1,600 per tonne. Under these assumptions, total annual economic value added would range between approximately EUR 1,190 million and EUR 1,505 million (Figure 2.5).

It is worth noting that the price assumptions used in this study reflect a relatively early stage of market development. As with other emerging clean technologies, including solar PV, onshore wind and batteries, eSAF and renewable methanol production costs are expected to decline materially over time as deployment scales, supply chains mature, and learning effects reduce capital and operating costs. The price ranges used here should therefore be interpreted as conservative for the longer-term outlook.

Geographical scope

The baseline scenario assumes that 80% of eSAF is exported to airports outside the Netherlands, primarily elsewhere in Europe. However, when assessing impacts at the EU level, the export share effectively falls to zero because consumption occurs within the EU. As a result, eSAF expenditure largely substitutes for other spending within the EU economy. Expanding the geographical scope to the EU level would therefore reduce indirect

Figure 2.5 Economic value added (x EUR mln) under various renewable methanol price assumptions



18 EASA (2026). 2025 Aviation Fuels Reference Prices for ReFuelEU Aviation.
19 Methanol institute (2024). Economic value of methanol for shipping.
20 Gerstein et al. (2026), A comparative techno-economic assessment of renewable methanol production under FuelEU maritime and EU ETS regime and long-term reliability of supply
21 The levelised costs are the average discounted costs of building and operating an energy assets over its lifetime, per unit of energy generated.
22 Galimova et al. (2025), Analysis of green renewable methanol supply costs: Domestic production in Europe versus imports via pipeline and sea shipping

value added. At the same time, eFR relies on imported renewable methanol. In the baseline scenario, 100% of renewable methanol is assumed to be imported from outside both the Netherlands and the EU. As imports cause part of the economic value to flow outside the assessed region, domestic or European production would retain more value within the European economy and partially offset these effects. Consequently, lower import shares would increase indirect value added.

This import assumption reflects current market conditions, where renewable electricity costs make domestically produced renewable methanol more expensive than imports from lower-cost regions. Over time, as Dutch and European green hydrogen production scales up and costs decline, a shift towards locally sourced feedstock would increase the share

of economic value retained within Europe, while also reducing exposure to international commodity markets and strengthening energy security.

Lastly, the impact on economic value added is explored through two alternative scenarios. In Alternative I, eFR fully supplies Dutch mandated eSAF consumption (35% export share) while sourcing renewable methanol entirely domestically (0% import share). For consistency with the baseline scenario, the same renewable methanol price of EUR 1,400 per tonne is assumed. In reality, domestically produced renewable methanol would be expected to be more expensive than imported volumes due to Europe's higher renewable electricity costs, which would further increase domestic value added. Under this scenario, value added changes only marginally relative to the baseline, reaching EUR 1,284

million per year compared with EUR 1,347 million in the baseline (Figure 2.7). Direct value added increases slightly due to savings in transport and insurance costs associated with imports. The increase in indirect value added resulting from domestic renewable methanol sourcing largely offsets the reduction associated with lower eSAF exports.

In Alternative II, eFR fully supplies Dutch mandated eSAF consumption while renewable methanol remains fully imported. Under this scenario, annual economic value added falls to EUR 780 million. Taken together, the sensitivity scenarios demonstrate that, although the import share assumption is the single most significant driver of indirect value added, the overall economic contribution of eFR remains substantial across the range of plausible price and geographical scope assumptions tested.

including taxes, wages, depreciation, shareholder revenue, and purchases from Dutch suppliers. Key supplier categories include energy, financial services, R&D, warehousing, and machinery maintenance. The financial services estimate assumes that Dutch lead banks retain 20% of the financing on their own balance sheets. Power2X is expected to require approximately 200 full-time equivalent (FTE) employees for operations and support. Consumer spending by these employees is expected to generate an additional EUR 48 million in economic activity.

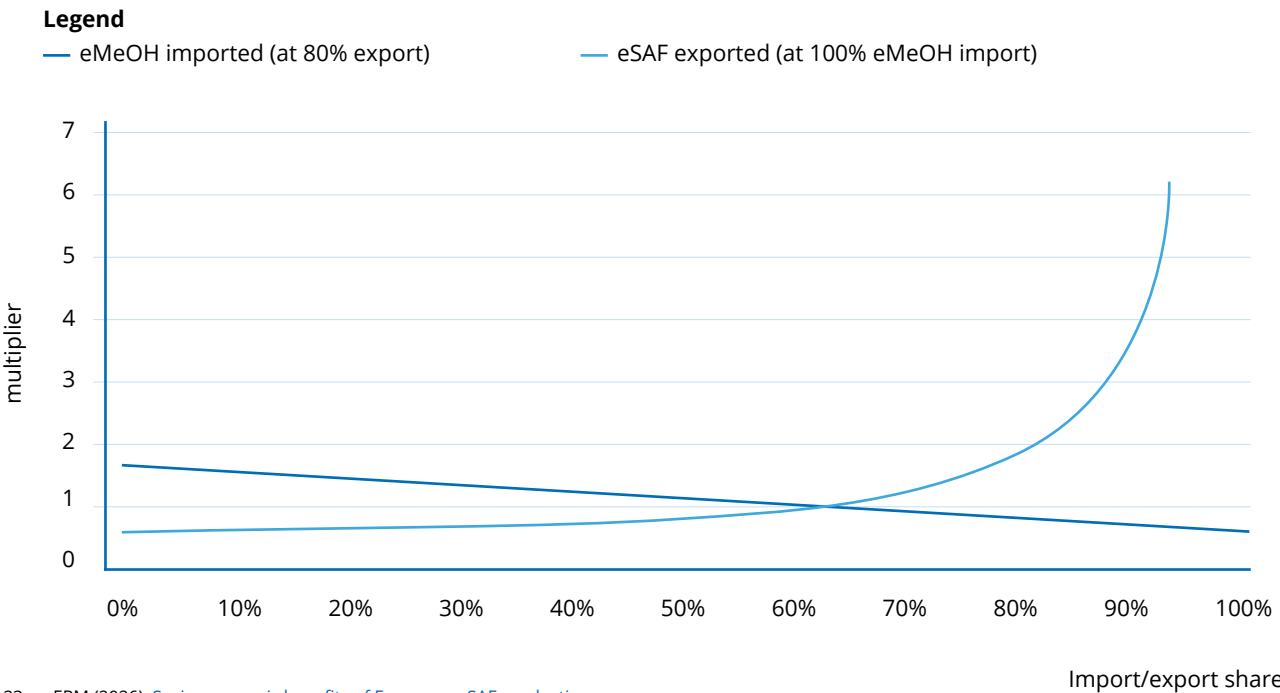
eFR is estimated to support between 4,000 and 6,400 FTE jobs in the Netherlands. Around 200 FTE employees would be directly employed by Power2X to operate the plant. This workforce is estimated to achieve labour productivity of EUR 2.4 million per employee in eSAF production. Supporting indirect economic activity through the supply chain would require a further 6,000 FTE workers, implying average labour productivity of approximately EUR 137,000 across the wider eSAF supply chain. Consumer spending by eFR employees is expected to support an additional 200 FTE jobs elsewhere in the Dutch economy.

Combining the value added generated during the investment phase (construction, years 1–4) and the operational phase (years 4–10), eFR is estimated to generate cumulative value added of almost EUR 10 billion over a ten-year period (Figure 2.8). This estimate assumes that key baseline assumptions, including eSAF

Case example: ERM study on EU-level impact of eSAF

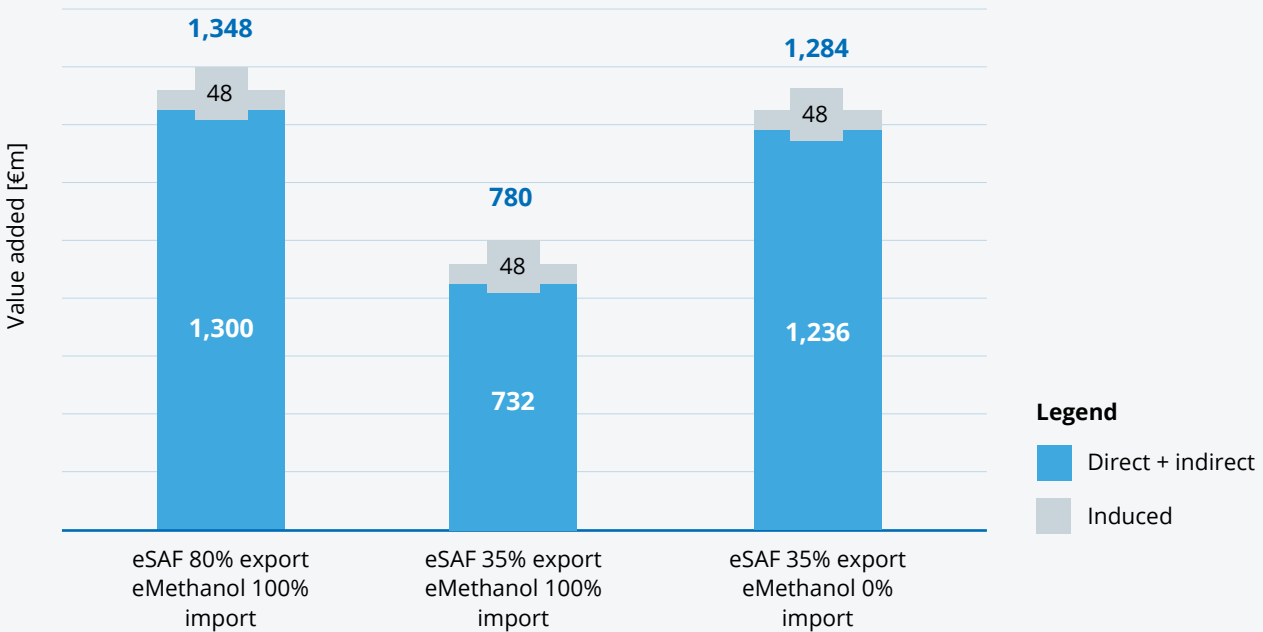
ERM (2026) recently estimated the economic value of eSAF production at EU level²³. They estimate total jet fuel demand across the EU+UK at 57,000 kton per year in 2030. Applying the 1.2% mandate results in demand of 684 kton, which ERM present as 600 kton. Multiplying this by their assumed average price of EUR 6,000 per tonne gives an annual revenue potential of EUR 3.6 billion in 2030. They estimate that half of annual revenue constitutes gross value added (direct + indirect), equivalent to EUR 1.8 billion in 2030, with a roughly equal split between direct and indirect value added. Their estimate that approximately 25% of annual revenue represents direct value added is similar to the estimate used in this report.

Figure 2.6 Indirect multiplier (excl. direct impact) against eSAF export and renewable methanol import shares



23 ERM (2026), [Socio-economic benefits of European eSAF production](#).

Figure 2.7 Economic value added of eFR depending on import and export assumptions



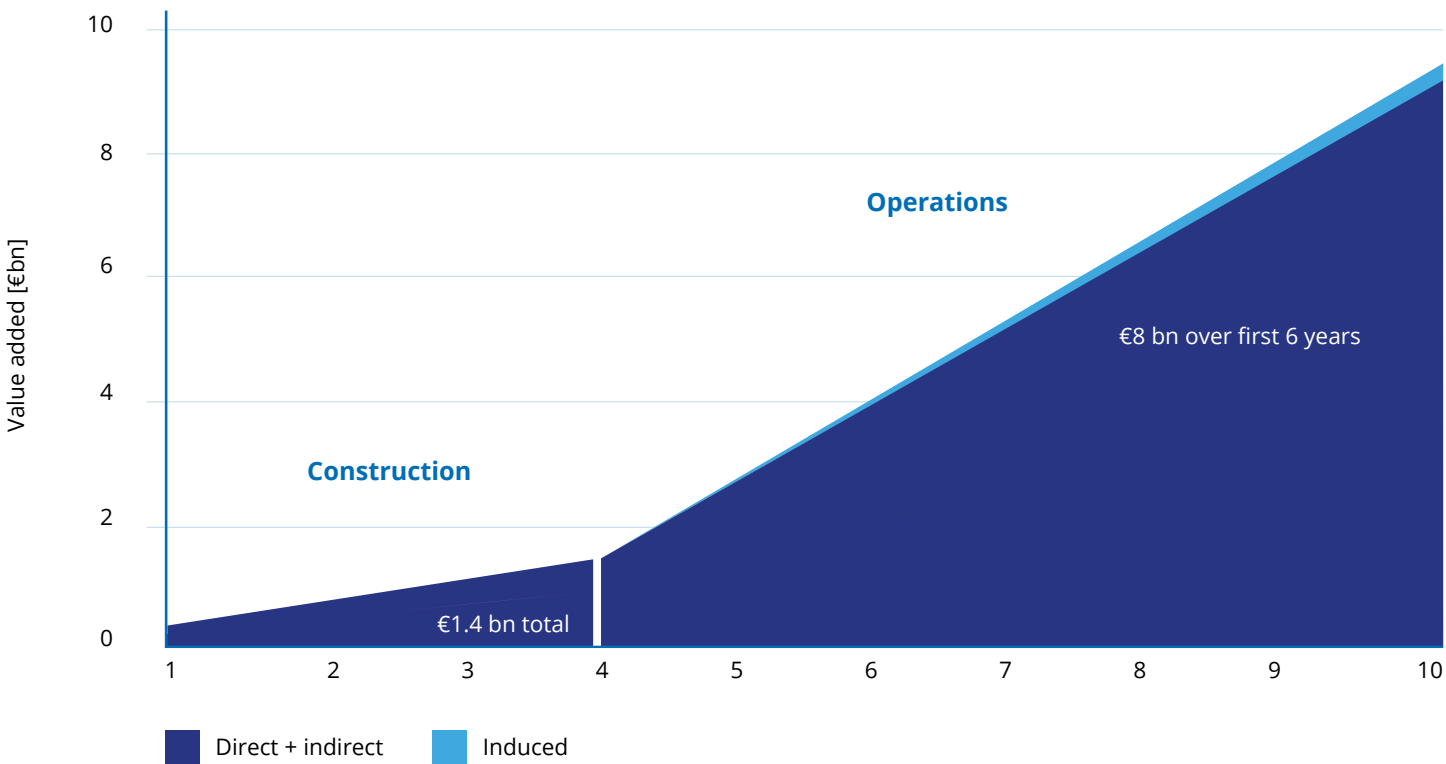
prices and renewable methanol import shares, remain constant throughout the period.

The baseline scenario of EUR 1.3 billion in annual value added assumes an eSAF sales price of EUR 7,520 per tonne, with 80% of production exported to other EU countries, and a renewable methanol price of EUR 1,400 per tonne, with 100% imported from outside the Netherlands. Depending on assumptions relating to prices and import and export shares, annual value-added during operations ranges from EUR 0.78 billion to EUR 1,57 billion. This indicates that the precise economic contribution of eFR remains dependent on the future development of these uncertain parameters.

A complementary perspective is to consider the counterfactual. Without eFR, the EUR 1.3 billion in annual value added and up to 6,400 jobs would not materialise in the Netherlands but instead accrue to whichever country produces the eSAF. At the same time, Dutch fuel suppliers would still need to procure eSAF to comply with the ReFuelEU sub-mandate.

If those volumes are imported instead, this would result in annual eSAF import expenditure of approximately EUR 300 million in 2030, rising to more than EUR 1 billion by the mid-2030s as mandated volumes increase. This represents a separate trade-balance effect: instead of capturing value through domestic conversion, supplier activity and employment, the Netherlands would transfer a growing share of mandated fuel expenditure to producers abroad.

Figure 2.8 eFR initial investment and cumulative annual eSAF operation value added, baseline scenario





03

Societal impact

Beyond its direct monetary contribution to the Dutch economy, eFR generates broader societal spillover effects that support the transition towards a more resilient, competitive, and sustainable economy and energy system. This chapter captures those impacts, structured around two pillars: (i) eFR's contribution to the strategic positioning of the Netherlands, and (ii) its effects on the wider value chain.

3.1 Strategic positioning

The eFR facility anchors new clean fuel production capacity in Europe's largest energy gateway, the Port of Rotterdam. In doing so, it strengthens the port's role as a future-proof industrial cluster and generates economic, societal and geopolitical effects that extend beyond the facility itself. This section analyses those effects for the Port of Rotterdam, the Netherlands and the European Union (EU).

A. The contribution to policy targets

This section addresses the research question: *To what extent does the eFR facility contribute to meeting relevant policy targets?* This is assessed through analysis of compliance with the ReFuelEU Aviation mandates for 2030 and 2050, together with the facility's contribution to Dutch national SAF targets and ambitions.

The analysis is structured around three dimensions:

- A1. The ReFuelEU mandates
- A2. Dutch national targets
- A3. eFR contribution to the targets

A1. The ReFuelEU mandates

ReFuelEU Aviation is the EU's primary regulatory instrument for accelerating Sustainable Aviation Fuel (SAF) uptake, adopted as part of the Fit for 55 package²⁴. It requires fuel suppliers to blend an increasing share of SAF into conventional jet fuel at EU airports. Under the mandate, SAF includes two main categories:

- ReFuelEU main mandate:** advanced biofuels from waste and residues, and biofuels derived from oils and fats. Targets rise from 2% in 2025 to 70% by 2050.
- ReFuelEU sub-mandate:** synthetic aviation fuels produced from renewable hydrogen and biogenic or captured industrial CO₂. Targets rise from at least 1.2% in 2030 to 35% by 2050²⁵.

A2. Dutch national targets

The Dutch Ministry of Infrastructure and Water Management (IenW) has published a SAF roadmap outlining the opportunities, challenges and building blocks required between 2025 and 2035 to meet EU obligations. In addition to EU mandates, the Dutch aviation sector has established a voluntary target of 14% SAF blending by 2030 across all SAF types²⁶.

A3. eFR contribution to the targets

Projected EU aviation fuel demand is estimated at approximately 46 million tonnes (Mt) in both 2030 and 2050²⁷. The Netherlands Environmental Assessment Agency (PBL) estimates Dutch aviation energy consumption at 3.38 Mt per year in 2030, increasing to 3.98 Mt per year by 2050²⁸. Under PBL's innovative scenario, e-kerosene or eSAF becomes the dominant fuel as fossil fuels are phased out.

The eFR facility is expected to produce 250 kt per year (0.25 Mt per year) of eSAF. Therefore:

- At the EU level, the ReFuelEU sub-mandate starts with a volume requirement of 0.5 Mt (1.2%) and increases to 2.3 Mt (5%) over the period 2035–2039 (with average mandated volumes of 1.54 Mt per year until 2039). This implies that eFuels Rotterdam can supply, on average, 15% of the required volumes during the first decade.
- At national level, the Netherlands requires approximately 40 kt to meet the 2030 sub-mandate, ramping up to 180 kt up until 2039. The facility would therefore roughly enable Dutch compliance with the ReFuelEU sub-mandate in 2030 up until 2039.
- eFR's relative contribution naturally declines towards 2050 as mandated volumes increase. However, the facility remains a strategic first-mover asset that supports market formation, infrastructure development and value chain maturity.

Note: actual national contribution may vary because of cross-border fuel trade, as not all fuel produced will necessarily be consumed domestically.

Main findings

The eFR facility provides a material contribution to early SAF compliance:

- At EU level, it delivers approximately 15% of the ReFuelEU sub-mandate during the first 10 years of implementation.
- At national level, it enables the Netherlands to meet its 2030 ReFuelEU sub-mandate and contributes to the Dutch aviation sector's voluntary 14% SAF ambition.
- Although its relative contribution declines towards 2050 as mandated volumes increase, eFR remains a strategic first-mover asset that supports market formation, infrastructure development and value chain maturity across the EU.
- Actual contribution levels may be lower because of cross-border fuel trade, as not all fuel is expected to be consumed within the Netherlands.

B. Energy security and strategic autonomy

This section addresses the research question: *How does eFR influence the Netherlands' dependence on imported jet fuel, and what are the implications for national energy security and EU strategic autonomy?* This is assessed through analysis of the role of locally produced eSAF.

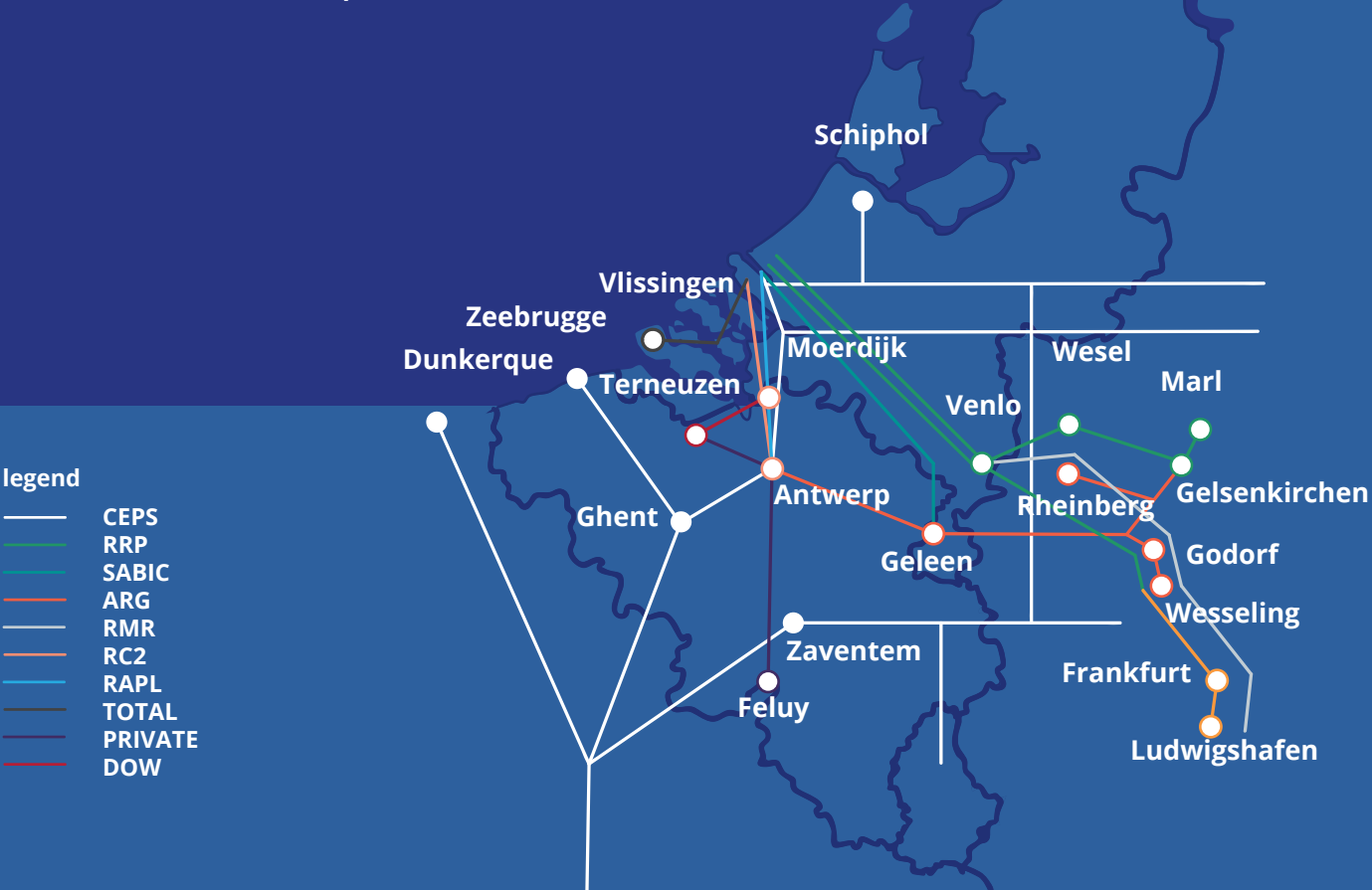
The analysis is structured around three dimensions:

- B1. Contribution to domestic supply and reduced exposure to fossil imports
- B2. Strengthening of strategic assets and geopolitical positioning
- B3. Realistic boundaries of self-sufficiency and the reshaping of external dependencies

B1. Contribution to domestic supply and reduced exposure to fossil imports

As Europe's energy gateway, Rotterdam has a refining capacity of 1.3 million barrels per day across five refineries (Shell, BP, ExxonMobil, TotalEnergies and Vitol). More than 1,500 km of pipelines connect the Port of Rotterdam to mainland Europe, including CEPS, RMR, RRP and RAPL. The Rhine waterway is also the Netherlands' second-largest export route.²⁹

Figure 3.1 Overview of pipeline systems across North-West Europe



24 European Commission (2024): [EU economy and society to meet climate ambitions](#)

25 European Commission (2026): [ReFuelEU aviation - Mobility and Transport - European Commission](#)

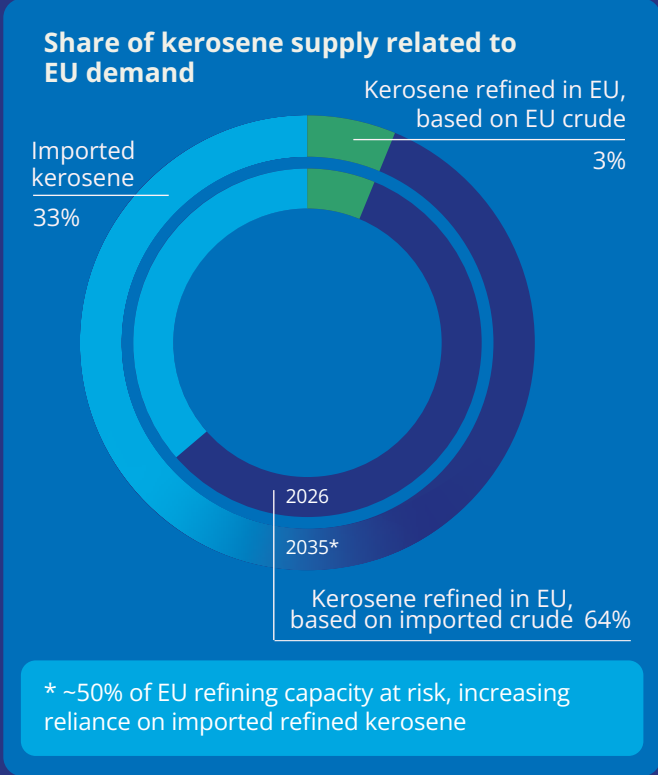
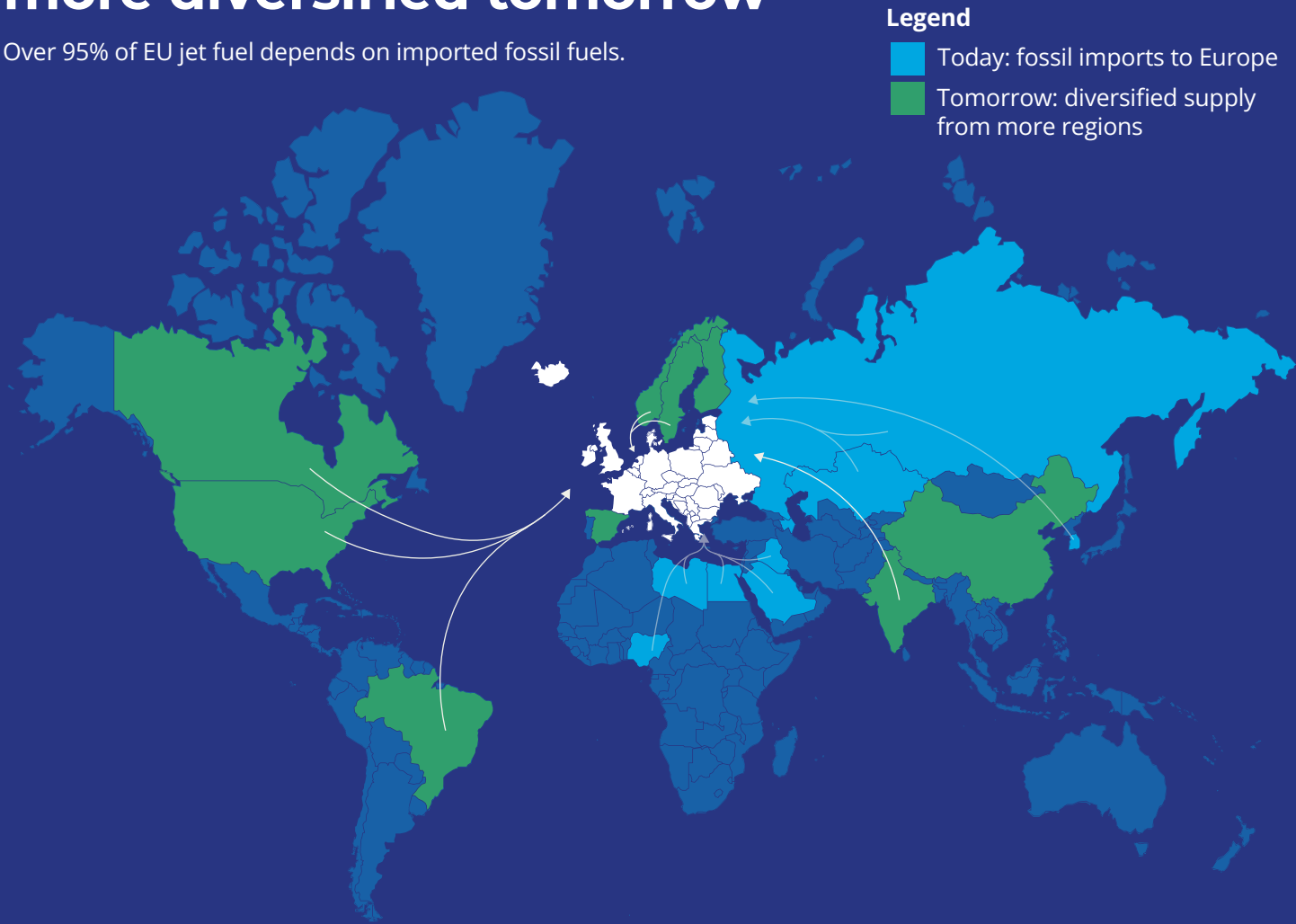
26 Deloitte (2025): [Dutch SAF Roadmap 2025 | Deloitte](#)

27 European Commission (2022): [Sustainable Aviation Fuels \(SAF\) and other Alternative Fuels Used for Aviation | European Alternative Fuels Observatory](#)

28 Ministry of Infrastructure and Water Management (2025): [Flying towards a sustainable energy system](#)

EU jet fuel: highly import-dependent today, more diversified tomorrow

Over 95% of EU jet fuel depends on imported fossil fuels.



Energy security & resilient value chains

- Reduce fossil import dependence**
 - >95% of EU jet fuel relies on imported kerosene or imported crude
 - Only 3% is based on EU-origin crude
- Refinery capacity projected to shrink**
 - High cost and weaker margins are putting EU refineries at risk
 - Increasing dependency on foreign refineries and finished-fuel supply chains
- Build strategic production and storage**
 - eFR shifts aviation fuel supply from imported fossil to renewable methanol whilst increasing refining capacity
 - Methanol and eSAF add resilience beyond conventional fossil chains
- Diversify future supply routes**
 - Renewable methanol can be sourced from a broader set of regions than today's fossil fuel supply
 - Reducing exposure to supply chain disruptions

Import dependence: Dutch total final energy consumption reached 2,629.6 PJ in 2024, of which 78% originated from imported fossil fuels. Petroleum products account for 43% of the Dutch energy mix.²⁹ Demand is driven by aviation, maritime transport, road transport and industry. In 2025, aviation represented 12% of transport sector final energy consumption. Approximately 95% of Europe's jet fuel supply remains dependent on imports. Around one-third is imported directly as kerosene, while two-thirds is produced domestically using imported crude oil³⁰.

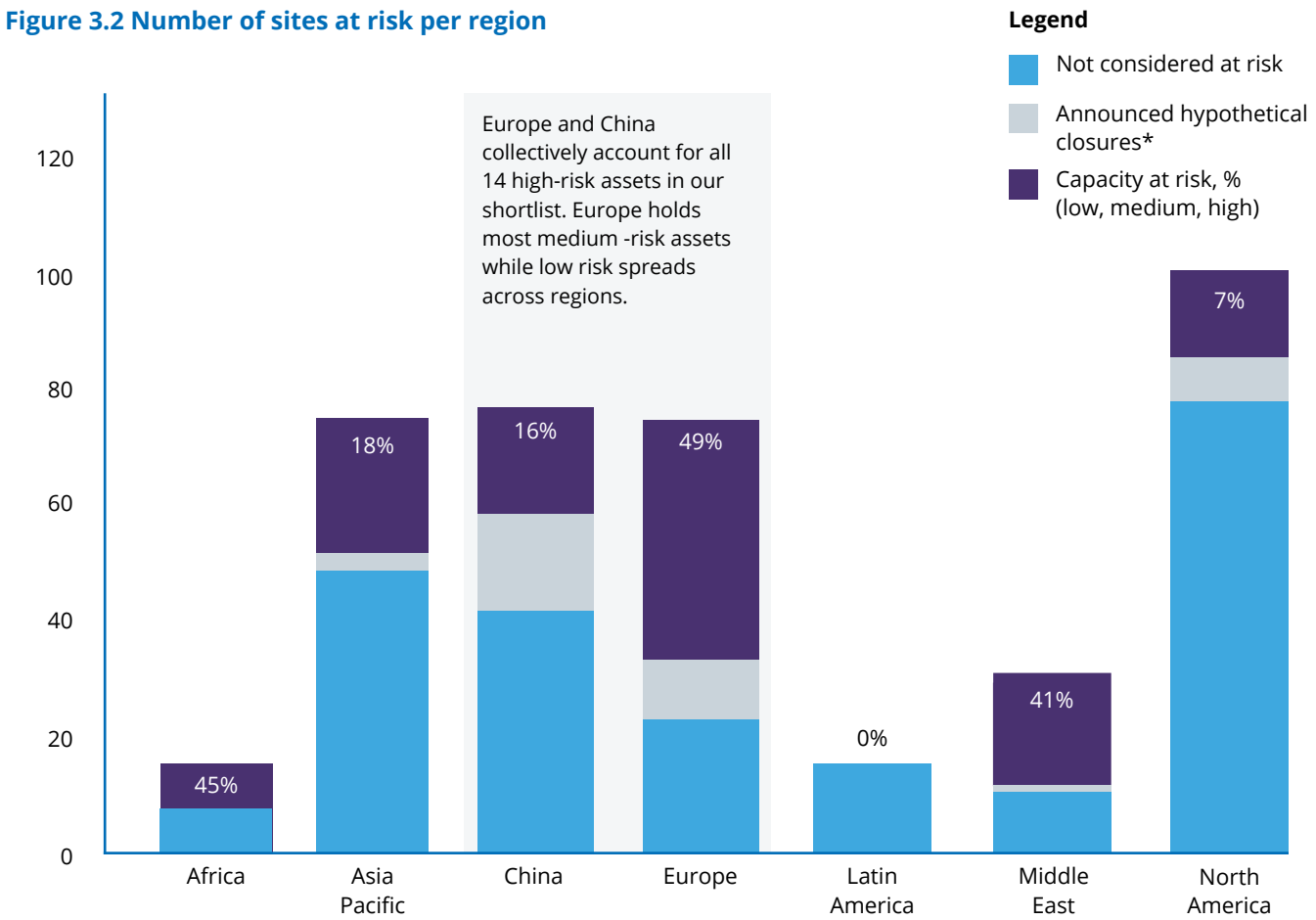
Declining refining capacity: Dutch refineries do not produce jet fuel in isolation. They process crude oil into a range of products simultaneously, with output determined largely by the physical chemistry of refining rather than demand signals. Between 2022 and 2025, diesel and gas oil consistently represented the largest output share (25 to 27%), followed by gasoline (19 to 24%), naphtha (12 to 16%), fuel oil

(15 to 16%), and kerosene (9 to 12%)²⁹. Although output shares vary according to the crude blend used, the overall distribution reflects physical separation processes during distillation. Operators can influence these outputs only marginally. Kerosene production can be adjusted by a few percentage points around its baseline share, but not substantially beyond that. Consequently, jet fuel cannot simply be prioritised when demand increases.

Refineries operate as integrated systems. Operating a refinery produces the entire product slate, while closure removes all products simultaneously, including diesel, jet fuel, gasoline, naphtha and petrochemical feedstocks.

Over recent decades, Europe has experienced substantial rationalisation of refining capacity, driven by declining utilisation rates and weaker margins, resulting in a 22% reduction in capacity

Figure 3.2 Number of sites at risk per region



Source: Wood Mackenzie, ERM, Product Market Services
* Announced closures includes bio-site conversion

29 COVA (april 2026): Fuel Dashboard <https://cova.nl/en/oil-dashboard-netherlands/>
30 T&E (2026): eSAF made in Europe – A source of jobs, growth and energy security

since 2009. This has increased dependence on imported diesel and jet fuel. The combination of new refining capacity outside Europe and declining European oil product demand is expected to place further pressure on refinery margins and drive additional rationalisation cycles.

According to Wood Mackenzie, approximately 50% of refinery sites may be at risk, further increasing import dependency by 2040³¹. HCSS estimates that under a full-scale conflict scenario, up to 35% of Dutch aviation fuel demand and 13% of Dutch road fuel demand could remain unmet by 2030. By 2040, maintaining fuel resilience becomes increasingly difficult because Dutch and European refining capacity is expected to decline significantly, while fossil fuels are still expected to account for more than half of aviation and road fuel demand.

Storage and strategic reserve composition:

Current EU and Dutch emergency reserves are held predominantly as crude oil rather than finished jet fuel, comprising approximately 4.1 Mt of crude oil compared with only 13 kt of jet fuel²⁹. Their practical value during an aviation supply disruption therefore depends on the availability of refining capacity. In addition, EU and IEA reserve release mechanisms are primarily designed for economic disruptions, with military consumption not explicitly included as a release trigger.

This creates vulnerabilities to geopolitical shocks and broader market disruptions. The 2026 Middle East conflict triggered one of the most severe oil supply disruptions in recent history, highlighting the structural risks associated with Europe's dependence on imported energy. The combined effects of the closure of the Strait of Hormuz and targeted strikes on Gulf production and export infrastructure placed significant upward pressure on global oil prices.

Europe's ability to source alternative supplies was further constrained by competing global demand, as redirected shipments were absorbed by Asian markets facing their own supply shortages. According to IATA's Jet Fuel Monitor, jet fuel prices reached EUR 180.08 per barrel on 27 March 2026, representing an increase of up to 117% relative to the annual average.³² This reflected the sharp rise in crude oil prices following the conflict in Iran and disruptions to transport through the Strait of Hormuz. Europe's major airlines indicated that rising fuel costs would increase passenger fares³³.

As the global aviation fleet remains overwhelmingly dependent on fossil fuels, the sector is highly exposed to fuel price volatility and supply disruptions.

The transition to e-fuels does not eliminate external dependencies. Rather, it reshapes and diversifies them. By producing 250 kt of eSAF per year from renewable methanol, eFR introduces a dedicated source of non-fossil aviation fuel into Dutch and European supply systems that operates independently of crude oil imports, refinery product-slate constraints, and Gulf export routes.

eFR's feedstock supply chain, however, also introduces dependencies of its own, particularly if methanol is sourced outside Europe. These dependencies may be more geographically diversified than current crude oil import routes and could provide flexibility to source European-produced green, and where required, grey methanol for energy security purposes.

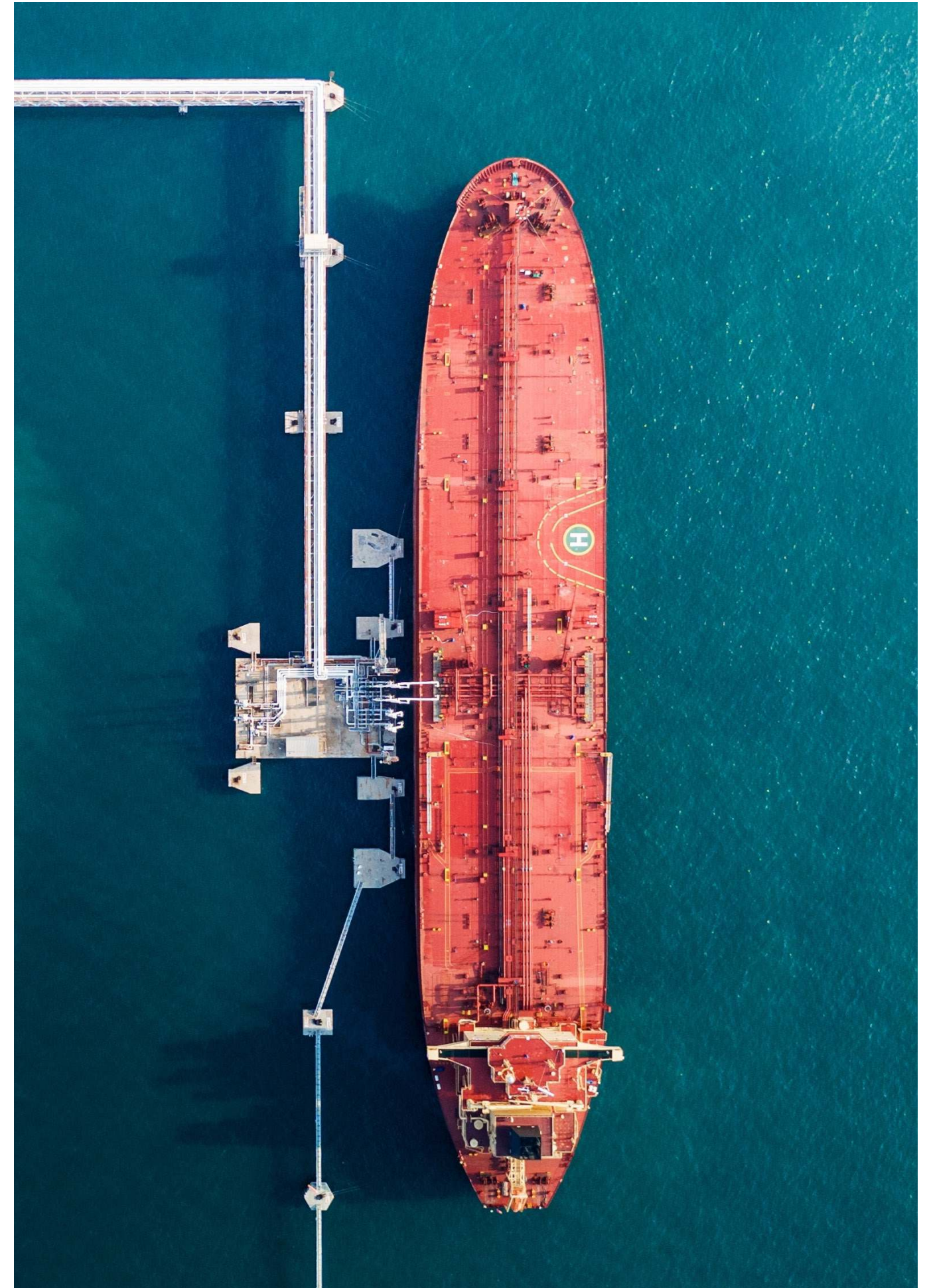
In addition, eFR is expected to provide dedicated domestic storage capacity for both methanol and finished jet fuel. This creates additional buffering capacity for feedstock and distribution-ready aviation fuel that is independent of conventional refining systems.

Scaling domestic eSAF production could therefore reduce exposure to external disruptions and strengthen energy security³⁴. A broader renewable methanol value chain could also reduce exposure to crude oil price volatility while strengthening long-term resilience through a more diversified supply portfolio.

Current eSAF feedstock and energy markets, including electricity and hydrogen, remain subject to uncertainty and potential price volatility. However, this may decrease over time as renewable energy systems mature, deployment expands, and learning effects and economies of scale improve cost efficiency across the value chain.

B2. Strengthening of strategic assets and geopolitical positioning

Europe and the Netherlands face several challenges that may affect their geopolitical and economic competitiveness. The Draghi Report highlights³⁵ the need for the EU to strengthen strategic autonomy in order to remain competitive. Key priorities include reducing external dependencies in energy, raw



31 Wood Mackenzie (2024): [Assessing refineries at risk of closing](#)

32 IATA (2026): [IATA - Fuel Price Monitor](#)

33 The Guardian (2026): [Europe's biggest airlines say fuel price spike caused by Iran war will drive up fares | Airline industry | The Guardian](#)

34 Transport & Environment (2026): [Iran conflict costing shipping industry €340 million a day | T&E](#)

35 Draghi (2026): [The Draghi report on EU competitiveness](#)

materials, defence, digital infrastructure and high-technology supply chains.

The report argues that Europe can no longer rely extensively on market structures shaped primarily by Russia, China or the United States if it aims to maintain strategic relevance and autonomy. It calls for a revised economic model centred on large-scale investment, coordinated industrial policy and stronger economic security.

Dutch policy thinking broadly aligns with this direction. The Wennink Report highlights³⁶ the importance of strengthening the Netherlands' strategic assets and economic positioning. Within this framework, the Port of Rotterdam plays a critical role through its industrial cluster, logistics infrastructure and knowledge ecosystem, serving as an important gateway for European energy and economic security.

The recently published EU Port Strategy³⁷ similarly identifies major ports such as Rotterdam as critical strategic hubs.

One example of supporting infrastructure is the national HyNetwork hydrogen system, which links industrial regions with neighbouring countries. Although most hydrogen used for eFR is expected initially to be embedded in imported methanol rather than supplied directly through domestic hydrogen production, pipeline infrastructure provides flexibility as European hydrogen production expands over time.

B3. Realistic boundaries of self-sufficiency and the reshaping of external dependencies

Developing a methanol-to-eSAF value chain creates new dependencies on both European and non-European countries. Producing 250 kt per year of eSAF is expected to require approximately 750 kt per year of renewable methanol. Renewable methanol production, in turn, requires substantial renewable electricity inputs to produce green hydrogen.

Although renewable sources accounted for approximately half of Dutch electricity generation in 2024, further development continues to face constraints including grid congestion, curtailment, spatial limitations and nitrogen permitting restrictions. In addition, hydrogen production costs are largely driven by electricity prices, which remain comparatively higher in the EU than in regions such as South America and Asia.³⁸

³⁶ Wennink (2025): [The Route to future prosperity: A strong Netherlands in a relevant Europe](#)

³⁷ European Commission (2026): [Commission unveils EU Ports Strategy to strengthen competitiveness, security and sustainability of European ports- Mobility and Transport](#)

As a result, both the EU and the Netherlands are likely to remain dependent on certain external supply chains, including those associated with renewable energy technologies and components.

This question of strategic autonomy is increasingly relevant because managing external dependencies to maximise competitiveness has become an explicit objective in policy initiatives such as the Draghi Report, the Wennink Report and the European Port Strategy discussed above.

Continued reliance on concentrated external dependencies may increase the risk that critical technologies and industrial capabilities shift away from strategic European locations. This could reduce the likelihood that future clean technology ecosystems become anchored in locations such as the Port of Rotterdam.

Main findings

- European jet fuel supply faces structural vulnerabilities. Approximately 95% of Europe's jet fuel supply ultimately depends on external sources, while refining capacity is expected to decline further towards 2040. Around 50% of refining capacity may be at risk, while strategic reserves remain concentrated in crude oil rather than finished jet fuel.
- eFR diversifies rather than eliminates external dependencies. By producing 250 kt per year of eSAF and providing storage capacity for renewable methanol and finished jet fuel, eFR adds domestic production and buffering capacity that is independent of crude oil imports, Gulf export routes and refinery product constraints. Feedstock dependencies remain but draw on a more geographically diverse supply base.
- eFR strengthens the Netherlands' strategic positioning by anchoring a clean molecule value chain in Rotterdam during a period of structural change in the fossil refining sector.
- In the longer term, resilience depends less on self-sufficiency and more on the quality and diversity of supply portfolios. eFR contributes to this diversification, while delayed action may increase the risk of losing first-mover advantages in clean molecule development and production.

C. Contribution to accelerating EU's emerging eFuel industry and competitiveness

This section addresses the research question:

Which factors does the eFR facility enable that could support the scaling of innovation hubs and accelerate the e-fuel industry?

This is assessed through analysis of the competitive value of eFR.

The analysis is structured around three dimensions:

- C1. Knowledge and technology spillovers
- C2. Reinforcing an emerging synthetic cluster
- C3. Improving investor confidence and Dutch investment climate

C1. Knowledge and technology spillovers

Most eSAF projects currently under development in the EU are smaller in scale, typically using different conversion technologies at capacities of 100 kt per year or less. At approximately two to three times this scale, eFR represents a significant increase in size that could generate important knowledge and technology spillovers. Although eFR is not expected to hold foundational patents, as these are likely to sit with Honeywell UOP, operating the EU's first methanol-to-jet (MtJ) facility at this scale may create integration and operational expertise across several areas:

- Plant design and systems integration at industrial scale
- Real-world performance data under commercial operating conditions
- Start-up and ramp-up experience for first-of-a-kind conversion processes
- Operations and maintenance best practices
- Licensor-contractor-operator learning loops that benefit the entire ecosystem

These spillover effects could support the wider EU industry. As owner and operator, Power2X may develop capabilities as a system integrator, supporting future developers, engineering, procurement and construction contractors, and plant operators in the design, optimisation and operation of subsequent facilities. This could strengthen the broader ecosystem of industrial

³⁹ WITS: [Netherlands Methanol imports by country in 2023](#)

⁴⁰ Offshore Energy (2026): [Methanol and ethanol storage expansion project begins at Port of Rotterdam](#)

⁴¹ Port of Rotterdam (2025): [Metafuels en Evos werken samen om de productie van eSAF in Rotterdam te versnellen | Port of Rotterdam](#)

⁴² SkyNRG (2026): [SkyNRG announces Financial Close and starts construction on its first Sustainable Aviation Fuel plant DSL-01 in Delfzijl the Netherlands – SkyNRG](#)

and engineering expertise in the Port of Rotterdam as the EU market develops.

C2. Reinforcing an emerging synthetic fuel cluster

eFR may contribute to the development of a clean molecule hub centred on methanol in Rotterdam and more broadly within the Netherlands. The Netherlands currently imports approximately 2.8 Mt of grey methanol³⁹. This methanol serves as an important feedstock for chemical manufacturing within industrial clusters such as Botlek, Europoort and Geleen. Rotterdam also functions as an important bunkering hub, where methanol is increasingly being considered as a lower-emission fuel option.

Several developments are occurring in parallel that support the emergence of a clean fuel hub in the Netherlands:

- Evos Rotterdam has kicked off an expansion project for (low-carbon) methanol and ethanol storage at the Port of Rotterdam⁴⁰. Here Metafuels and Evos are collaborating to develop the Turbe eSAF production plant based on Methanol to Jet⁴¹.
- Blue Circle Olefins has selected Rotterdam as the site for a commercial methanol-to-olefins plant.
- The Port of Rotterdam published its Port Vision to 2050 in Q1 2026, committing to become the most competitive, sustainable and resilient port in Europe, with clean fuels and circular production as central pillars of that strategy.
- Beyond the methanol-to-jet pathway, the Netherlands is also strengthening its position as a broader SAF production hub. In April 2025, Neste began SAF production at its Rotterdam refinery. In February 2026, SkyNRG⁴² announced financial close for its SAF production facility in Delfzijl. Once operational in 2028, the facility is expected to produce 100,000 tonnes of SAF annually, alongside 35,000 tonnes of sustainable by-products using the HEFA pathway.

C3. Improving investor confidence and the Dutch investment climate

The Wennink Report highlights the importance of maintaining a stable and attractive investment climate in order to retain and attract large-scale industrial investment while sustaining Dutch leadership in enabling technologies.

eFR aligns with several of these priorities:

- Developing the facility may signal long-term commitment to a future-proof industrial base and reinforce Rotterdam's role as a hub for clean molecules.
- As a first-of-a-kind project, eFR could demonstrate the deployment and scaling of Power-to-X conversion technologies at commercial scale.

The Dutch investment climate currently faces pressures linked to rising costs, grid congestion and regulatory uncertainty⁷. These challenges have already affected investment decisions. For example, Shell⁴³ and BP⁴⁴ halted construction of large biofuel facilities in the Netherlands, citing an unfavourable investment climate.

The European Commission and the Dutch government have begun addressing challenges identified in both the Draghi and Wennink reports, although significant barriers remain. Investment in critical technologies and industrial capabilities within clusters such as the Port of Rotterdam may therefore play an important role in maintaining long-term competitiveness. Without continued investment, there is a risk that industrial activity and related technological capabilities could increasingly shift to alternative locations outside the Netherlands.

Main findings

- Although eFR does not own foundational patents, its scale and operational characteristics may generate knowledge and technology spillovers that support the wider EU eSAF industry.
- eFR could strengthen the Dutch innovation ecosystem by supporting the development of emerging clean molecule value chains and reinforcing industrial clustering effects.
- The project may contribute to strengthening Rotterdam's position as a hub for clean fuel production and related industrial activities.
- As a first-of-a-kind commercial facility, eFR may also contribute to investor confidence by demonstrating the deployment and scalability of Power-to-X technologies.

3.2 Wider system effects

The eFR facility does not operate in isolation. Its development creates dependencies and linkages across an emerging value chain, from upstream feedstock suppliers to downstream off-takers and logistics operators. This section maps those cluster dependencies and assesses eFR's impact on the Dutch energy system.

A. Cluster dependency of companies linked to the eFR facility

This section addresses the research question:

How does the eFR facility affect its surrounding value chain?

This is assessed through analysis of relationships between actors upstream and downstream of the facility.

Upstream dependencies

The facility's sourcing strategy reflects a cost-driven reality. As discussed in Section 3.1, renewable energy remains more expensive in the Netherlands than in many other regions. eFR can therefore source methanol from the EU, Asia (including India and China), the Americas and the UAE via maritime shipping. Over time, a significant and growing share of renewable methanol supply is expected to come from European producers, as the EU renewable methanol industry scales up in response to demand from aviation, shipping and the chemical sector, and as European renewable electricity costs continue to decline. This would further strengthen the European value chain captured around eFR. While the Port of Rotterdam is expanding its renewable energy and green hydrogen capacity, which may supply future volumes, near-term economics currently favour global sourcing.

This sourcing strategy does not diminish the facility's strategic value. Rather, it reflects the broader argument that eFR reshapes energy dependencies into a more diversified and resilient form, rather than eliminating them entirely. A globally diversified methanol supply portfolio reduces concentration risk compared with the current reliance on a limited number of crude oil exporters and declining EU refining capacity. In addition, the facility enables investment in approximately 750 ktpa of methanol production capacity and 2 GW of renewable energy deployment.

Downstream dependencies

eFR's downstream market spans five distinct customer segments. Together, these segments create the demand base that underpins the facility's bankability. In turn, each segment benefits from eFR's ability to deliver eSAF at scale.

- **Fuel suppliers** - Fuel suppliers are the mandated parties under ReFuelEU and are therefore required to blend mandated percentages into fuel supplied to airlines. Their activities typically include fuel sourcing, transportation, blending, certification, airport storage and into-wing fuelling services. At Schiphol, jet fuel reaches aircraft through an underground hydrant system supplied by pipeline-linked terminals in the Amsterdam-Rotterdam region. SAF and eSAF use this same infrastructure, meaning all fuel passes through fuel suppliers regardless of any direct agreements between airlines and producers. Fuel suppliers are therefore eFR's most important customer segment and act as key gatekeepers for large-scale domestic deployment.
- **Airlines** - Most airlines purchase fuel directly from fuel suppliers as the end users of the fuel. Some airlines also operate their own fuel supply services at major hubs, allowing them to negotiate contracts and secure more favourable pricing through higher volumes.
- **Air cargo operators** - Cargo operators such as DHL and FedEx operate long-haul, high-frequency networks with substantial fuel demand. Some manage their own fuel supply arrangements, purchase directly from fuel suppliers, or establish sustainability targets for partner airlines transporting their cargo, including passenger airlines.
- **Traders** - Like fuel suppliers, several traders are mandated parties under ReFuelEU. In addition to their role as fuel suppliers, traders can bridge supply gaps by aggregating volumes from multiple producers and enabling delivery to demand centres.
- **Military** - Military fuel procurement prioritises availability, versatility, logistics efficiency and operational effectiveness. As eSAF is a drop-in fuel compatible with existing infrastructure, it can support dual-use benefits across civil and defence applications. Reliable access to fuels for strategic sectors such as aviation and defence is increasingly becoming a geopolitical consideration. In addition, the methanol-to-jet process is compatible with all methanol types (fossil, bio and renewable methanol),

allowing greater flexibility during periods of supply disruption or geopolitical instability. In November 2025, the European Commission presented the Military Mobility Package, which explicitly referenced increased use of SAF and eSAF as part of its diversification strategy⁴⁵.

- **Co-products: broadening revenue and value-chain linkages** - The methanol-to-jet conversion process produces two co-products alongside eSAF: eNaphtha and eDiesel. eNaphtha can serve as a renewable feedstock for the plastics and chemicals industry, connecting eFR to the broader clean molecules import and production value chain supporting Rotterdam's future industrial cluster. eDiesel provides a renewable fuel option for maritime and road transport.

B. Wider energy system effects

Beyond direct value-chain linkages, eFR interacts with the wider Dutch and EU energy system in two ways: through its relationship with grid congestion and through its environmental impacts.

Main findings

- eFR sits at the centre of an emerging industrial value chain that extends in both directions.
- Upstream, the facility creates demand for methanol imports and related infrastructure, as well as for green hydrogen, CO₂ capture and renewable methanol production.
- Downstream, a diversified customer base consisting of fuel suppliers, airlines with self-supply capabilities, cargo operators, traders and military users can provide the demand required to reach financial close while supporting the decarbonisation of their operations.
- Co-products such as eNaphtha and eDiesel extend the facility's relevance into the chemicals, maritime and road transport sectors, broadening its industrial significance beyond aviation.

43 NOS (2025): [\(Shell stopt definitief met bouw van biobrandstoffabriek in Rotterdam\)](#)

44 Nieuwsbladtransport (2025): [Ook BP stopt met bouw van biobrandstoffenfabriek in haven Rotterdam | NT](#)

45 European Commission (2025): [Military mobility - Mobility and Transport European Commission](#)

Grid congestion

Grid congestion in the Port of Rotterdam can limit companies' ability to secure the electricity connections required for green hydrogen production, methanol synthesis, and eSAF conversion, depending on location. The eFR facility itself depends on the expansion of the Gerbrandyweg substation, which in turn relies on wider grid capacity upgrades. However, eFR's design mitigates rather than exacerbates this challenge. Because the facility can source methanol from other regions instead of producing hydrogen domestically, it avoids placing substantial additional demand on an already congested grid.

The use of methanol at the volumes envisaged for eFR avoids the need for approximately 2 GW of additional Dutch wind capacity to produce an equivalent amount of energy domestically, based on 750 ktpa of methanol and an offshore load factor assumption of 40%. For context, this represents around a third of the planned IJmuiden Ver Wind Farm Zone build-out, the Netherlands' largest planned offshore wind development, with approximately 6 GW of capacity across the Alpha, Beta, Gamma-A and Gamma-B sites, covering around 609 km² of the North Sea. Avoiding 2 GW of additional capacity also avoids the associated offshore turbines, foundations, export cables and onshore conversion stations, as well as the multi-year permitting requirements and supply chain demands associated with each additional gigawatt.

Beyond the headline wind capacity, a fully domestic methanol pathway would also require the system around it: grid connection, firming through battery

Main findings

The wider system effects of eFuels Rotterdam extend beyond the facility's direct output:

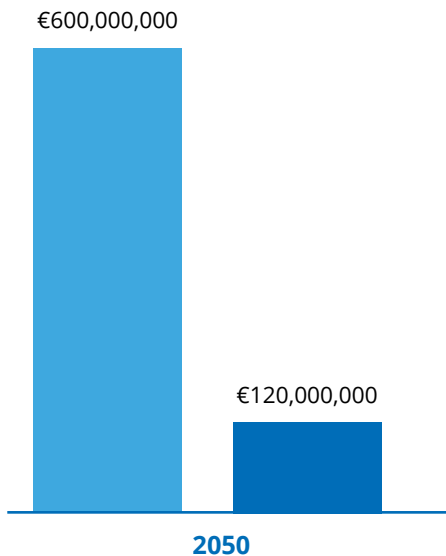
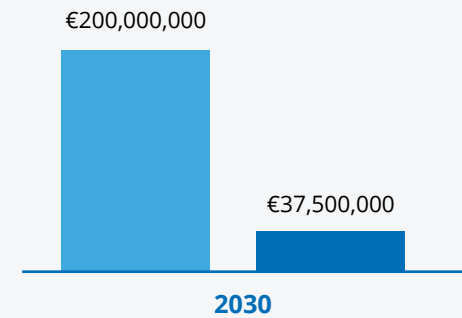
- By sourcing methanol from other regions, the project avoids adding pressure to an already constrained electricity grid and reduces demand for scarce Dutch renewable generation capacity, equivalent to approximately 2 GW of installed renewable capacity.
- From a climate perspective, the facility has the potential to avoid up to 550-750k tonnes of CO₂ emissions annually, translating into an estimated monetised societal benefit of approximately €200 million in 2030, increasing to €600 million by 2050 at EU level.
- The environmental performance of eSAF depends on production pathways and locations, additional value chain emissions, including methanol and eSAF transport, and whether displaced fossil fuels are consumed in alternative markets.

storage or hydrogen buffering, and dedicated CO₂ capture and transport infrastructure.

This is particularly relevant at a time when the Dutch electricity system is already heavily constrained. TenneT's national waiting list alone includes 212 offtake

Figure 3.3 Monetised climate benefits

- Monetised climate benefit (all member states)
- Monetised climate benefit (Dutch level)



requests, totalling 38 GW of grid expansions⁴⁶. A further 14,000 regional requests, representing 9 GW, are on the waiting lists of Liander, Enexis and Stedin⁴⁷. To address this backlog and accommodate additional offshore wind capacity, TenneT Netherlands plans to invest €43 billion in onshore and offshore grid infrastructure between 2025 and 2029. Longer-term plans also outline investment of approximately €200 billion in strengthening the Dutch electricity network by 2050⁴⁸.

Environmental effects

Switching from fossil jet fuel to synthetic jet fuel produced using green hydrogen and captured CO₂ can reduce Well-to-Wake (WtW) greenhouse gas emissions by 70% to 95%⁴⁹. The upper bound assumes methanol produced entirely from renewable electricity and captured CO₂, either close to Rotterdam or transported

using renewable fuels. The lower bound reflects more conservative assumptions regarding emissions across the value chain, including the transport of methanol to Rotterdam and eSAF to airports.

One tonne of fossil jet fuel produces 3.16 tonnes of CO₂⁵⁰. Assuming all eFR output is used as jet fuel and achieves the 95% upper-bound reduction, the facility would avoid up to 550-750k tonnes of CO₂ emissions annually.

It is important to note that indirect emissions from grid electricity can reduce environmental benefits if project design is weak⁵¹. More fundamentally, e-fuels do not inherently guarantee an absolute reduction in global emissions because their climate performance is shaped by wider market dynamics⁵². When eSAF

displaces fossil kerosene in one region, unused fossil fuel does not necessarily remain unexploited. It may instead be redirected to markets where demand continues to support consumption.

This market-mediated displacement effect means that emissions reductions achieved in one region may be partially offset by increased fossil fuel use elsewhere. The environmental performance of eSAF therefore depends not only on technological parameters and electricity carbon intensity, but also on whether supply-side constraints or coordinated policy mechanisms prevent displaced fossil fuels from entering alternative markets.

Monetised climate benefits

To quantify the societal value of these emissions reductions, we apply the European Investment Bank's (EIB) shadow carbon price, a monetised estimate of the climate damage associated with emitting one tonne of CO₂. Unlike the market-based price under the EU Emissions Trading System (EU ETS), the shadow price aims to capture the full long-term societal cost of carbon emissions. The EIB projects this value at €250 per tonne in 2030 and €800 per tonne in 2050 (at 2025 price levels), consistent with a pathway that limits global warming to a maximum temperature increase of 1.5°C⁵³.

At EU level, replacing fossil jet fuel with eFR's eSAF output generates a monetised climate benefit of approximately €200 million per year in 2030, increasing to around €600 million per year by 2050. Distributed across

EUROCONTROL's projected EU flight volumes, more than 12 million flights in 2030 and approximately 16 million in 2050, this equates to around €15 per flight in 2030 and €37 per flight in 2050. These values per flight remain relatively modest because the total benefit is distributed across the entire EU aviation system⁵⁴.

At Dutch level, assuming that 20% of eFR's production is allocated to Dutch airlines and airports, and taking into account the government's cap of 478,000 flights per year, the monetised benefits amount to approximately €37.5 million in 2030 and €120 million in 2050. This corresponds to approximately €79 per flight in 2030 and €251 per flight in 2050. The higher values per flight reflect the concentration of benefits across a smaller national flight volume.

3.3 Conclusion

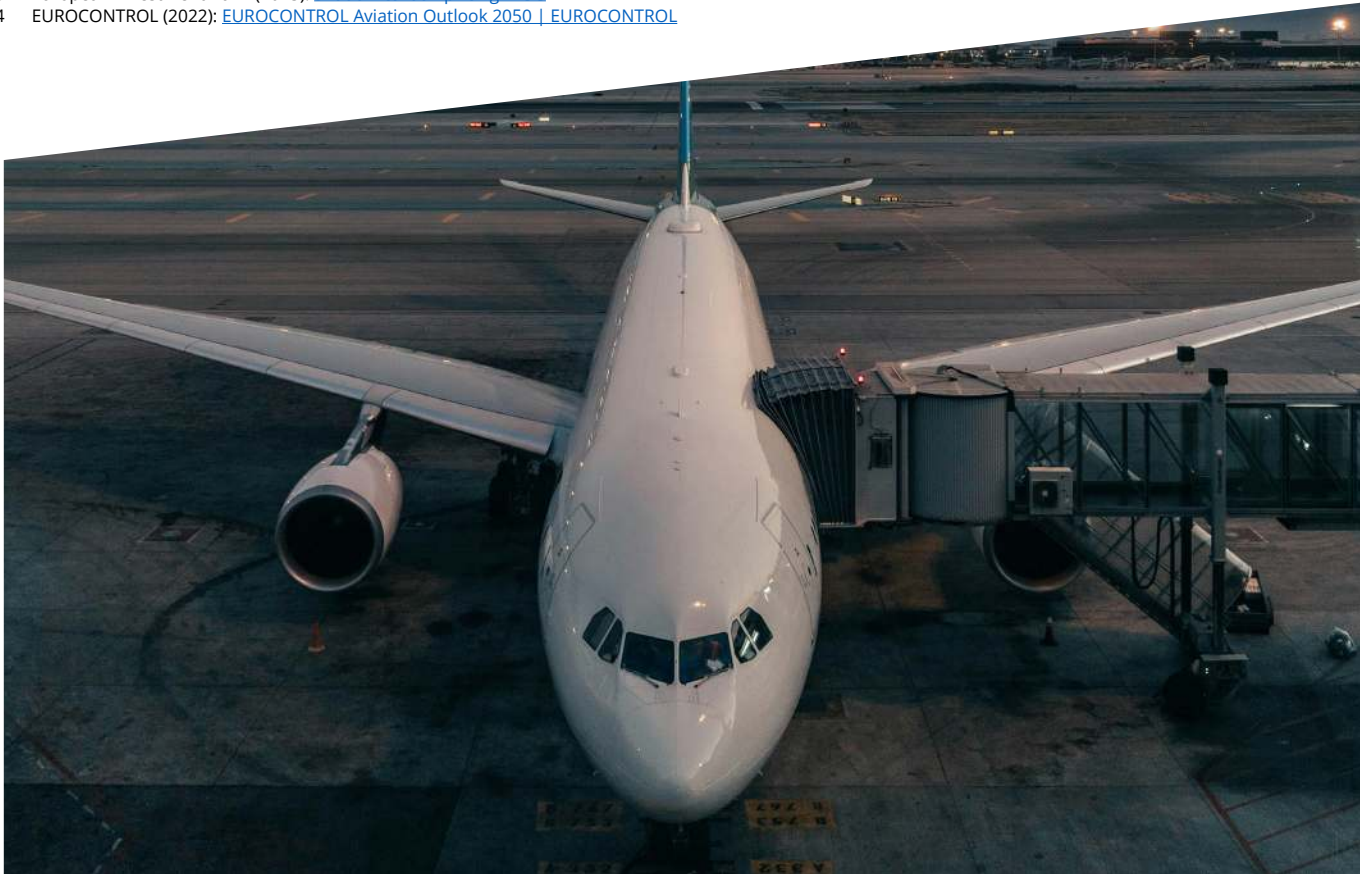
The spillover impacts are summarised in the overview below. Collectively, these findings indicate that eFR can generate broader societal value through supporting compliance with SAF mandates, strengthening Europe's strategic energy resilience, contributing to the development of a competitive e-fuels industry and enabling substantial system-wide CO₂ emissions reductions. Together, these effects position the project as a potentially important component of the EU's transition towards more sustainable aviation.

Table 3.1 Spillover impacts overview

Section	Research question	Key impacts
Strategic positioning A. The contribution to policy targets	To what extent does the eFR facility contribute to meeting relevant policy targets?	250 kt eSAF/year, supplying 100% of the Dutch sub-mandate; positions eFR as a decisive early-mover enabling mandate compliance and market formation.
Strategic positioning B. Energy security and strategic autonomy	How does eFR influence dependence on imported jet fuel and energy security?	eFR diversifies away from geopolitically exposed fossil supply chains and reduces long-term volatility exposure. Creating a dual-use fuel that can serve both civil and military aviation, enhancing operational flexibility and strategic autonomy
Strategic positioning C. Contribution to accelerating EU's emerging Efuel industry and competitiveness	Which factors does eFR enable to scale innovation and EU e fuel competitiveness?	First of a kind >250 kt methanol to jet facility in the EU; anchors and strengthens the chemical fuel cluster in Rotterdam and improves investor confidence through scale, learning and replication effects.
Value chain & system effect A. Cluster dependency of companies linked to eFR facility	How does eFR affect upstream and downstream value chain development?	Activates 750 ktpa of renewable methanol
Value chain & system effect B. Wider energy system effects	How does eFR interact with the wider energy and climate system?	Avoids ~2 GW domestic renewable electricity demand; Can avoid up to ~750 kt CO ₂ /year; Based on shadow price calculations, the monetised benefits are €200m (2030) rising to €600m (2050) at EU level; For the Dutch perspective this monetised benefit equals €37.5m (2030) rising to €120m (2050).

46 Netbeheer Nederland (2025). Aanbevelingen over omgang met wachtrijen.
47 Netbeheer Nederland (2025). Wachtrijsten groeien, meer inzet op flexibel gebruik essentieel.
48 Strategy& (2025). Financiële Impact Energietransitie voor Netbeheerders.
49 Argus (2026): Methanol to Jet: SAF Pathway for Aviation Decarbonisation | Argus Media
50 EUROCONTROL (2026): Amount of emissions released by fuel burn – EUROCONTROL Standard Inputs for Economic Analyses
51 Energy Solutions Intelligence (2026): E-Kerosene (Power-to-Liquid) 2026: The Path to Unlimited Aviation Fuel | Energy Solutions Intelligence
52 Micheli, M.; Moore, D.; Bach, V.; Finkbeiner, M. Life-Cycle Assessment of Power-to-Liquid Kerosene Produced from Renewable Electricity and CO2 from Direct Air Capture in Germany. Sustainability 2022, 14, 10658. <https://doi.org/10.3390/su141710658>

53 European Investment Bank (2025): Shadow carbon pricing - E3G
54 EUROCONTROL (2022): EUROCONTROL Aviation Outlook 2050 | EUROCONTROL





Annex

A. Methodological steps economic impact analysis

This annex presents the methodological steps taken to estimate the indirect and induced value of eFR in the economic impact analysis.

Estimation of indirect value added

The indirect value added of Power2X is estimated in five steps:

- 1. Explore multipliers in the literature - To gain a preliminary understanding of important factors contributing to the indirect value of Power2X, multipliers from the literature were analysed. In addition, multipliers for the Dutch refinery sector were calculated to understand which factors contribute the most to the indirect value added. In the end, we concluded that the eFR production is too different from the refinery processes or the chemical industry to apply the multipliers from such sectors to Power2X, and we decided to add eFR production as a new industry to the input-output table.
- 2. Identifying relevant types of costs and suppliers - To add eFR production to the input-output table, we first estimated the value of domestic purchases from the various suppliers. These estimates were based on the structure of purchases from different suppliers documented in the literature.
- 3. Converting costs to the Power2X business case - The data from the literature apply to different plants, with different capacity levels, with data from the past, from countries with different currencies and purchasing power. We therefore converted the costs from the literature to data that are relevant for Power2X, at 2025 prices. About the share of imports, we made the baseline assumption that all feedstock is imported and that all other purchases are done domestically.
- 4. Adding eFR production as a new industry to the input-output table - To add the eFR production as a new industry to the input-output table:

- A value chain column with annual domestic purchases from other industries was added to the core input-output table.

- A value chain row with annual domestic sales to other industries was added to the core input-output table.
- The values of imports, taxes (minus subsidies; but absence of subsidies is assumed for this study), labour costs and operational surplus were added to the non-core input blocks.
- The value of exports was added to the non-core final demand (output) block.

- 5. Automate the indirect value added calculations - The columns of the core input-output block are then divided by the total values of all inputs to estimate unit responses to purchases. The resulting block is called the input coefficient matrix or simply the A-matrix. The first round of impacts is then represented by A, the second round by A2, the third round by A3, and so on. The indirect output is the sum of all these impacts; Indirect output = Direct output x (A + A2+ A3 ...). The value of all rounds A + A2 + A3 ... converges to the so-called Leontief matrix (I – A)⁻¹, where I is the unit matrix and (...) ⁻¹ indicates the matrix inverse of (...).

Estimation of induced value added

A similar analysis is done to calculate the induced value of an industry but with an additional row for the labour cost and an additional column consumer spending; taking into account that employer social security contributions also in the end increase consumer spending.

B. Estimation of costs

This annex presents how the costs for the calculation of the direct value are estimated for eFR. For an estimate of the costs, two papers were considered: studies from Gupta et al. (2023)¹³ for a hydrogen plant and Chen et al. (2021)¹⁴ for a methanol-to-olefins plant. The latter

study is more relevant to identifying the relevant types of costs (as its operations are more comparable with eFR), but the former study has the advantage of a more detailed breakdown of the suppliers.

Table B.1 Estimated costs per year for eFR and different plants of comparable size in literature

Item	From NACE industry	Cost per year (% of total cost)		
		Hydrogen	Chen	eFR
Operating supplies	C20 Chemical industry	--	14.9%	7.5%
Machine maintenance	C33 Machinery industry	9.4%	9.9%	14.0%
Energy	D35 Electricity	64.1%	-3.3%	13.5%
Water	E36 Water	0.4%	--	--
Construction maintenance	F41-F43 Construction	5.3%	6.6%	5.5%
Pipeline fees	H49 Pipeline transport	--	26.4%	1.6%
Warehousing	H52 Transport support	--	--	12.1%
Telecom	J61 Telecommunications	0.4%	--	0.4%
IT services	J62-J63 IT services	1.6%	--	1.6%
Interest	K64 Financial services	1.6%	16.5%	10.8%
Insurance	K65 Insurance	3.7%	--	6.7%
Land lease	L68 Land rent/lease	1.6%	--	0.7%
Legal, accounting	M69 Legal, accounting	2.9%	1.7%	2.8%
Head office, consulting	M70 Management consulting	2.9%	--	2.8%
Laboratory charges	M71 Engineering, laboratory	--	0.2%	0.1%
Patents and royalties	M72 R&D	--	27.3%	13.6%
Communication	M73 Communication	0.2%	--	0.2%
Administrative support	N82 Administrative support	6.1%	--	6.2%
Total domestic supply costs	C20-N82	100%	100%	100%

Note: the codes C20-N82 are so-called NACE codes. These codes are necessary to link costs to the industry classification used in Input-Output tables, which are used to estimate the indirect and induced values.

Different capacities

Gupta estimated the costs for a standard unit of a 1 MW hydrogen plant and assumed implicitly that costs are proportional to capacity. The Power2X plant is assumed to correspond to a 250 MW plant. Although in reality, a hydrogen plant and an eSAF plant (and their capacities in MW) are not directly comparable⁵⁵. Gupta reported the costs in US\$, the data are from 2023 and the purchasing power in Switzerland is slightly higher than in the Netherlands. For simplicity, the costs reported by Gupta are multiplied by 250 (capacity of eFR plant) to obtain an initial cost estimate for eFR in this study.

Chen et al. made their cost calculations for a plant of roughly three times the size of the Power2X plant. The plant considered by Chen et al. processes 8,750 kmol/h with an assumed 8,000 operational hours per year. Since 1 metric tonne corresponds to 31.2 kmol, this means that the Chen plant consumes 2,244 kton of feedstock⁵⁶ which is three times as much as the 750 kton of feedstock (renewable methanol) that the Power2X plant is estimated to need. The Chen plant produces 367 kton ethylene per year and 373 kton propylene per year, and an undisclosed quantity of C4+ as a by-product. Thus, the output of the Chen plant is more than 2.5 times the output of 250 kton per year estimated for eFR. For the cost estimates for eFR, the Chen plant is assumed to be 3 times as large as eFR.

Different currencies

For Chen, the costs are from 2019 when the US\$ sold on average for EUR 0.893⁵⁷. The price index of January 2026 compared to January 2019 is 1.307⁵⁸. The most recent data on the purchasing power compared to the US\$ are from 2023 and were 0.730695 for the Netherlands and 13.88 for Taiwan (where the Chen plant is located)⁵⁹. The exchange rates in 2023 were EUR 1.0813 for one US\$ and 33.743 TWD for one US\$, respectively, according to the same Eurostat data on exchange rates. Thus, after correcting for exchange rates, the purchasing power parities are 0.68 for the Netherlands and 0.41 for Taiwan respectively⁶⁰. This means that an average person in America could buy more for the same dollar than someone from the Netherlands and even more so than someone from Taiwan.

Harmonising

The costs from the Chen report are multiplied by 0.64, which is calculated as follows:

- 0.64 =
- 0.33 (the Power2X plant is 3x as small as the Chen plant)
- x 0.893 (US\$ to EUR in 2019)
- x 1.307 (consumer price inflation in the Netherlands, 2019–2026)
- x 0.68 / 0.41 (purchasing power parity correction based on the most recent available data)

As noted earlier, Gupta allocated costs to industries, but Chen et al. did not. Thus, we made assumptions about the allocation of costs to suppliers for the costs reported by Chen. In addition, construction costs were assumed to be evenly distributed between building construction, civil engineering and specialised construction activities (e.g., installation and maintenance of utility connections). We present the costs reported by the two studies after conversion to eFR and compare those with the final estimates.

It can be seen that Chen et al. have more data on engineering aspects, and the estimated costs of Power2X are based on the Chen paper for:

- Operating supplies (mainly chemical reactants)
- Laboratory charges (to confirm the origin of feedstock)
- Royalties and patents (for methanol reforming)

Gupta in his paper on the hydrogen plant has more data on financial aspects, and estimated costs of Power2X are based on this paper for:

- Construction maintenance
- Telecom
- IT services
- Legal, accounting
- Head office, consulting
- Communication
- Administrative support

C. List of abbreviations

Abbreviation	Full form
CapEx / CAPEX	Capital Expenditure
CBS	Centraal Bureau voor de Statistiek (Statistics Netherlands)
CEPS	Central European Pipeline System
EASA	European Union Aviation Safety Agency
eFR	eFuels Rotterdam
EIB	European Investment Bank
EPC	Engineering, Procurement and Construction
ERM	Environmental Resources Management
eSAF	Synthetic Sustainable Aviation Fuel
EU-ETS	EU Emissions Trading System
EZK	Ministry of Economic Affairs
FID	Final Investment Decision
FTE	Full-Time Equivalent
GDP	Gross Domestic Product
GW	Gigawatt
HEFA	Hydroprocessed Esters and Fatty Acids
IATA	International Air Transport Association
ICIS	Independent Chemical Information Service
ITIC	OECD International Transport and Insurance Costs Dashboard
MtJ	Methanol-to-Jet
NACE	Nomenclature of Economic Activities (EU industry classification)
NATO	North Atlantic Treaty Organization
OECD	Organisation for Economic Co-operation and Development
PBL	Planbureau voor de Leefomgeving (Netherlands Environmental Assessment Agency)
PJ	Petajoule
PtX	Power-to-X
RED	Renewable Energy Directive
RVO	Rijksdienst voor Ondernemend Nederland
SAF	Sustainable Aviation Fuel
SDL	Stimulering Duurzame Luchtvaart
STIP	Sustainable Transport Investment Plan

55 A 1 MW gas plant produces 5,000 – 7,500 MWh per year. At 40-50% conversion rate, one kton eSAF would be equivalent to 4,700 – 6,000 MWh per year. The lower bound MW estimate to produce 250 kton eSAF would be 250 * 4,700 / 7,500 = 156.6 MW. The upper bound MW estimate would be 250 * 6,000 / 5,000 = 300 MW, with an average of about 250 MW.

56 8,750 kmol/h x 8,000 hours / 31.2 kmol per tonne = 2,244,000 tonne or 2,244 kton per year.

57 Eurostat, ert_bil_eur_a.

58 Eurostat, prc_hicp_minr, total of goods. The index value for January 2026 was 134.79 and is divided by the index value for January 2019 which was 103.13.

59 World Bank, PPP conversion factor, GDP (LCU per international \$)

60 The Netherlands: 0.730695 / 1.0813 = 0.68. Taiwan: 13.88 / 33.743 = 0.41.



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