

Hydrogen network under severe pressure

Ineffective grant to offset startup losses

2025



Netherlands
Court of Audit

Contents

1. Executive summary | 4

Conclusions and recommendations | 12

2. About this audit | 13

2.1 Audit background | 13

2.2 Audit design | 14

2.3 Roles and responsibilities of the ministers | 14

2.4 Structure of this report | 15

3. Hydrogen network and climate policy | 17

3.1 The how and what of sustainable hydrogen | 17

3.2 Hydrogen in the Netherlands' climate policy | 20

3.3 Hydrogen network to connect industrial clusters | 23

3.4 Management by the Minister of KGG | 25

4. Effectiveness of the grant | 26

4.1 The need for a hydrogen network | 26

4.2 Policy and policy goals timeline | 29

4.3 Effectiveness of grant to cover startup losses | 30

5. Cost estimates of the hydrogen network | 34

5.1 Functions of the hydrogen network cost estimates | 34

5.2 Timeline of the hydrogen network cost estimate | 35

5.3 2021 cost estimate for the hydrogen network | 36

5.4 Draft 2025 cost estimate of the hydrogen network | 42

5.5 Hydrogen network estimates versus investments in individual sections | 43

6. Risk allocation and efficiency 45

6.1 Financial risks in the construction of the hydrogen network | 45

6.2 Options and decisions for hydrogen network grant | 47

6.3 Efficiency of the grant | 49

6.4 What will happen in the regulated period after 2033? | 55

7. Conditions applying to the repurposing of natural gas pipelines | 57

- 7.1 RIVM sets 14 conditions on repurposing | 57
- 7.2 Uncertain percentage of repurposed pipelines | 58
- 7.3 No independent evidence for repurposing | 58

8. Information position of the House of Representatives | 59

- 8.1 Detailed information on network progress | 59
- 8.2 Incomplete information on costs | 59
- 8.3 Incomplete information on repurposing conditions | 60
- 8.4 Complete information on the risks of storage in salt caverns | 61

9. Conclusions and recommendations | 62

- 9.1 Conclusions | 62
- 9.2 Recommendation | 65

10. Response of the ministers and the Court of Audit's afterword | 67

- 10.1 Response of the ministers | 67
- 10.2 Court of Audit's afterword | 69

Appendices | 70

- Appendix 1 Audit question and criteria | 70
- Appendix 2 Methodology | 74
- Appendix 3 Timeline of the policy goals | 75
- Appendix 4 Timeline of the cost estimate | 77
- Appendix 5 Alternative grant options | 79
- Appendix 6 WACCs in SDE++-rounds 2022 and 2023 | 81
- Appendix 7 Dutch funding for hydrogen | 82
- Appendix 8 Terms and definitions | 85
- Appendix 9 Abbreviations | 86
- Appendix 10 References | 87
- Appendix 11 Endnotes | 94

1.

Executive summary

Climate neutral in 2050 – a role for hydrogen

The Netherlands has set ambitious climate goals for 2030 and 2050. To combat climate change and fulfil its international commitments, the Dutch government aims to considerably reduce national greenhouse gas emissions by 2030 and become a zero net emitter by 2050. Emissions can be cut in many ways, one being the replacement of natural gas with green hydrogen (hydrogen produced using renewable electricity).

This report concerns the effectiveness and efficiency of public investment in the development of a national hydrogen network by Hynetwork Services (HNS), a wholly-owned subsidiary of Gasunie, a state-owned enterprise ('Gasunie/HNS'). In keeping with the government's policy on state-owned enterprises, the hydrogen network would thus be under public ownership. The network would connect industry clusters and supply them with green hydrogen. The Minister of Climate Policy and Green Growth (KGG) announced in November 2023 that grant funding of up to €750 million would be available for the construction of the network, which would come on stream in 2030. That grant is the subject of this audit.

The government is promoting the rollout of hydrogen by means of grants, loans, guarantees, tax schemes and other financial instruments. A total of €11 billion will be released from the budget over a period of 6 years to support the production and import of sustainable hydrogen, its use by customers, the development of storage facilities and development of a national hydrogen network. The many aspects of each transaction must be compatible. This, however, may not always be the case. Green hydrogen production and import, for instance, are falling short of expectations, as is industrial demand for hydrogen.

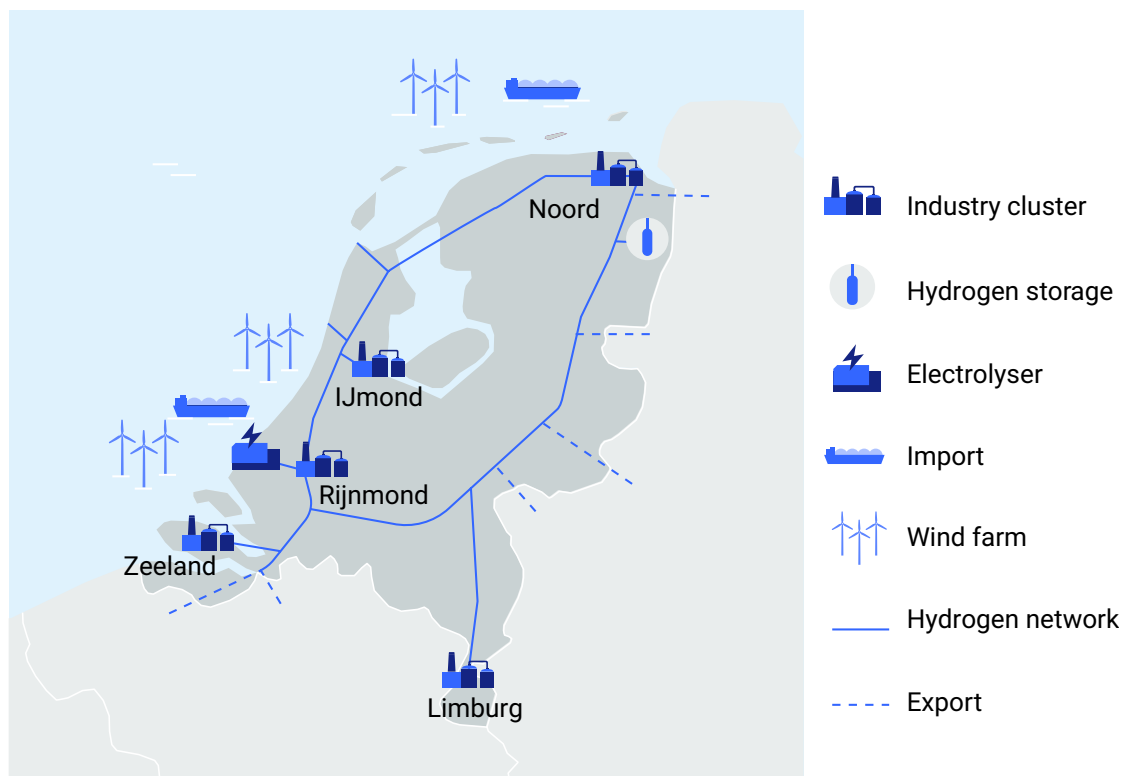
In this report, we look at the influence this is having on supply, demand and the development of infrastructure.

The Dutch hydrogen network

The hydrogen network will be some 1,200 km long and will connect 5 industry clusters, the import terminals and a hydrogen storage facility in Zuidwending (Groningen province). In Rotterdam (1 of the 5 industry clusters) Shell is the only company in the Netherlands that is currently building a 200 megawatt (MW) electrolyser. The network will also export hydrogen to Antwerp and the Ruhr area through international connections with Belgium and Germany. In the longer term, the network may also connect regional industries in a sixth cluster. The hydrogen network will be constructed in 15 distinct sections. Gasunie/HNS is currently building the Rotterdam Hydrogen Network (WNR). This is the first, and to date only, section that Gasunie/HNS is building.

Figure 1 *The Dutch hydrogen network*

The hydrogen network enables national and international transport and storage



Construction delayed and more expensive

Construction of the hydrogen network has been delayed by 2 years and will cost far more than projected. The most recent cost estimate, from February 2025, is now €3.8 billion, against an original estimate in 2021 of €1.5 billion. The increase is in part to higher steel prices, less repurposing of natural gas pipelines and stricter sustainability requirements.

Construction and operation is a Service of General Economic Interest

The Minister of KGG has classified the construction and operation of a national hydrogen network as a Service of General Economic Interest (SGEI) and has made Gasunie/HNS responsible for delivering the SGEI until hydrogen transport is regulated. As part of the European hydrogen and gas decarbonisation package, regulation will come into force no later than 1 January 2033, when a regulator will have to be appointed. In the Netherlands, the minister of KGG has designated the Authority for Consumers and Markets (ACM) as the future regulator. Until then, the Minister of KGG will perform a number of regulatory tasks that the ACM will assume in 2033 at the latest. They concern:

- the transport fee charged by Gasunie/HNS;
- a reasonable return for Gasunie/HNS;
- the efficiency of Gasunie/HNS's investment and operating costs.

Hydrogen has many uses but electrification is gaining ground

Hydrogen has been used for many years in the Netherlands in the fertiliser industry to produce ammonia, by refineries in cracking and desulphurisation processes, and in industrial chemical processes. The hydrogen is produced from natural gas, which inevitably involves the release of CO₂. If the Netherlands is to meet its sustainability goals, it must use green hydrogen or at least capture and store CO₂ emissions. The government sees hydrogen as an opportunity to make industry more sustainable, and has identified applications in shipping, aviation, mobility (passenger and freight transport) and the built environment (heating). Yet several potential uses of hydrogen have lost their appeal due to recent advances in electrification. Homes will be heated by means of heat pumps or heat networks and electric vehicles are becoming the norm. Batteries are also making great strides in the storage of green electricity. These developments weaken demand for green hydrogen.

Harder and harder to make energy-intensive industry more sustainable

In 2023, energy-intensive basic industries such as refineries, chemical plants, steel producers and fertiliser manufacturers accounted for nearly half of all energy demand in the Netherlands. It is uncertain whether these industries will remain in the

country. Several chemical factories, such as Vynova in Chemelot and Westlake, LyondellBasell and Tronox in the Port of Rotterdam, shut down in 2025. Economists also have doubts about the feasibility of the business case for Tata Steel Nederland's sustainability. Progress was made towards a binding tailor-made agreement with Tata Steel in September 2025. Attempts to reach similar agreements with most of the biggest CO₂ emitters, however, have stranded.

Replacing natural gas with hydrogen to meet the country's sustainability goals has so far failed. Market conditions are not yet conducive for green hydrogen. There is little production, demand is low and prices are still high. The Netherlands' targets of producing 4 gigawatts (GW) of green hydrogen by 2030 and 8 GW by 2032 are not realistic. At present, just 1 electrolyser, with a capacity of 0.2 GW, is under construction and an investment decision has been taken on another electrolyser with the same capacity. This is relevant to the hydrogen network's business case because the network builder and operator, Gasunie/HNS, has based its earnings potential on the production and transport of 4 GW of green hydrogen by 2030.

Minister of KGG funding construction of the hydrogen network

A large-scale market for green hydrogen is not possible without a transport network, and a hydrogen transport network will not be built without demand for hydrogen. This is a case of market failure; the market itself cannot bring about a satisfactory outcome. This form of market failure is known as a chicken and egg problem. The minister wants to overcome it by grant funding construction of the network. Subject to conditions, the European Commission permits this in the case of an SGEI. One condition is that the grants may not be higher than necessary.

The grant is intended to cover Gasunie/HNS's startup losses. Startup losses will be incurred if low initial demand for transport capacity does not generate enough income (from transport fees) to cover all costs. Preparation costs, depreciation, operating costs and other startup losses are covered by the minister's grant to a maximum of €750 million. In the 2023 grant decision, the minister assumed that the network would cost €1.5 billion, would be regulated and fully operational in 2031 and would transport 3-4 GW of hydrogen per annum as from that year.

Lower transport volume and higher costs make grant ineffective ...

Production of green hydrogen and the demand for it are making such very slow progress that little hydrogen is available for transport. So little, in fact, that by the time Gasunie/HNS has built the hydrogen network there will not be enough fee-paying customers to earn back the investment. The grant will provide compensation

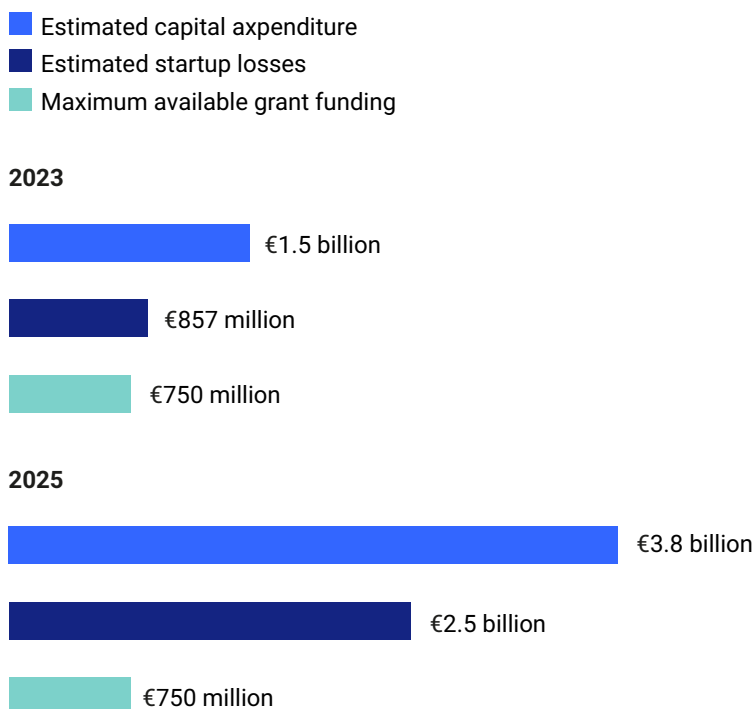
for up to €750 million in startup losses until the regulated period commences (no later than 2033). The ACM will then set break-even fees. The fees must be affordable, they may not be infinitely high.

Our audit found that Gasunie/HNS's grant application had estimated total loss compensation at €857 million, €107 million more than the available grant. The grant ceiling was almost certainly in sight from the very outset. By 2025, the estimated cost of the network had risen to €3.8 billion and the transport volume was lower than expected. Losses will likely substantially exceed the maximum available grant of €750 million. Gasunie/HNS says it will need €2.5 billion in loss compensation (under current agreements). This is €1.8 billion more than the maximum foreseen by the minister (see figure 2) and 3 times higher than the estimated startup losses.

We accordingly conclude that the grant is not effective as it is highly likely that €750 million will not be enough to cover startup losses and the national network will not be completed by 2030. Expected startup losses represent a substantial risk to the government. The Ministers of KGG and Finance are responsible for managing this risk. Talks are still being held on a solution.

Figure 2 *Estimated startup losses in 2023 and 2025*

Estimated startup losses in 2025 are 3 x higher than available grant funding



... and are placing pressure on the construction of individual network sections

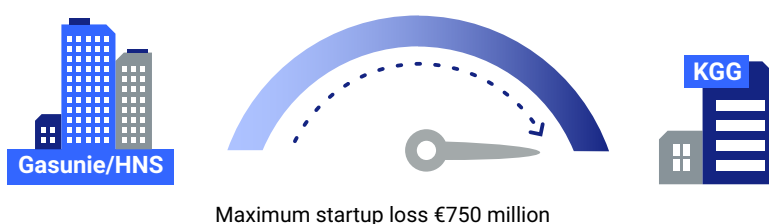
Our audit found that the lower transport volume and higher costs are also exerting pressure on the construction of individual sections of the network. It is doubtful whether all sections will be built. The Minister of Finance and Gasunie/HNS have agreed that Gasunie/HNS will take demand into account when deciding on the construction of a particular section. If demand is weak, an investment decision will not be taken and the section will not be built. Each section thus has its own chicken and egg problem.

Minister not managing grant efficiency appropriately

Together with Gasunie/HNS, the Ministers of KGG and Finance have studied 3 alternative grant options in which financial risks are allocated differently to the Minister of KGG, Gasunie/HNS and Gasunie/HNS's customers. In the Minister of KGG's preferred alternative, she will cover the capacity risk in case demand falls short to a maximum of €750 million. The capacity risk is the risk of demand for hydrogen transport being lower than anticipated and income from transport fees not covering costs. The Minister of KGG will provide compensation for all capacity losses during the unregulated period until 2033 at the latest, provided the costs are 'efficient'. In other words, the costs have to be necessary and efficient. Other options had allocated part of the capacity risk to Gasunie/HNS. When the Minister of KGG assumed the risk in full in June 2022 and undertook to cover up to €750 million of all startup losses, she did not insist on Gasunie/HNS earning a lower return. The required rate of return remained 6%, even though the minister could have demanded a reduction because Gasunie/HNS had gained firmer assurances on its future earnings. If she had, there would have been a knock-on effect on the amount of the grant: the Minister of KGG could have reduced the amount she budgeted for the grant by up to €268 million. We conclude that the minister did not design the grant with a view to its efficiency. She did not balance the risks she would bear against the return that she permitted Gasunie/HNS to earn during the unregulated period.

Figure 3 Risk allocation between Gasunie/HNS and Minister of KGG

Minister of KGG bears the risk of lower than anticipated demand during unregulated period



When the grant decision was taken in November 2023, a return of 6% was not unreasonable. But that was on account of a chance increase in interest rates in 2022-2023 and was not the outcome of a strategy or an assessment of what constituted a reasonable return for Gasunie/HNS during the preparatory stage.

Poor quality cost estimates

The Minister of KGG based her 2023 grant decision on a cost estimate made in 2021. The estimate put the cost of investment at €1.5 billion (2020 prices). In our opinion, the grant decision should not have been based on such a poor estimate (partly because it ignored the surge in inflation in 2022) and its range was too wide (€1.1-€2.5 billion). The minister should have been more critical of the cost estimate because it underpinned the size of the grant. In June 2022, the Minister of Finance received an updated estimate from Gasunie/HNS amounting to €2 billion (2022 prices). To our amazement he did not share this update with the Minister of KGG.

Before the Ministers of KGG and Finance took their decision, 2 independent firms carried out an external validation of the 2021 cost estimate. They raised concerns about the dated prices, the rate of inflation applied and Gasunie/HNS's return during the unregulated period. The validations did not prompt the ministries to revisit or reconsider their decision. This is a matter of concern; external validations are an excellent tool to ensure the estimate is of appropriate quality.

House of Representatives receives partial and incomplete information

The Minister of KGG informed the House of Representatives of the expected €1.5 billion investment costs in June 2022. She did not reveal that the estimate was based on 2020 prices. As the first independent validation had referred in February 2022 to 'recent significant price increases', we conclude that the minister informed the House incompletely. In subsequent letters to parliament on the hydrogen network's progress, she did not mention updates or potential cost increases, despite the many indications she received in Gasunie/HNS's grant application in May 2023 and the second independent validation in June 2023.

Moreover, the minister informed the House about the possible repurposing of natural gas pipelines for hydrogen but failed to mention the strict conditions that would apply. On this point, too, the minister informed the House incompletely.

Our recommendations

Climate neutrality by 2050 will require the government to take the lead in major transition projects, such as hydrogen storage (Hystock), carbon capture and storage (the Aramis project), heat networks (EBN), nuclear energy and other change projects. These ambitious transition projects are surrounded by significant uncertainties, especially in their early preparatory phase. If the Minister of KGG supports these projects, we expect her to be aware of the uncertainties and manage both the windfalls and the setbacks as effectively as possible.

Recommendations to the Minister of KGG

- Before awarding a grant, carefully examine the financial risks and use the insights into government and businesses' exposure when deciding on the appropriate WACC.
- After awarding a grant, monitor changes in the business case and periodically inform the House of Representatives of potential and actual windfalls and setbacks in both financial and technical area.

Recommendation to the Ministers of KGG and Finance

- Involve all stakeholders in the decisions taken on the future development and funding of the hydrogen network.

Conclusions and recommendations

Table 1 *Conclusions and recommendations*

Court of Audit's conclusion	Recommendation	Respons of the ministers of KGG and Finance
<ul style="list-style-type: none"> • Quality of hydrogen network cost estimate inappropriate for grant decision. • Reviews did not lead to changes in the cost estimate. • Minister of KGG inadequately manages the efficiency of grant expenditure. 	<p>To the Minister of KGG Before awarding a grant, carefully examine the financial risks and, specifically, the government and businesses' exposure to the financial risk in the WACC.</p>	<p>The minister responds to several of our conclusions. She admits that it would have been wiser to work with a budget that clarified uncertainties and indexed costs during the process. She will adjust the WACC if Gasunie's risk profile changes.</p>
<p>Minister of KGG provides incomplete information to the House of Representatives.</p>	<p>To the Minister of KGG Before awarding a grant, carefully examine the financial risks and use the insights into government and businesses' exposure.</p>	<p>The minister takes the recommendation to heart.</p>
<ul style="list-style-type: none"> • Grant is not effective owing to the significantly higher startup losses and later than planned completion. Expected startup losses are a substantial risk to the public purse. • Build individual sections subject to conditions on investment decisions. 	<p>To the Ministers of KGG and Finance Involve all stakeholders in the decisions taken on the future development and funding of the hydrogen network.</p>	<p>The ministers accept the recommendation. They state, however, that current estimates suggest the available €750 million grant will be sufficient for the unregulated period to mid-2033. The ministers write that the financial instrument is effective to develop the transport network.</p>

2.

About this audit

This chapter explains the audit background and audit objective. We then discuss the roles and responsibilities of the ministers concerned. We close the chapter with an explanation of the structure of this report.

2.1 Audit background

In the 2019 Climate Act, the Netherlands undertook to becoming climate neutral by 2050. Its net carbon emission in that year will be zero. To achieve this goal, the government is seeking alternatives to replace natural gas in its energy supply. The government wants hydrogen to contribute to the sustainability of industry, the built environment, transport sector and electricity generation sustainable (National Hydrogen Programme, 2022). Civil society organisations in the Netherlands expressed their support for this strategy in the Climate Agreement (2019).

To meet the climate goals, the government will provide grants to support the production, import and use of sustainable hydrogen. It will also grant-fund the development of a national hydrogen network, complete with appropriate storage facilities. The government recognises that a market for hydrogen cannot be created without a transport network (K&E, 2022). This audit is concerned with the construction of the hydrogen network (transport pipelines), for which the Minister of Climate Policy and Green Growth (KGG) has made up to €750 million available.¹ The hydrogen network will be built by Hynetwork Services (HNS) ('Gasunie/HNS'), a subsidiary of N.V. Nederlandse Gasunie ('Gasunie'), a state-owned enterprise. The Dutch government is thus involved on several fronts in the development of the hydrogen network.

Audit objective

The Minister of KGG will invest in several major energy transition projects in the coming years (carbon storage, hydrogen storage, heat networks, nuclear power stations) that will involve state-owned enterprises. We believe public money should be spent effectively and efficiently and that ministers must manage the financial risks of future energy transition investments. Our audit conclusions and recommendations can help the House of Representatives and the government take responsible decisions on such major investments.

2.2 Audit design

We audited the reasons given by the Minister of KGG for her plans for a hydrogen network. We asked whether the plans were designed effectively, in other words, whether they would enable the minister to meet her goals. We also considered the efficiency of the grant she had released for Gasunie/HNS's development of the hydrogen network and whether it would be used efficiently. To do so, we analysed Gasunie/HNS's cost estimates and assessed the Minister of KGG's management of the financial and non-financial risks attaching to the grant. Finally, we asked whether the Minister of KGG provided the House of Representatives with appropriate information. The audit questions and criteria are presented in appendix 1 and a detailed explanation of the audit methodology in appendix 2.

Scope

Our audit takes hydrogen as a sine qua non for energy transition, as laid down in the 2019 Climate Agreement. The audit was carried out between the effective date of the Climate Agreement in 2019 and mid-2025.

2.3 Roles and responsibilities of the ministers

Minister of KGG is responsible for hydrogen infrastructure

The Minister of KGG is responsible for hydrogen policy, including the necessary infrastructure. During the unregulated period (see § 3.4.2), she is responsible for overseeing Gasunie/HNS, which will build and operate the hydrogen network. She will oversee compliance with applicable conditions, the amount of the transport fee charged to customers and the reasonable return earned by Gasunie/HNS. Under the European hydrogen and gas decarbonisation package, hydrogen transport must be regulated no later than 1 January 2033. The Netherlands Authority for Consumers and Markets (ACM) will then become the regulator and set on the fee and the reasonable return.

During our audit, responsibility for hydrogen was transferred from the Minister of Economic Affairs and Climate Policy (until 2021) to the State Secretary for Economic Affairs and Climate Policy (2021-2022), the Minister of Climate Policy and Energy (2022-2024) and, finally, to the Minister of Climate Policy and Green Growth (2024-present). This report is addressed to the Minister of KGG, who was responsible for climate policy, including hydrogen, at the time of writing.

Minister of Finance is responsible for Gasunie/HNS's investment policy

The Minister of Finance is responsible for policy on state-owned enterprises. The primary purpose of such enterprises is to protect the public interest and their own financial value and to strengthen good corporate governance (Finance, 2022). The Minister of Finance is the sole shareholder in the state-owned enterprise Gasunie, of which Gasunie/HNS is a 100% subsidiary. In his capacity as shareholder, the Minister of Finance assesses major investment projects proposed by Gasunie and its subsidiaries.

Important role of the Minister of Infrastructure and Water Management (I&W)

The Minister of I&W oversees the safety of the transport of gases, including the safety of natural gas and hydrogen pipelines. The minister issues environmental permits for the pipelines and sets applicable rules. For the hydrogen network, the minister has established separate conditions on the repurposing of natural gas pipelines.

Responsibility of regulators for safety

Other parties relevant to the hydrogen network are the Human Environment and Transport Inspectorate (ILT) and the State Supervision of Mines (SodM). ILT oversees Gasunie/HNS's fulfilment of its agreements regarding the design, construction and operation of the hydrogen network. SodM supervises the safe use of the subsurface, in this case the storage of hydrogen in underground caverns.

2.4 Structure of this report

Chapter 3 explains what hydrogen is, the design of the hydrogen network and the government's expectations regarding hydrogen's importance to industry in the Netherlands. Chapter 4 discusses developments in hydrogen policy and the need for and expected effectiveness of grants. Chapter 5 analyses Gasunie/HNS's cost estimates for the hydrogen network. The Ministers of KGG and Finance base their grant decision and investment decision on the estimates. In chapter 6 we describe how the financial risks of developing the hydrogen network are borne by the parties

concerned and look at the grant's expected efficiency. Chapter 7 considers the conditions applying to the repurposing of natural gas pipelines. Chapter 8 looks at the information provided to the House of Representatives on the network's progress. Chapter 9 presents our conclusions and recommendations. The report closes with the response of the ministers concerned and our afterword in chapter 10.

3.

Hydrogen network and climate policy

There are several ways to produce hydrogen. Its sustainability is indicated by the colours grey, blue and green (see figure 4). Sustainable hydrogen is an important means for industry to meet the climate goals. Green hydrogen is produced using sustainably generated electricity. According to the Netherlands Environmental Assessment Agency (PBL), a large but not impossible amount of sustainable energy is needed to produce green hydrogen (PBL, 2024b). Lack of market interest to develop wind parks, however, recently cast doubts on the goals.

The Minister of KGG has tasked Gasunie/HNS with the construction and operation of the hydrogen network and will provide €750 million towards its construction. When built, the network will connect 5 industrial clusters (see figure 5), the import terminals, a storage facility in Zuidwending and connect to Belgium and Germany.

3.1 The how and what of sustainable hydrogen

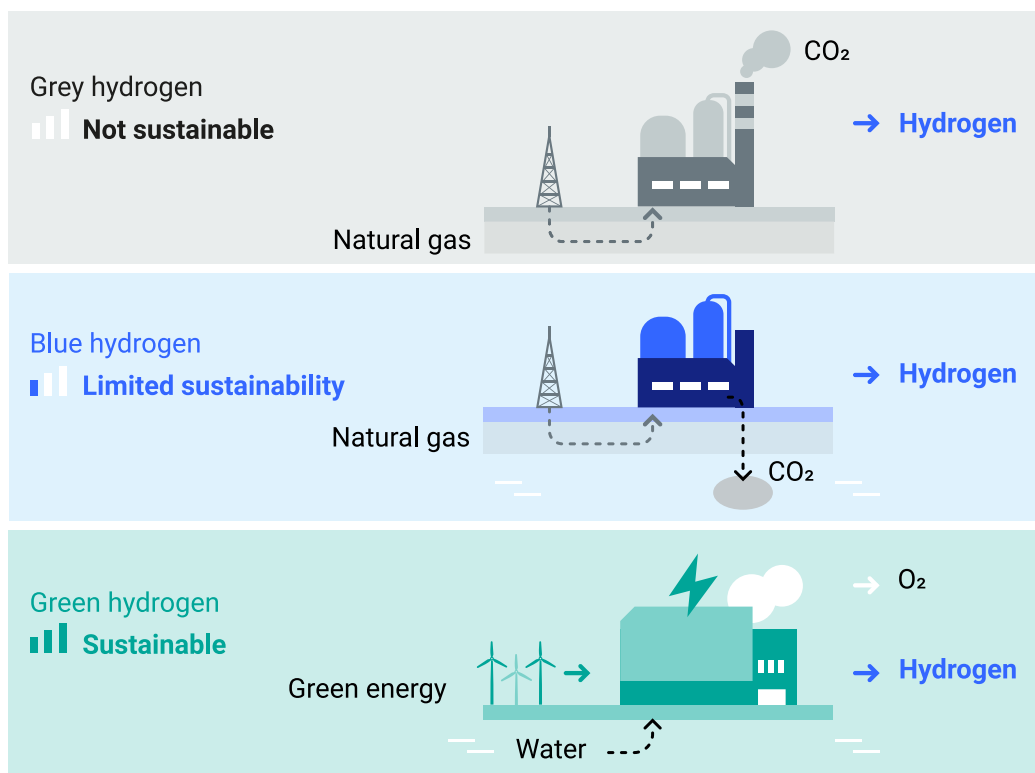
Hydrogen production

In normal conditions, hydrogen is a low-density, flammable gas made up of 2 hydrogen atoms bonded into molecules. The molecular formula of hydrogen is H₂. Pure hydrogen is rarely found in nature. Hydrogen can be produced from natural gas in a process known as steam methane reforming or by electrolysis, in which electricity splits water into hydrogen and oxygen molecules (see figure 4). Production from natural gas is not sustainable as the process releases carbon dioxide (CO₂). Hydrogen that is produced from natural gas is known as grey hydrogen. If the CO₂ released during the process is captured, the hydrogen is more sustainable and is known as blue hydrogen (see figure 4). CO₂ is not released during

electrolysis. If the electricity is sustainable, if, for instance, it is generated by a wind farm, the hydrogen is sustainable, green hydrogen (see figure 4). There are also other hydrogen production methods. Purple hydrogen, for instance, is produced using nuclear energy, and in some parts of the world white hydrogen is produced naturally in underground processes. Only grey, blue and green hydrogen are relevant to the Netherlands.

Figure 4 Grey, blue and green hydrogen production process

Only hydrogen produced with green electricity is truly sustainable



Hydrogen as an industrial feedstock, for combustion and for storage

Hydrogen has been used for many years in the Netherlands to produce ammonia, fertilisers, in refinery cracking and desulphurisation processes, and in industrial chemical processes. The box below explains how much hydrogen is produced and used directly in the Netherlands. Hydrogen is an energy carrier, not an energy source. As such, it can be used as an alternative in high-temperature combustion processes (above 600 °C). It is difficult at present to electrify high-temperature processes that use natural gas, such as steel production. Hydrogen can be used as an alternative to natural gas. It can also be stored in, for instance, salt caverns to reduce imbalances in the electricity network: hydrogen can be produced when there is a surplus of sustainable energy and be used to generate electricity when there is a shortage of

wind and solar energy. It also has potential in shipping, aviation, mobility (passenger and goods transport) and the built environment (heating). More efficient solutions, however, are coming to market for these applications (see next paragraph).

Current hydrogen production in perspective

After Germany, the Netherlands is the biggest producer of grey hydrogen in Europe. The Netherlands uses about 10% of its natural gas to produce grey hydrogen (EZK, 2020). The production process emits about 12 megatonnes of CO₂ per annum (PBL, 2025), about 9% of the country's total annual CO₂ emission.² Replacing this grey hydrogen with green hydrogen would require about half of the electricity currently generated in the country. In this scenario, offshore wind parks would need to generate 15 gigawatts (GW) (PBL, 2024b). In July 2025 North Sea wind parks generated just 4.7 GW.

Recent developments outpacing minister's policy

Recent developments in electrification are making some of hydrogen's potential applications less interesting. In the future, for instance, we will heat our homes with heat pumps or by means of heat networks and electric goods vehicles are becoming the norm for passengers and freight. Balancing the electricity network is becoming increasingly precarious; according to a study by the PBL (PBL, 2025), it can be balanced by electric boilers, batteries and electricity exports. Hydrogen imports, moreover, are also precarious owing to the low efficiency of both hydrogen production and its conversion for transport. To transport hydrogen efficiently it must be pressurised until liquid or converted into another molecule. On arrival for use it has to be converted back into a gas. These conversions cost energy at the expense of efficiency. The box below illustrates the efficiency losses using the example of a grant-funded project carried out by Vopak involving imported hydrogen.

Wind and solar electricity generation is also lagging behind the government's ambitions. Interest in building wind farms off the coast of IJmuiden is low (KBB, 2025d). Lack of offshore wind capacity will hold back the production of green hydrogen.

Grant-funded hydrogen importation project

The Minister of KGG awarded a grant of €86.4 million to Vopak and Hydrogenious for their Northern Green Crane project, an Important Project of Common European Interest (IPCEI, see § 3.2.2). The grant was awarded to convert an import terminal and infrastructure for a liquid organic hydrogen carrier (LOHC) (RVO, 2022). The project was as follows: green gas produced abroad would be converted into LOHC and shipped to the Port of Rotterdam, where it would be converted back into hydrogen and pressurised for the hydrogen network. The efficiency of the entire LOHC chain is generally estimated at about 40% (Sterner et al., 2024). Putting the residual heat released during hydrogen production to good use would increase the efficiency of the entire project.

3.2 Hydrogen in the Netherlands' climate policy

The Netherlands wants to be climate neutral by 2050. To realise this ambition, the Climate Act states that the country must cut its annual emissions of greenhouse gases (such as CO₂) by 55% by 2030 relative to 1990. Industries are working towards this ambition by becoming more sustainable and emitting less CO₂. Climate neutrality by 2050 calls for zero or minimal emissions of greenhouse gases from industrial processes and products. Residual emissions must be offset by means of, for instance, sequestration in trees or carbon capture and storage (CCS). The Netherlands will generate wind and solar energy in order to reduce its CO₂ emissions (the energy transition). Statistics Netherlands (CBS) has calculated that renewable energy was good for nearly 20% of total energy consumption in 2024. Some 50% of the electricity generated in 2024 was already sustainable (chiefly wind and solar). A disadvantage of sustainable wind and solar electricity is that it is very difficult to store. As it is not always windy or sunny in the Netherlands, the minister believes we need a sustainable electricity backup or storage system. The National Energy System Plan gives hydrogen an essential role in the future energy system, where it will be used in industrial and national and international mobility applications (K&E, 2023a).

3.2.1 Hydrogen for sustainable industries in the Netherlands

Behoud bestaande (energie-intensieve) industrie

Retention of energy-intensive industries

Future demand for energy will be determined by the industries that locate and/or remain in the Netherlands, particularly energy-intensive industries. Energy-intensive

basic industries accounted for nearly half of energy demand in the Netherlands in 2023 (Netbeheer Nederland, 2023). The government has not decided which sectors or companies should or should not remain in the Netherlands but assumes that the industries we currently have, including the energy-intensive industries, will remain.

Industrial sustainability through green offshore wind energy

In the National Energy System Plan (NPE), the Minister of KGG sets out the steps the Netherlands has to take for a climate neutral energy system in 2050 (K&E, 2023a). Under the plan, industry plays an important role in the energy transition. Industrial electrification is boosting demand for electricity and increasing the profitability of new offshore wind farms. This sustainable electricity can be converted into green hydrogen to replace grey hydrogen or be stored and turned back into electricity when there is insufficient wind or sunlight. Production of green offshore hydrogen can ease the congestion in the electricity network. Under the NPE, a national hydrogen network would provide industries throughout the country with green hydrogen.

In the Minister of KGG's opinion, 'offshore wind will be the engine of energy production in an entirely CO₂-free energy system' (K&E, 2022). The Netherlands Environmental Assessment Agency (PBL) has calculated that about 50% of offshore wind capacity will be needed to produce enough green hydrogen to meet the government's goal of climate neutrality by 2050. According to the PBL, 'this seems to be on the high side but in itself is not impossible', even with the ongoing electrification of various sectors, such as mobility and heating (PBL, 2024b).

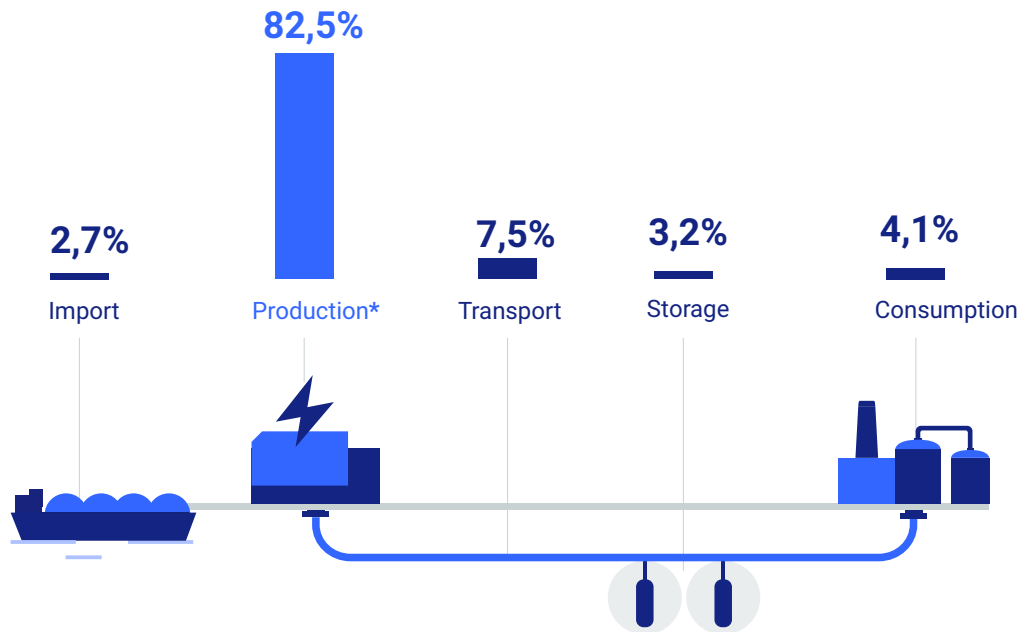
3.2.2 Public money to implement hydrogen policy

For our audit we analysed the flow of funds provided to or reserved for sustainable hydrogen projects in 2019-2024. In total, 6 ministries have reserved roughly €11.2 billion for 24 schemes and 201 projects/decisions. This is the aggregate not only of the grants awarded and reserved (94% of the total) but also of tax schemes, a guarantee, an equity investment, a loan and grants with a clawback obligation. These funds flows are summarised in appendix 7 of this report.

We also looked at how sustainable hydrogen funds were allocated to production (carbon capture during the production of both grey and green hydrogen), import, transport, use and storage (see figure 5). By far the majority of funds were awarded for production (carbon capture and electrolysis). This is in keeping with government policy (see § 4.2).

Figure 5 Allocation of public funds for hydrogen (2019-2024)

Hydrogen production receives the majority of the public funding



*CO₂ electrolysis and capture (in grey hydrogen production)

Production is funded chiefly by means of the 3 grant schemes described in the box below, the SDE++, OWE and IPCEI. The largest grant after these 3 schemes is the €750 million awarded to Gasunie/HNS for the hydrogen network at the centre of our audit.

Hydrogen production funded by 3 grant schemes: SDE++, OWE and IPCEI

By far the largest grant scheme to fund hydrogen is the SDE++ (Sustainable Energy Production and Climate Transition Incentive Scheme). The total amount provided from the SDE++ scheme for hydrogen is €6.7 billion. Of this amount, €3.62 billion has been awarded for hydrogen produced from electrolysis (green hydrogen). The remaining €3.14 billion has been provided for carbon capture during grey hydrogen production (for grey hydrogen to become blue). In our 2024 report Carbon Storage under the North Sea, we investigated some of the SDE++ grant for the production of blue hydrogen. The maximum amount of the grant was €2.1 billion.

The OWE scheme to support large-scale production of entirely renewable hydrogen from electrolysis and the scheme for an Important Project of Common European Interest (IPCEI) follow at some distance, amounting to €1.24 billion and €810 million respectively. Under these 2 schemes, the EU

must approve grant awards in order to prevent state aid. As the Netherlands awards the grants, the funds are not provided by the EU. In July 2025, the Netherlands Enterprise Agency (RVO) announced that it had provided €700 million to 11 electrolysis projects with a combined capacity of about 602 MW (RVO, 2025).

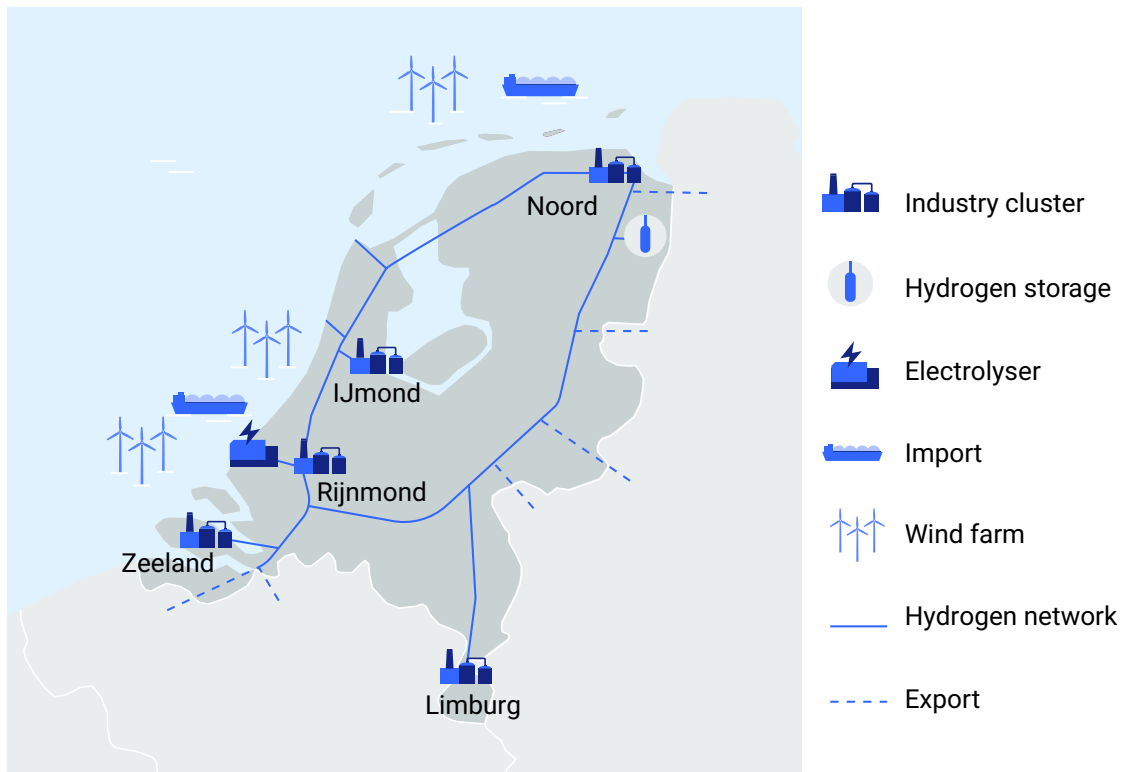
The EU, too, has mobilised funds to promote sustainable hydrogen. Total EU funding of sustainable hydrogen projects is currently estimated at €18.8 billion for the period 2021-2027. In 2014-2027, the Netherlands will receive at least €765 million in sustainable hydrogen grants and/or loans from European institutions.

3.3 Hydrogen network to connect industrial clusters

Gasunie/HNS is building the hydrogen network using new and repurposed gas pipelines. The network will be about 1,200 km long and connect 5 energy-intensive industrial clusters, the import terminals and a storage facility in Zuidwending (Groningen province). Industrial clusters are concentrations of different but often related industries. The Netherlands has five large industrial clusters: Rotterdam/Rijnmond, the North Sea Canal Area, Chemelot, Zeeland and East Groningen. Companies using green hydrogen in these clusters will contribute to the climate goals by reducing their CO₂ emissions. In the longer term, regional industries can also be connected to the network. Network capacity will be 10 GW, which can be increased by compressors to 15 GW. The network will have international connections to Antwerp in Belgium and the Ruhr area in Germany (see figure 6).

Figure 6 *The Dutch hydrogen network*

The hydrogen network enables national and international transport and storage



Development of the hydrogen network has had to adapt to changing circumstances over time. The war in Ukraine has forced a reduction in the repurposing of gas pipes and increased the need for new pipes. A new pipeline is also needed between Rotterdam and Germany, the Delta Rhine Corridor (DRC). Planning has also had to adapt. Construction has been divided into 15 sections. At the time of writing (September 2025), the only section Gasunie/HNS had actually started to build was the Rotterdam Hydrogen Network (WNR). WNR currently has 1 producer and 1 customer, both Shell. Completion of the WNR is planned for 2026.

In Gasunie/HNS's new draft rollout plan the 5 clusters will be connected to the storage facility and Belgium and Germany in 2031-2033 (Hynetwork, 2024). Completion of the DRC connecting Rotterdam and Germany is also planned for that period. It had originally been planned for 2028.

3.4 Management by the Minister of KGG

Service of General Economic Interest

In 2023, the Minister of KGG appointed Gasunie/HNS to build and operate the national hydrogen network and classified the network as a Service of General Economic Interest (SGEI). At the same time, the minister made a €750 million grant available to enable construction. The SGEI-grant-agreement sets out the responsibilities of the Minister of KGG and of Gasunie/HNS. The national hydrogen network must:

- be safe, reliable and efficient;
- satisfy reasonable demand for hydrogen in both the short and long term;
- apply non-discriminatory, transparent and reasonable conditions and fees.

The unregulated and regulated periods

The minister appointed Gasunie/HNS to develop and operate the hydrogen transport network during the unregulated period. The network will probably be classified as vital infrastructure. Under the European hydrogen and gas decarbonisation package, hydrogen transport must be regulated by 1 January 2033 at the latest (Regulation 2024/1789 of the European Parliament and of the Council). A regulator must have been appointed by then. In the Netherlands, the Minister of KGG has designated the Authority for Consumers and Markets (ACM) as the future regulator. In the grant decision, the minister stated that regulation would commence in 2031. The same date is also given in the SGEI-grant-agreement. Our audit found there was a real option to postpone regulation, possibly until 2033. The following tasks will pass from the Minister of KGG to the ACM when the regulated period commences:

- regulation of the level of the transport fees charged by Gasunie/HNS;
- regulation of Gasunie/HNS's reasonable return;
- audit of the efficiency of Gasunie/HNS's investment and operating costs.

The Minister of KGG will act as regulator until the regulated period commences. Regulatory agreements and the grant conditions are laid down in the SGEI decision. The SGEI grant agreement sets the fee that Gasunie/HNS will charge in the unregulated period, the amount of Gasunie/HNS's reasonable return and how the minister will audit the costs Gasunie/HNS declares in accordance with the grant decision.

4.

Effectiveness of the grant

Effectiveness and efficiency are not the only conditions applying to the award of a grant; there must also be a demonstrable need for grant funding. The minister has based the grant instrument on scenarios of future demand for green hydrogen. A key factor in the expected effectiveness is whether there will be an established hydrogen market.

4.1 The need for a hydrogen network

Under the 2019 Climate Agreement, the minister tasked national and regional network operators to perform integrated infrastructure surveys of future energy consumption. The surveys include integrated 'II3050 scenarios' of future hydrogen demand (Netbeheer Nederland, 2021).

4.1.1 Minister demonstrates the need for a hydrogen network

Our audit found that the Minister of KGG had demonstrated that a hydrogen network was necessary to meet the 2050 climate goals and become climate neutral.

'To unlock such huge volumes of hydrogen,' according to the minister, 'each II3050 scenario requires new hydrogen transport chains' (EZK, 2021a). The minister deliberately did not single out a particular scenario but declared that all scenarios in the II3050 report required a hydrogen network for the Netherlands to become climate neutral. Updated scenarios in the final report in 2023 again demonstrated the need for a hydrogen network (Netbeheer Nederland, 2023). In 2024, the PBL presented similar figures confirming the future demand for hydrogen (PBL, 2024a). We conclude that the Minister of KGG has demonstrated the need for a hydrogen network.

Retention of energy-intensive industries currently uncertain

Energy-intensive industries, such as the refining, chemical, steel and fertiliser industries, are major consumers of hydrogen. Green hydrogen can replace non-sustainable hydrogen not only in refineries and the chemical industry but also in high-temperature industrial processes at Tata Steel's production plant in IJmuiden (see § 3.1). The government wishes to retain such energy-intensive industries in the Netherlands and support them with every means at its disposal to become more sustainable (EZK, 2020). To this end, the Minister of KGG has provided financial support through the SDE++ scheme and wishes to make tailor-made agreements with the biggest carbon emitters. There is some uncertainty, however, about the extent to which these industries will remain in the Netherlands. Several chemical factories, such as Vynova (VNCI, 2025a) in Chemelot and Westlake (VNCI, 2025b), LyondellBasell (VNCI, 2025c) and Tronox (VNCI, 2025c) in the Port of Rotterdam, ceased operations in 2025. Economists also have doubts about the feasibility of the business case for Tata Steel's sustainability (Beetsma and Romagnoli, 2025), although a step was taken towards a binding, tailor-made agreement with the company in September 2025 (KGG, 2025e). Since the policy launch, tailor-made agreements with the biggest carbon emitters have been challenging (KGG, 2025b). Several advisory reports (Study Group on the Implementation of the Green Deal, 2021; Council of State, 2025; Netbeheer Nederland, 2023) have discussed the credibility of retaining energy-intensive industries in the Netherlands.

The scenarios underpinning the decisions on the construction of the hydrogen network will probably be overtaken by events in the market. One of the II3050 scenarios did allow for a decline in energy-intensive industries. In its Exploration of pathways towards climate neutrality 2050, by contrast, the PBL foresaw a modest increase in these industries (PBL, 2024a). Netbeheer Nederland's latest scenario in 2025, however, again foresees a decline in energy-intensive industries (Netbeheer Nederland, 2025). The Supply Horizon scenario states, 'The Netherlands imports a lot, including industrial semi-manufactures. Energy-intensive industries will therefore disappear to some extent from the Netherlands. The final result will be low energy consumption.'

In our opinion, the volume of energy-intensive industries that remains in the Netherlands will be a major factor in future demand for green hydrogen and its transport. The government has not decided on which energy-intensive industries are compatible with climate neutrality by 2050. If anything, the government assumes that energy-intensive industries that have already located in the Netherlands to benefit from inexpensive Groningen natural gas will remain here. Whether or not they

actually do is uncertain. Several studies (II3050, PBL, Netbeheer Nederland) do not include a scenario in which there is little if any demand for hydrogen and its production and importation. Only time will tell how the hydrogen and transport market will develop but the decisions taken by energy-intensive industries will be of major importance.

4.1.2 Government's role in hydrogen infrastructure

Ministerial policy needed to overcome chicken and egg problem

At present, there is only a limited market for sustainable hydrogen in the Netherlands. The hydrogen used in refineries and the chemical industry is produced onsite from natural gas and is not sustainable (see figure 4 in § 3.1). Without a transport network, there can be no large-scale market for green hydrogen, and there cannot be a network without demand for transport. This is a failure that the market itself cannot resolve. Stakeholders are waiting for each other to invest in a transport network, hydrogen production and the adaptation of production facilities. This form of market failure is known as a chicken and egg problem.

The chicken and egg problem of hydrogen transport is not only acknowledged in the HyWay27 report, it is also recognised by the Council for the Environment and Infrastructure (RIL, 2021), the ACM (ACM, 2023) and the Van Geest Committee (Working Group on the Implementation of the Green Deal, 2021).

Market failure justifies government intervention. Failure to resolve the problem will set back the energy transition and lead to unnecessary costs (ACM, 2023). To overcome the failure and develop the network while demand is gradually rising, the Minister of KGG launched a plan in 2021 for the phased rollout of a national hydrogen network (EZK, 2021a).

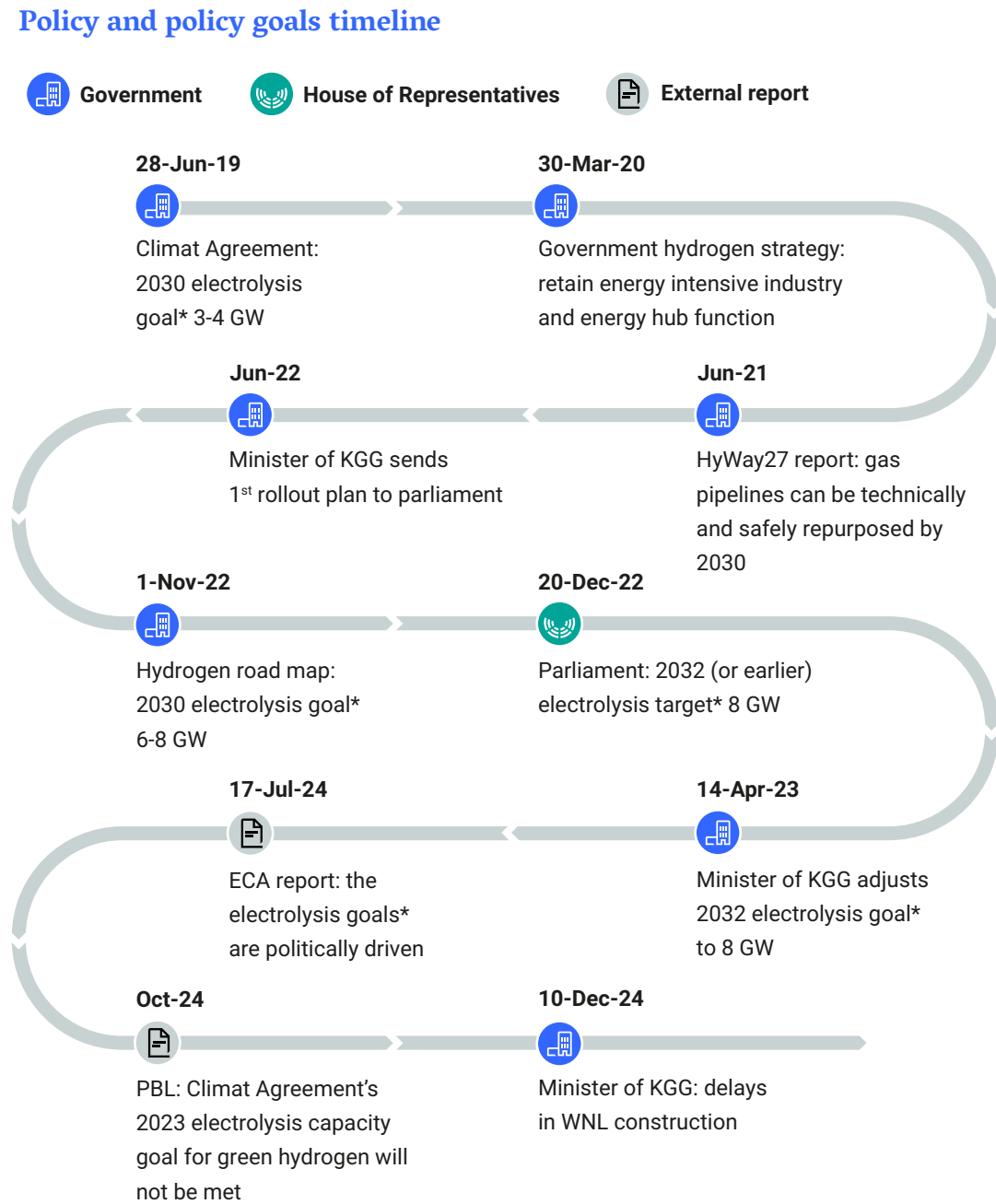
Reasons for public ownership of the hydrogen network

The Minister of KGG appointed Gasunie/HNS to develop and operate the hydrogen network and carry out a Service of General Economic Interest (SGEI) (see also § 3.4). The Minister of KGG's decision complied with the framework on state-owned enterprises as the network will probably be classified as vital infrastructure, which justifies the use of a state-owned enterprise (EZK, 2021a; Finance, 2022). The decision therefore anticipates legislation from Brussels that, in accordance with the European hydrogen and gas decarbonisation package, the hydrogen market will be regulated no later than 2033 (Regulation 2024/1789 of the European Parliament and of the Council).

4.2 Policy and policy goals timeline

Successive governments have developed plans for the production of sustainable hydrogen by means of electrolysis. It was thought that demand would follow production. The timeline in figure 7 shows the key moments in the development of hydrogen policy. They are explained further in appendix 3.

Figure 7 Timeline of key documents and decisions on policy and policy goals



*electrolysis capacity for green hydrogen

Electrolysis capacity targets no longer realistic

Our audit revealed that the targets set for electrolysis capacity are no longer realistic. The Minister of KGG gave no reason for raising the 2032 electrolysis production goal. The PBL had already concluded in 2024 that the 2030 electrolysis capacity target was not feasible (PBL, 2025). At the time of writing, only 1 electrolyser was being built, by Shell and with a capacity of 200 MW (i.e. 0.2 GW); in 2025 Air Liquide also decided to invest in a 200 MW electrolyser (Air Liquide, 2025). The electrolysis capacity target for 2030 is 4 GW and that for 2032 no less than 8 GW. Meeting the 2030 and 2032 targets will require 20 or 30 electrolysers with the same capacity as Shell's.

The Netherlands is not the only country lagging behind its targets. According to the International Energy Agency (IEA), worldwide electrolysis capacity totals 1.4 GW, located mainly in China. Low worldwide production means there are few import opportunities. Delays in hydrogen production, moreover, reduce the need for storage. The handover of salt caverns for storage has been put back from 2030 to 2031-2037. Hydrogen will be stored in the salt caverns by another Gasunie subsidiary, Hystock.

4.3 Effectiveness of grant to cover startup losses

Under the SGEI, Gasunie/HNS will develop a hydrogen network connecting 5 industrial clusters in the Netherlands with each other and the storage caverns (see figure 6 in § 3.3). The minister awarded a grant to cover the startup losses foreseen in the investment plan for the hydrogen network's development and operation. Gasunie/HNS states in the plan that all industrial clusters and Germany and Belgium will be connected by 2030 at the latest.

The network must make maximum possible use of existing natural gas pipelines. According to PWC, this is 4 times less expensive than laying new pipelines (PWC Strategy&, 2021). Gasunie/HNS is currently laying the first section, the Rotterdam Hydrogen Network (WNR). It decided to invest in WNR in light of the grant and because some transport capacity has already been contracted. Investment decisions still have to be taken on other sections of the network.

4.3.1 Ineffective grant for startup losses

At present, both supply of and demand for green hydrogen are below expectations. Demand for green hydrogen is not helped by the fact that the limited sustainable hydrogen that is available is more expensive than unsustainable hydrogen and natural gas or by the progress that electrification is making (see § 3.1). The low

supply of and demand for sustainable hydrogen and the resultant low demand for transport capacity have consequences for network utilisation. Given the lower demand for capacity and the higher network costs, it is uncertain whether Gasunie/HNS will be able to earn back the costs through the fees it charges to future customers. The most recent estimate of investment costs is €3.8 billion, versus an original estimate in 2021 of €1.5 billion. We take a closer look at cost estimates in chapter 5.

Higher startup losses

The higher costs and low demand for transport capacity is directly related to the expected effectiveness of the grant provided by the Minister of KGG. When the grant application was submitted in May 2023, startup losses were estimated at €857 million, €107 million more than the available grant of €750 million. Owing to the higher costs and the lower than expected transport volume, Gasunie/HNS recently estimated that startup losses would significantly exceed the maximum available grant. At the end of 2024, Gasunie/HNS put the necessary loss compensation at €2.5 billion (all other things being equal), €1.8 billion more than the maximum provided by the minister (see figure 8). If so, total startup losses would be 3 times higher and the necessary loss compensation would exceed the €750 million grant. This estimate is uncertain as it is based on the continuation of the SGEI grant agreements. The outcome of the estimate relies heavily on the fee agreements, the regulatory framework, the development of transport volume and the completion of the various network sections. The last 2 variables will largely determine what part of the necessary loss compensation falls during the unregulated period or in the regulated period, commencing in 2033 at the latest.

Construction delays

Apart from the higher startup losses, construction of the network was 2 years behind schedule at the time of writing. The SGEI grant was made available in 2023 based on Gasunie/HNS's investment plan to complete construction of the entire network and connect all industrial clusters and Belgium and Germany by the end of 2030. The minister can amend the plan by changing her rollout plan, but she has not officially done so (see § 4.3.3).

Figure 8 *Estimated startup losses, 2023 and 2025*

Estimated startup losses in 2025 are 3 x higher than available grant funding



4.3.2 Construction of sections under pressure

Besides the higher expected startup losses, it is uncertain whether the entire network will be constructed. This depends on the market demand for transport capacity. The Minister of Finance and Gasunie/HNS have agreed that Gasunie/HNS will consider whether there is sufficient demand on a section-by-section basis. Before an investment decision can be taken on the construction of a section in an industrial cluster, 25% of revenue must be contractually agreed and 10% of revenue must be contractually agreed before a pipeline interconnection can be greenlighted.³ This creates a chicken and egg problem for each section. Gasunie/HNS must first sign contracts with customers before it begins construction. Failure to do so will further delay the network. Energy-intensive industries must therefore provide assurances on their use of hydrogen to become more sustainable and sign contracts with Gasunie/HNS before decisions are taken on the construction of the sections. This is a problem for the Minister of KGG because it frustrates construction of the hydrogen network. On the other hand, the network will be more affordable in the future thanks to the agreements made between the Minister of Finance and Gasunie/HNS. As the ACM noted, the network will be more affordable if construction costs and transport volumes are not too far out of step with each other (ACM, 2025).

4.3.3 Minister of KGG managing construction through the rollout plan

Development of the hydrogen network is a long-term project that can be adapted in response to changing circumstances and market conditions. The Minister of KGG agreed a system in the SGEI grant agreement in which:

- Gasunie/HNS prepares an investment plan and a multiannual budget every year;
- Gasunie/HNS can submit a review of the rollout plan every year;
- the Minister of KGG approves the investment plan, multiannual budget and rollout plan.

Minister can direct by adapting the rollout plan

The Minister of KGG has designed the grant so that she can adapt the rollout plan in response to new insights. She can decide not to build part of the network and to delay or, if possible, speed up the rollout. New insights could be due to lower than expected supply if it is decided not to invest in sustainable hydrogen production or to the €750 million grant not covering startup losses. The minister has based the timing of the rollout plan on the assumption that there will be demand for hydrogen transport by the time the network is completed. Customers must therefore indicate their demand for hydrogen transport in a timely manner (K&E, 2022).

Minister must approve the rollout plan

In early 2023, Gasunie/HNS prepared a new draft rollout plan mainly because the invasion of Ukraine has reduced the availability of natural gas pipes that could be repurposed. The minister did not approve the new plan and the grant was based on the original 2022 rollout plan, in which the network would be completed no later than 2030 (K&E, 2022). Gasunie/HNS revised the rollout plan in 2024 to allow for the Delta Rhine Corridor (DRC). In the new draft rollout plan the 5 clusters will be connected with the storage site and Belgium and Germany in 2031-2033 (Hynetwork, 2024). According to Gasunie, '3 factors prompted material changes: the hydrogen market is not developing as fast as expected, construction of the network has been delayed and network costs have increased' (Gasunie 2025). The Minister of KGG received this rollout plan in March 2025 (following market consultation). At the time of writing she still had to approve the new rollout plan.

5.

Cost estimates of the hydrogen network

The Minister of KGG based the grant decision on Gasunie/HNS's May 2023 cost estimate. The Minister of Finance in turn used the estimate in his decision as shareholder to approve the investment by Gasunie/HNS. Information on the costs is therefore relevant and given the House of Representatives' right to approve the budget must be valid. This chapter looks at the cost estimates for the hydrogen network.

5.1 Functions of the hydrogen network cost estimates

In our report on the construction of the Betuwe freight railway (Netherlands Court of Audit, 2001) we wrote that cost estimates had at least 2 important functions in major infrastructure projects. The first was to provide policy information, the second was to serve as a management tool.

By providing policy information, cost estimates underpin the decisions taken on a project, allowing costs to be weighed against the benefits. If it is decided to start construction, the estimate should justify the size of the reserve set aside in the multiannual budget. A cost estimate is also a management tool during project implementation. It is the reference point for a more concrete assessment and for updates.

The cost estimate for the hydrogen network fulfils both functions. Both the Minister of KGG and the Minister of Finance based policy decisions on the cost estimate. Besides the grant decision, the Minister of KGG used the estimate to calculate the transport fee that Gasunie/HNS will charge its customers to use the network.

The fee is calculated as the product of estimated annual depreciation and operating costs and estimated demand for transport capacity. The fee is laid down in the grant decision for the construction of the network.

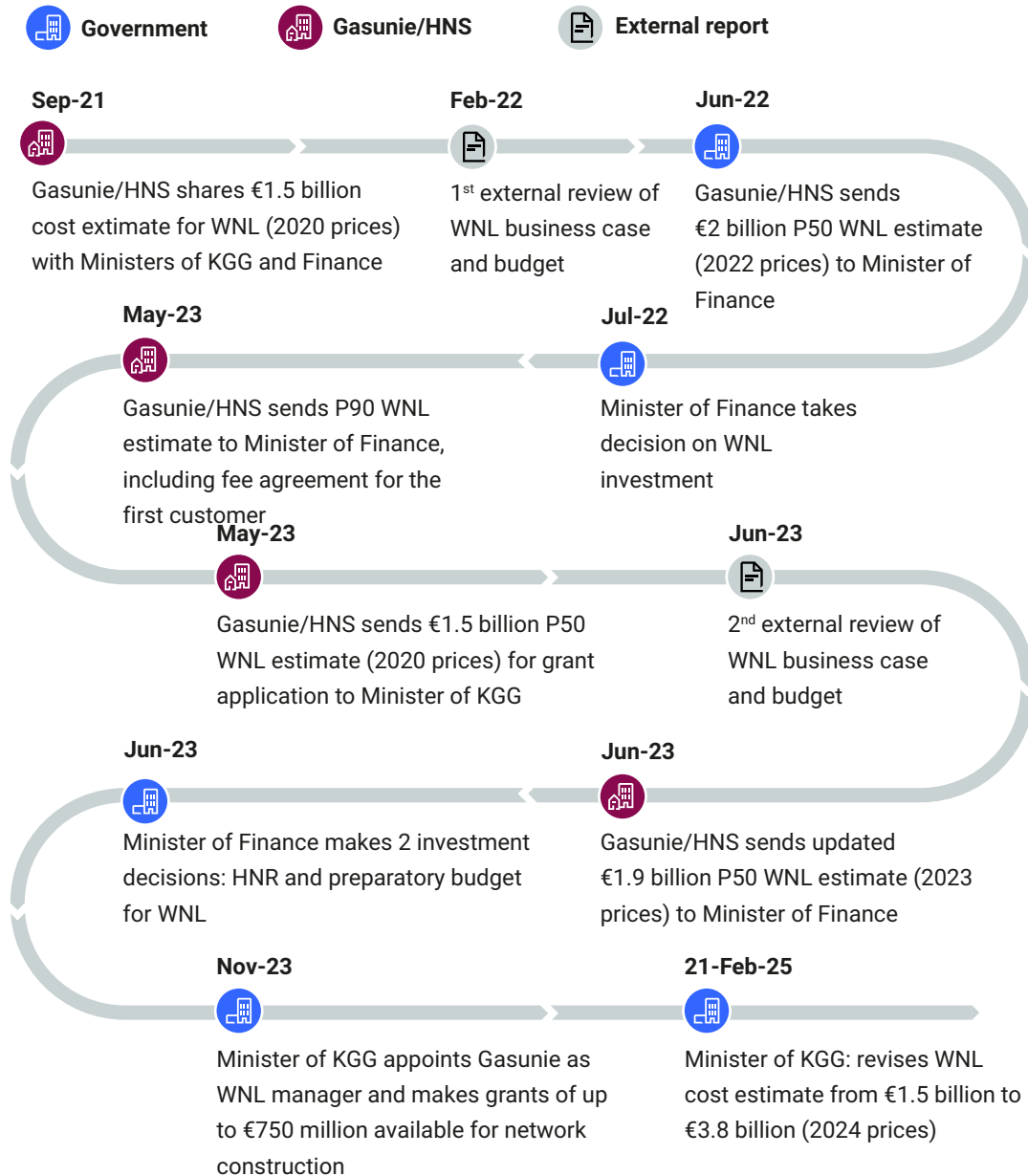
The cost estimate also serves as a management tool. The Minister of KGG included an agreement to control construction costs in the grant decision of November 2023 (K&E, 2023b)

5.2 Timeline of the hydrogen network cost estimate

Key moments and documents for the cost estimates are shown in figure 9 below. Individual moments and documents are considered in more detail in appendix 4.

Figure 9 Timeline of key cost estimate documents and decisions

Timeline of WNL and HNR cost estimates



5.3 2021 cost estimate for the hydrogen network

Gasunie/HNS usually applies a fixed internal method to make cost estimates. The applicable method when the budget for the hydrogen network was prepared in 2021 was the Budget Brochure 2016 (Gasunie, 2016). The brochure prescribes a standard method for all Gasunie’s operating units. Budgets must:

- be based on a quantity x price calculation;
- be a fairly rough or, depending on the available information, more detailed ‘key figure per km pipe’;

- include an item for allowances, i.e. costs that will certainly be incurred but whose size is not yet known, such as small provisional estimates;
- include amounts for contingencies, i.e. amounts to cover identified safety, planning and budget risks;
- be based on the most recent price levels;
- be adjusted for inflation.

The more accurate the available design and cost information, the more accurate the estimate. In principle, estimates are based on a fixed scope: the length of network sections and other variables must be constant so that successive estimates can be compared with each other.

Standard method not used for initial cost estimate of the hydrogen network

Gasunie/HNS did not base the cost estimate for the hydrogen network on the Budget Brochure. Not enough information was available to do so. The 2021 cost estimate was based on a highly simplified design, a standard price per pipe and an area surcharge. Gasunie/HNS carried out a basic analysis of the risks and classified the hydrogen network as a high risk project. But because network risks were not quantified, they were not factored into the cost. Gasunie/HNS classed the estimate as a P50 estimate; there was a 50% probability that actual costs would be higher (or lower).

Gasunie/HNS's €1.5 billion estimate did not allow for identified risks (contingencies). It was thought that identified risks would be covered by the grant agreements and were thus smaller than the available €750 million. The estimate ranged from €1.1 billion to €2.3 billion. Neither the Minister of KGG nor the Minister of Finance was informed of this range.

Small adjustment for inflation and price level not considered in decision-making

The €1.5 billion estimate of investment costs was published in the HyWay 27 report in June 2021. With network construction costs being incurred in phases (planned at the time between 2022 and 2030), the estimate included an adjustment for inflation of 1.5% per annum. This was too low. The European Central Bank's medium-term inflation target for the euro area is (and was) 2%.

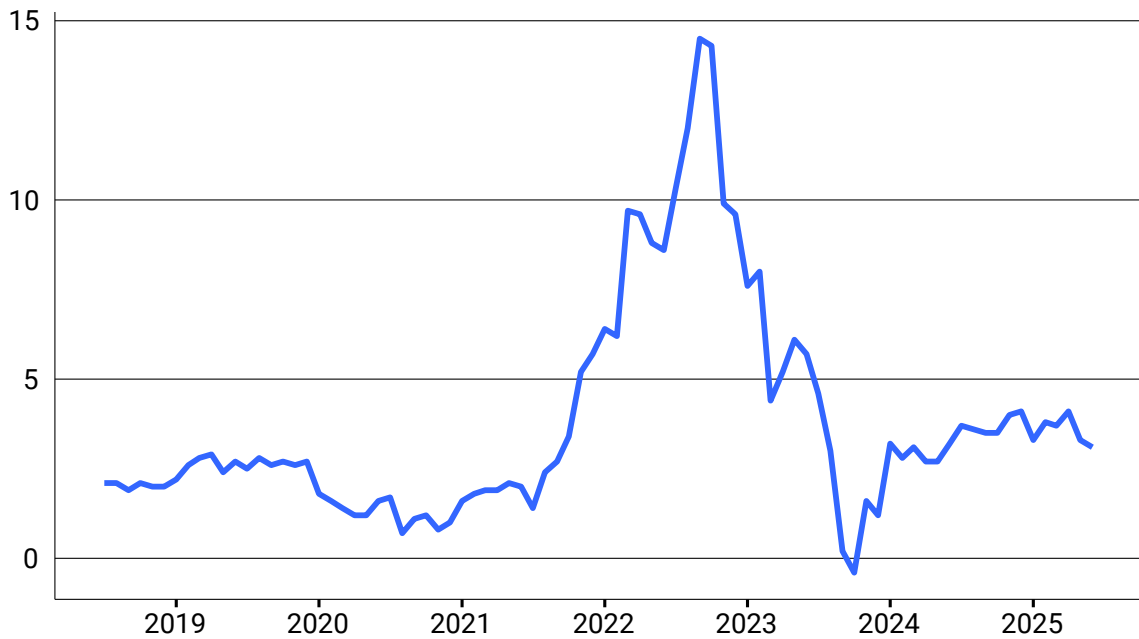
The price level in HyWay 27's report was up to date in June 2021. It was not up to date when Gasunie/HNS submitted its grant application to the Ministry of KGG at the end of December 2022 and also not when the Minister of KGG took the grant

decision in November 2023. The consequences of this error have been magnified by the surge in inflation in 2022 (see figure 10). The Minister of KGG did not ask Gasunie/HNS to update the prices in 2023.

Figure 10 Rate of inflation in 2019-2025

Sharp spike in inflation in 2022 and 2023

% year-on-year change in consumer price index



Source: CBS

5.3.1 Reviews did not prompt changes

The cost estimate in the HyWay 27 report is a key factor in the business case for the hydrogen network. Before the Minister of KGG took the grant decision in November 2023, the business case was independently reviewed twice. The business case included the expected investment costs of €1.5 billion and Gasunie/HNS's expected operating costs and revenues. The main points of the business case are shown in table 2 below.

Table 2 Main points of the hydrogen network business case on grant application

Investment	€1.5 mbillion (2020 prices)
Operational costs (percentage of asset value)	2.6%
Return (WACC*) after tax: in unregulated period	6%
Return (WACC*) after tax: in regulated period	3%
Indexation	1.5%
Depreciation	30 years
Fee set by Minister of KGG	€40 per kW/year
Growth in transport demand in 2031	3.5 GW
Start of regulation	2031

* WACC = Weighted Average Cost of Capital: weighted average cost of Gasunie/HNS's equity and debt capital.

On behalf of the Ministers of Finance and KGG, an independent consultancy carried out a first validation review in early 2022 (EY, 2022). Another independent consultancy carried out a second review for the Minister of KGG in 2023, without the further involvement of the Minister of Finance (Improven and Witteveen+Bos, 2023). The reviews informed the Minister of KGG about the quality of Gasunie/HNS's estimate. Both were honest about their own limitations. The information used to check prices, for example, was provided not by a third party but by Gasunie, and the reviews could not make comparisons with existing hydrogen networks because there weren't any. Apart from these limitations, the two reviews were critical on the following points:

- Whether the 6% required rate of return after tax was reasonable given: a) the preferred grant form covering the capacity risk, and b) the agreement that Gasunie/HNS and KGG would consult each other if the capacity risk was significantly higher than expected.
- Actual price increases differed from the rate of inflation applied of 1.5%.
- Gasunie/HNS is named as the author or co-author of a considerable proportion of the data sources. Lack of independent sources frustrates external validation.

Reviews provide assurance but too little use made of them

The 2 reviews provided assurance for the ministers concerned about the business case's mathematical accuracy (such as the formulas in an Excel file) and the reasonableness of the prices applied (based on figures from 2020). However, they also identify manifest weaknesses in the business case. They both refer to the absence of external sources to verify key figures. We note that the reviews did not lead to a discussion at or between the ministries or to changes in:

- the price level in the estimate to allow for higher steel and labour costs in 2021 and 2022;
- the 1.5% rate of inflation over a period of 30 years;

- Gasunie/HNS's required rate of return of 6% after tax during the unregulated period.

As the Ministers of KGG and Finance did not insist on Gasunie/HNS making changes to the business case in light of the criticism, the review findings were largely ignored..

5.3.2 Cost estimate not suitable as policy information

As we showed in § 5.1, the Minister of KGG used Gasunie/HNS's cost estimate to inform policy and set the amount of the grant and form a reserve for it in the multiannual budget. The minister also used the estimate to calculate the transport fee. When cost estimates inform policy, we expect them to:

- have high predictive value;
- describe uncertainties as clearly as possible so that measures can be taken to manage them;
- identify financial and non-financial risks so that reserves can be formed for them.

As noted above, the estimate the minister used in decision-making did not meet the standards expected of policy information. The estimate had low predictive value, with a range of -30% and +50%, risks were not quantified and prices did not allow for the surge in inflation in 2022.

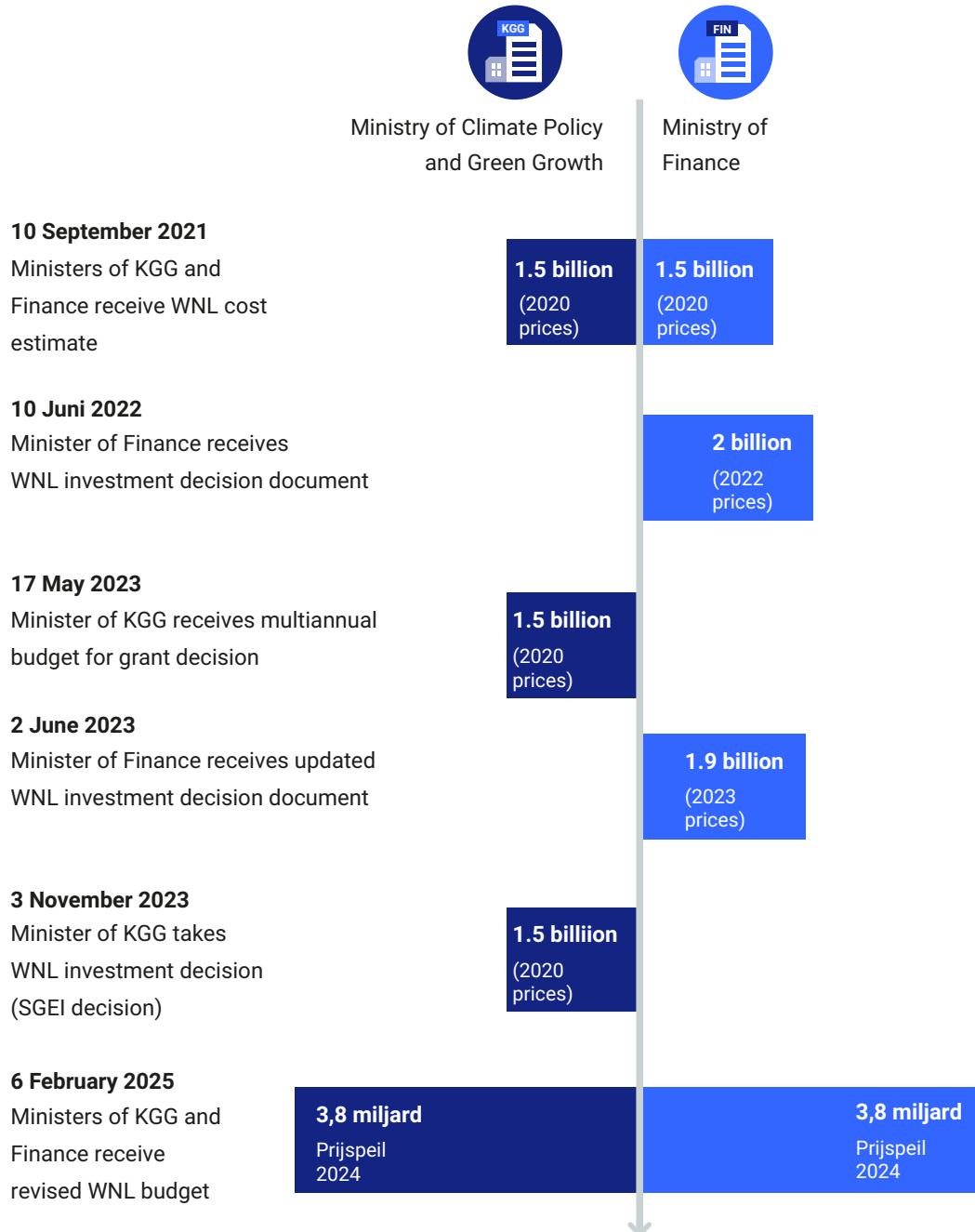
Minister of Finance receives updates of cost estimate, Minister of KGG does not

For internal decision-making purposes and to obtain the shareholder's approval, Gasunie/HNS updated its cost estimate twice. In June 2022, it revised the investment cost upwards by €500 million to €2.0 billion (2022 prices) to allow for inflation. In June 2023 it prepared a new document for the Minister of Finance's approval of the preparatory budget for the entire hydrogen network. This was one month after Gasunie/HNS had submitted its grant application to the Minister of KGG based on an expected investment cost of €1.5 billion. In the update for the Minister of Finance, the investment cost amounted to €1.9 billion (2023 prices). Gasunie/HNS put the €400 million increase from the original estimate down to inflation and a rerouting of the network.

Gasunie/HNS informed the Minister of Finance about the updated cost estimates of June 2022 and June 2023, but not the Minister of KGG. The Minister of Finance did not share the updates with the Minister of KGG either, even though the latter was working on the grant conditions during January 2023 and November 2023 (see figure 11). If the Minister of KGG had used the revised estimates to calculate the expected startup losses, the required grant would have amounted to €1 billion. Since the

maximum amount available to the minister was €750 million, she would had to have considered how the shortfall would be made up.

Figure 11 *Gasunie/HNS's provision of information on cost estimates*
Minister of Finance receives more up-to-date information than Minister of KGG (in euros)



5.3.3 Hydrogen network cost estimate not a management tool

The sharp jump in estimated investment costs raised questions at both ministries. Talks about the increase and its causes were still being held at the time of writing.

It is clear that the Ministers of KGG and Finance need Gasunie/HNS to provide more information if they are to understand and control the expected increase in investment costs and take action where necessary.

The SGEI grant is subject to financial management conditions agreed between the Minister of KGG and Gasunie/HNS. For example, Gasunie/HNS must provide the Minister of KGG with annual updates and seek advance permission if there is a 15% or higher change in a cost item. In practice these agreements are not effective. Firstly, the estimated investment costs of €1.5 billion (December 2022) and €3.8 billion (February 2025) are not sufficiently robust to manage costs and controls are accordingly difficult. With a 50% probability (P50) of being too high or too low, the estimates have a very wide range. The first estimate ranged from €1.1 billion to €2.3 billion, the second from €2.8 billion to €4.9 billion. Secondly, the Ministers of KGG and Finance have not yet defined what information they wish to receive regarding the estimate in order to oversee changes in investment costs.

5.4 Draft 2025 cost estimate of the hydrogen network

Gasunie/HNS reviewed the hydrogen network at the end of 2024 and updated the estimated investment costs. Gasunie/HNS notified officials at the two ministries of its reviews and informed Ministers of KGG and Finance by letter on 6 February. The Minister of KGG informed the House of Representatives about the 'substantially higher' €3.8 billion cost estimate on 21 February 2025 (KGG, 2025a). This estimate was taken from a draft multiannual budget that Gasunie/HNS had sent to the minister. At the time of writing, the minister had not yet approved it. The estimate has a range from €2.8 billion to €4.9 billion. We refer to the 2025 estimate as a draft in this report as, after consultation with the Ministers of KGG and Finance, it was still open to revision by Gasunie/HNS. At the time of writing (September 2025) talks were still ongoing and the Minister of KGG had not approved the revised estimate.

Review of draft cost estimate

Gasunie/HNS had the revised cost estimate reviewed by an independent consultancy. The consultancy concluded that construction and engineering costs were presented with sufficient depth and detail but noted that it was very difficult to estimate market conditions and the many risks attaching to hydrogen. It also suggested costs should be indexed at 3.5% per annum whereas Gasunie/HNS applied 2%.

Multiple causes of higher investment costs

According to Gasunie/HNS, the increase in expected investment costs is due to:

1. less repurposing of natural gas pipelines owing to changes in natural gas flows.
The invasion of Ukraine has necessitated a new east-west hydrogen pipeline, the Delta Rhine Corridor (DRC). New pipelines are also needed in the Noord region of the Netherlands;
2. more detailed knowledge of the intended design, changes in pipe diameter and a small number of network extensions;
3. additional sustainability requirements, including measures relating to nitrogen emissions, green steel and water management;
4. higher prices in the supply chain and higher material costs;
5. other variances, such as longer completion times and uncertainties.

Difference analysis of investment costs

Gasunie/HNS analysed the differences between the €1.5 billion cost estimate and the €3.8 billion estimate. It calculated the cost of each of the 5 causes listed above and shared the analysis with the Ministries of KGG and Finance. As the estimate is still a draft proposal, we have not analysed it in further detail.

Less repurposing increases costs

Less repurposing is a definite cause of higher costs. Gasunie/HNS's latest rollout plan increases the length of new pipeline from 202 kilometres in the original plan to 457 kilometres now (see figure 10 in § 6.1.2). New pipelines are 4 times more expensive than repurposed natural gas pipelines (PWC Strategy&, 2021).

5.5 Hydrogen network estimates versus investments in individual sections

Both Gasunie/HNS and the Minister of KGG needed a cost estimate in 2022.

Gasunie/HNS needed to estimate the costs in order to greenlight preparations for the investment in the hydrogen network. The Minister of KGG needed to validate the grant decision and have the amount of the additional item transferred from the Ministry of Finance to its own budget.

Cost estimates of individual sections have little risk of overrun

This chapter has shown that Gasunie's standard method was not used to estimate the costs. At the time, Gasunie/HNS had insufficient information on the network's development. This was not the case for its investment decisions on individual sections of the network. Our audit found that the standard estimation method and

the standard decision-making steps were taken to estimate the cost of investing in each section. The estimated cost of the Rotterdam hydrogen network (WNR), which is expected to be completed in 2026, was based on information in the WNR tender. Gasunie/HNS estimates the risk of a cost overrun at 10%, considerably less than the 50% risk for the network as a whole.

6.

Risk allocation and efficiency

This chapter considers the financial risks in the development of the hydrogen network and the efficiency of the grant awarded for its construction. The allocation of risks and costs has consequences for the grant's efficiency.

6.1 Financial risks in the construction of the hydrogen network

There are financial risks attaching to the development of the hydrogen network. They are relevant to all parties and must be allocated appropriately. The parties are Gasunie/HNS, which will develop the network, the Minister of KGG, who is responsible for policy, the Minister of Finance, in his capacity as Gasunie's shareholder, and the network's customers. During the unregulated period, the risks are allocated to these 4 parties in accordance with the SGEI decision, which also lays down the grant conditions. The financial risks are different during the regulated period (as from 2033 at the latest, see § 6.4). We discuss the risks below.

6.1.1 Capacity risk: uncertain demand for transport capacity

Gasunie/HNS is already developing a national hydrogen network even though the sustainable hydrogen market is in its infancy. Businesses in the industrial clusters that will be connected to the network are still drawing up sustainable production plans. It is uncertain whether they will actually use hydrogen, and thus the network (see § 4.1.1). This creates a risk of network underutilisation, or capacity risk, and unprofitable investments. Gasunie's business case for the network is based on contracted transport capacity of 3.5 GW in 2030, which is based on the minister's target of 4 GW of electrolysis capacity in 2030 and 8 GW in 2032. In the SGEI decision, hydrogen production will create demand for hydrogen transport between

producers and customers. We concluded in § 4.2 that the target of 4 GW by 2030 was unrealistic. Lower than expected production will affect demand for transport capacity and thus the business case.

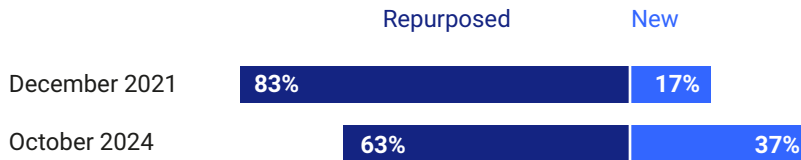
Recent estimates by Gasunie/HNS indicate that there is a capacity risk in the regulated period: expected demand for transport capacity in 2030 will be lower but expected investment costs will be higher.

Risk of higher investment costs due to less repurposing

Gasunie/HNS will incur costs chiefly to repurpose natural gas pipelines and to lay new pipelines for the hydrogen network. The reduction in repurposed natural gas pipelines is an incontrovertible cause of higher investment costs (see also § 5.4.2). Gasunie/HNS’s most recent rollout plan increases the length of new pipeline from 202 kilometres originally to 457 kilometres now (see figure 12). New pipelines are 4 times more expensive than repurposed pipelines (PWC Strategy&, 2021).

Figure 12 *Percentage of new pipelines versus repurposed natural gas pipelines in the hydrogen network*

Higher percentage of expensive new pipelines



Risk of inefficient costs

During both the unregulated and the regulated period, Gasunie/HNS will be compensated for all efficient costs. Efficient costs are those that the network operator incurs to fulfil its task. In the unregulated period, the grant will cover startup losses to an amount of €750 million. In the regulated period, costs will be covered by the transport fee. The stricter the Minister of KGG’s control of efficient costs, the lower the risk that:

- the Minister of KGG includes inefficient costs in the grant calculation during the unregulated period;
- inefficient investments are incurred in the regulated period..

The Minister of KGG has not yet decided whether her ministry will actually control Gasunie/HNS’s costs (see § 6.3.4). The ACM will control costs during the regulated period but it must still decide how it will do so.

6.2 Options and decisions for hydrogen network grant

In June 2022, the Minister of KGG's predecessor presented the case for awarding a grant (K&E, 2022). To remove obstacles to the development of the hydrogen chain, the minister made €750 million available for the period before regulation commences in 2033. This grant is to cover Gasunie/HNS's expected startup losses due to low transport volumes in combination with the fee being too low to cover costs. Several options were considered when designing the grant, with differing risk allocations to the Minister of KGG, Gasunie/HNS and Gasunie/HNS's customers (see table 3).

The allocation of financial risk to Gasunie/HNS and the Minister of KGG influences the grant's efficiency. In the 3 options considered below the amount of the grant and the WACC are unchanged but the risk allocation differs. In the first option, dating from 2021, and the second option, dating from 2022, certain risks were borne by Gasunie/HNS. The grant worked out in the SGEI decision is based on option 3, with risks being borne by the Minister of KGG. Appendix 5 summarises the first 2 grant options. Table 3 describes the SGEI grant chosen by the Minister of KGG.

Table 3 *The 3 grant options and respective risk allocations during the unregulated period*

Actor	Rejected option 1: volume risk partly for Gasunie/HNS	Rejected option 2: Cost risk for Gasunie/HNS	Option 3: capacity risk for KGG; adopted in grant decision
Minister of KGG	Max. €750 million No cost or volume risk	Max. €750 million Bears volume risk	Max. €750 million Bears capacity risk
Gasunie/HNS	Risk at volumes < 2,5 GW and > 5 GW	Bears cost risk	No risk
Customers	Fee declines as volume increases	Fixed fee	Fixed fee

6.2.1 Option 3: capacity risk for Ministry of KGG

The option worked out in the SGEI grant decision of November 2023 includes Gasunie's proposal to carry out post hoc efficiency checks. In brief, it was agreed that:

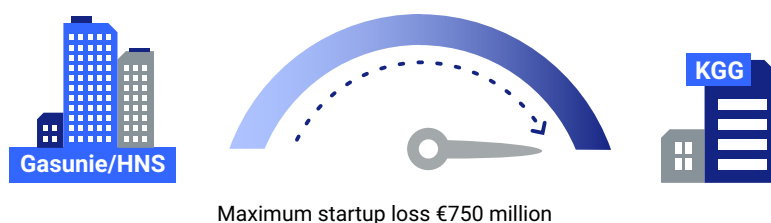
- the Minister of KGG would bear the capacity risk during the unregulated period by covering startup losses to a maximum of €750 million. The Minister of KGG has set the condition that the costs must be efficient, as they also must be during the regulated period;
- the Minister of KGG would check the efficiency of costs;

- the nominal WACC during the unregulated period would be 6% after tax. Any return above 6% after tax would accrue to the Minister of KGG.

In the SGEI decision, the Minister of KGG bears all the capacity risk and the grant covers all startup losses (see figure 13). The package of agreements in the decision means, in so far as possible, that the same conditions will apply in the unregulated period as in the regulated period.

Figure 13 Risk allocation between Gasunie/HNS and Minister of KGG

Minister of KGG bears the risk of lower than anticipated demand during unregulated period



6.2.2 What if the grant is not enough?

There is a risk that the maximum amount of the grant – €750 million – will not be enough to cover the capacity risk until 2033 at the latest. In that case, the Minister of KGG will enter into talks with Gasunie/HNS because the SGEI agreement does not include definite agreements on this risk. According to Gasunie/HNS the outcome of the talks is already known. The Minister of KGG must provide more government support if the market is weaker than anticipated. Otherwise, Gasunie/HNS will have to delay development of the hydrogen network. According to the Minister of KGG, other options are possible. Gasunie/HNS or its shareholder (the Minister of Finance) could step in to cover the shortfall.

The Minister of KGG also bears some of the risk of higher investment costs. Startup losses will consist chiefly of depreciation of capital expenditure as from the moment the network comes on stream. Higher investment costs will therefore affect the amount of the grant provided by the Minister of KGG. If the available €750 million grant runs out, the options are the same as those given above: either the network is delayed or another party will have to step in. Again, the Minister of KGG, the Minister of Finance and Gasunie/HNS have not made further agreements on this matter.

6.3 Efficiency of the grant

We would expect the Minister of KGG to have designed the grant as efficiently as possible in the SGEI decision. The grant's expected efficiency will depend on:

- the reasonable return (WACC) that the Minister of KGG permits Gasunie/HNS to earn;
- checks of the efficiency of the costs Gasunie/HNS charges to the Minister of KGG.

In the SGEI decision, the Minister of KGG chose to anticipate the regulated period and reimburse all Gasunie/HNS's efficient costs (see § 6.2). As a result, Gasunie/HNS runs the same risks during the unregulated period as it will during the regulated period. We asked whether the minister's decision to cover all the capacity risk by reimbursing all startup losses would influence the reasonable return (the WACC) that Gasunie/HNS applied in the business case.

In the following sections we explain how the Minister of KGG set the reasonable return. We compare 2 moments when the minister specifically referred to the level of the WACC: the decision in principle in June 2022 and the SGEI grant decision in November 2023.

6.3.1 Significance of the WACC differs per party

Gasunie/HNS believes a nominal WACC of 6% after tax is justified during the unregulated period in view of the risks it runs. There are two parts to the WACC during the unregulated period: a basic discount rate of 3% and a risk surcharge of 3%.

The **basic discount rate** of 3% is the reasonable return (WACC) that Gasunie expects during the regulated period. In a regulated market, the business risk is low because the fee set by the ACM is guaranteed by law to cover all efficient costs (Electricity Act 1998; Gas Act 2000). In 2021, Gasunie/HNS calculated the WACC during the regulated period at 3%. This 3% is the basic discount rate. This WACC will enable Gasunie/HNS to pay the interest on its borrowings (debt capital) and earn a reasonable return on its equity capital.

During the unregulated period, a 3% **risk surcharge** is added to the basic discount rate. Gasunie/HNS believes the business risk will be higher during the unregulated period owing to the higher capital and operating costs. Gasunie/HNS will be exposed to operating and technical risks when it develops the hydrogen network.

There is a trade-off between the amount of the grant provided by the Minister of KGG and the return required by Gasunie/HNS and the Minister of Finance as shareholder. This is relevant to the Minister of KGG because a lower required rate of return means a lower grant from KGG's budget can achieve the same goals. For the Minister of KGG this is an incentive to oversee the WACC. The incentive is weakened, however, by budget rules (see box below).

Budget rules weaken incentive to manage by efficiency

The €750 million grant can be paid out only for the development of the hydrogen network. Any remaining funds must be returned to the Ministry of Finance. This is because the grant is subject to the budget rules that apply to the government's financial policy. Initial analyses of the grant made available to Gasunie/HNS concluded that the full amount would not be needed. As the Minister of KGG has to return any surplus funds to the Minister of Finance, she has no financial incentive to manage the efficiency of expenditure, or insist on a lower WACC. This is separate from the legal requirement of the Government Accounts Act that the grant must be spent efficiently.

It is not so that Gasunie/HNS's return on the hydrogen network will never accrue to the public purse. Under the agreed dividend policy, part of the return will be distributed to the shareholder, the Minister of Finance. The remainder will be added to Gasunie's capital, which will increase the value of the State's shareholding.

Besides this efficiency incentive, the WACC is subject to requirements set by the European Commission to prevent anti-competitive state aid. The requirements to prevent state aid arise from the SGEI that applies to Gasunie/HNS. The WACC must be:

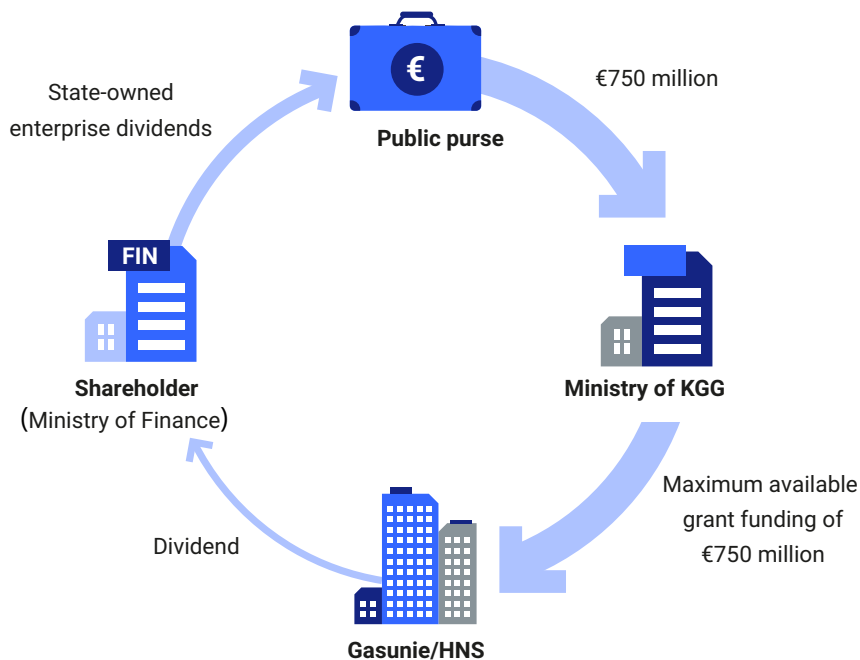
- objective and transparent;
- no higher than necessary to cover the cost of performing the public service in full or in part.

In his capacity as shareholder, the Minister of Finance takes a different perspective on Gasunie/HNS's WACC. A WACC of 6% after tax is a close approximation of the reasonable return the shareholder seeks for the company as a whole, based on the standard return the Minister of Finance has agreed with Gasunie for activities in unregulated sectors.

Figure 14 below shows that part of the grant will return to the public purse. If Gasunie/HNS's permitted return is lower and it accordingly receives less grant funding, less dividend will be distributed to the public purse.

Figure 14 *Financial flow*

Grants partially return to the public purse as dividend



June 2022: minister not managing by efficiency

In June 2022, the risk allocation between the Minister of KGG and Gasunie/HNS had not taken definite shape. Gasunie/HNS nevertheless wanted to start preparations for the construction and the Minister of KGG informed it by letter of the conditions underlying the grant decision. On the basis of this letter, the Minister of Finance gave Gasunie/HNS the green light to start preparations.

One of the agreements was that Gasunie/HNS could apply a WACC of 6%, of which 3 percentage points was a risk surcharge. We found, however, that the Minister of KGG:

- had agreed that the grant would meet cost increases outside Gasunie/HNS's control, such as inflation and the cost of stricter environmental laws;
- had agreed to assume the volume risk.

Assuming these risks made it more likely that Gasunie/HNS's future earnings would be higher and therefore justified a lower WACC. The Minister of KGG did not receive any justification for the 3% risk surcharge in June 2022.

The 6% WACC that the Minister of KGG accepted for Gasunie/HNS in June 2022 is higher than the WACCs used in the Sustainable Energy Production and Climate Transition Incentive Scheme (SDE++). The SDE++ is a grant scheme administered by the Minister of KGG as a financial incentive for the production of sustainable energy. The WACCs used in the SDE++ therefore represent a benchmark for Gasunie/HNS's WACC. Appendix 6 summarises the nominal WACCs after tax applied in the SDE++ rounds of 2022 and 2023.

Based on the SDE++ 2022 WACCs and the Minister of KGG's assumption of risks from Gasunie/HNS, we conclude that the nominal WACC of 6% in 2022 was high. In our opinion, it should have prompted the minister to open talks on the risk surcharge. The minister failed to negotiate a lower WACC with Gasunie/HNS in June 2022.

The relevance of this to the grant is shown in table 4. Gradually reducing the risk surcharge in the original business case to 0% reveals the impact on the grant. If the Minister of KGG had negotiated a risk surcharge of 0%, Gasunie/HNS's expected startup losses in the original business case would have been €268 million lower. With a risk surcharge of 3%, the loss would be €857 million, €107 million more than the maximum grant of €750 million available in the SGEI decision. For the sake of completeness, we note that the amounts in table 4 are nominal amounts. The methodological appendix (appendix 2) explains this choice.

Table 4 Risk surcharge and loss compensation (nominal amounts in millions of euros)

WACC to year-end 2030	Risk surcharge in WACC	Calculated loss compensation	Difference from grant with 6% WACC
6%	3%	857	
5%	2%	767	90
4%	1%	678	179
3%	0%	589	268

November 2023: interest rate rise makes management by efficiency unnecessary

The Minister of KGG set the WACC in the SGEI grant decision at 6% after tax. In anticipation of the WACC decision, the minister carried out 2 checks:

- a benchmarking check using WACCs in the SDE++;
- a check for possible state aid.

In April 2023, the Ministry of KGG made a comparison with the WACC applied in the calculation of the basic amounts of the SDE++ grant⁴ and concluded that a WACC of

6% was not uncommon, especially not following the increase in interest rates in the preceding years. Appendix 6 summarise the nominal WACCs after tax applied in the 2022 and 2023 rounds of the SDE++. The WACC in 2 of the 14 SDE++ categories in the 2023 grant round was lower than 6%.

In September 2023, the ministry of KGG made an internal analysis of the WACC and concluded that a nominal rate of 6% after tax was reasonable. The analysis was carried out in steps.

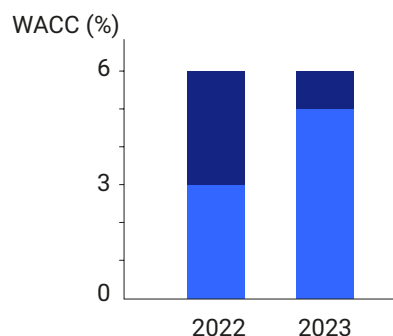
- Firstly, it was assumed that the 2 reviews of the business case raised questions about the risk surcharge in the WACC. The risks to Gasunie/HNS are limited.
- Secondly, it was assumed that the structure of the WACC had changed since June 2022 owing to the higher interest rates. This was because the WACC is a weighted average of the cost of Gasunie/HNS's equity and the cost of its debt. If interest rates rise, the cost of debt increases and it is more expensive for Gasunie/HNS to borrow money.
- Thirdly, higher interest rates increase the basic discount rate, thus reducing the risk surcharge if the WACC remains at 6%. Given the lower risk surcharge, the Ministry of KGG concluded that the 6% WACC was reasonable.

We conclude that, due to the chance increase in interest rates, the 6% WACC is reasonable from the point of view of the Minister of KGG. This is not the case for Gasunie/HNS however. According to it and the Minister of Finance, a risk surcharge of 3% was justifiable but higher interest rates had reduced it to about 1% (see figure 15). Gasunie/HNS took no action in response.

Figure 15 Increase in basic discount rate of WACC

WACC risk premium falls from 3% to 1%

■ Base discount rate ■ Risk premium



The nominal WACC in the Gasunie business case was not updated in the May 2023 grant application or in the November 2023 SGEI grant decision. We also referred to this in chapter 5 with respect to the investment costs.

6.3.4 Cost control: useful but wide margins

The grant's expected efficiency is determined by both the WACC and efficient control of the costs Gasunie/HNS declares to the Minister of KGG. The more efficient the controls, the lower the risk that the minister will reimburse inefficient costs.

The Minister of KGG has not yet decided whether her ministry will actually check the efficiency of Gasunie/HNS's costs. Under the grant decision, she 'can' check efficiency, which leaves the door open to carry out checks. The checks that KGG can carry out will be practically the same as those the ACM will carry out in the regulated period. The Minister of KGG has not worked out the checks in detail. The box below provides a brief example of how efficiency checks might affect the grant and the transport fee.

Effect of efficiency check

If, for example, 95% of costs are efficient, no more than 95% of the costs can be used to calculate the grant and no more than 95% of the costs can count as investment costs in the regulator's calculation of the transport fee.

Our audit found that the proposed efficiency checks provide only limited assurance on the efficiency of investment costs. According to the ACM, such complex checks have a margin of uncertainty of 15%. Only if there are evident and/or very substantial inefficiencies can checks have adverse practical consequences. In all probability, checks to determine the efficiency of operating costs also have substantial margins of uncertainty. Given the absence of comparable hydrogen networks, the Minister of KGG will thus have to set a benchmark with wide margins.

We conclude that efficiency checks are useful to obtain some assurance on the efficiency of grant disbursement but the minister has to accept margins of uncertainty. Efficiency checks are important not only to the Minister of KGG but also to future users of the hydrogen network. During the regulated period customers will pay the fee set by the ACM based in part on the efficiency of the costs incurred by Gasunie/HNS.

6.4 What will happen in the regulated period after 2033?

The hydrogen network must be regulated by 2033 at the latest. The ACM will be the regulator. It already regulates Gasunie's transport of natural gas and TenneT's transmission of electricity on the high-voltage grid. The ACM will set transport fees and Gasunie/HNS's return when it starts regulating the market (see § 3.4).

6.4.1 Risk allocation during regulated period uncertain

At the time of writing (September 2025), it was still uncertain how risks would be allocated to the stakeholders (the Minister of KGG, the Minister of Finance, Gasunie/HNS and customers) during the regulated period. Gasunie/HNS has legal assurances that efficient costs will be reimbursed via the ACM (Electricity Act 1998; Gas Act 2000). In principle, Gasunie/HNS must earn back its investment in the hydrogen network through the fees set by ACM. If Gasunie/HNS does not earn back its investment during the regulated period, it and the Minister of Finance will have a problem. It is still uncertain how this risk will be managed without delaying construction of the network.

6.4.2 Risk of a fee shock in regulated period

In the regulated period, Gasunie/HNS must earn back its investment costs through the fee set by the ACM. If the transport volume is lower and investment costs are higher than expected, the fee may rise significantly. The ministers and Gasunie/HNS will have to agree measures to avoid a sharp increase in the transport fee after the start of regulation, which all parties (the Minister of KGG, the Minister of Finance, Gasunie/HNS and customers) wish to avoid.

The two ministers are not currently intending to cover future losses on the hydrogen network. The Minister of Finance is not contemplating further financial support. The Minister of KGG is assuming that Gasunie/HNS will recover its costs and earn a reasonable return through the fee. The ACM says additional measures are needed to prevent a fee shock (ACM, 2025).

According to the ACM, the cost of building the network and the development of volume must not depart too far from the business case if hydrogen transport is to be affordable. The ACM also finds it reasonable that Gasunie/HNS has asked potential customers to commit to the network before it takes a final decision on the construction of parts of it. The ACM has a number of options to keep fees affordable while the market establishes itself.

The first option permitted under EU law is to apply an intemporal cost allocation mechanism. Gasunie/HNS earns back its costs by spreading the transport fee over time. If permitted under the law, the ACM could use such a mechanism to support market development during the startup phase and spread the initial cost of the rollout more evenly across the first and future customers. Secondly, the ACM refers to the options available to the ministers themselves. If they want fees to be affordable during the startup phase, they could award a grant or a loan guarantee.

That additional measures are necessary is illustrated by Gasunie/HNS's calculation that the loss during the regulated period could be €1.8 billion higher than the maximum available grant of €750 million. This figure is shrouded in uncertainty and rests on many assumptions, including the transport fee, the volume transported, investment costs and depreciation periods.

7.

Conditions applying to the repurposing of natural gas pipelines

A key facet of the construction of the hydrogen network is the repurposing of former natural gas pipelines. According to the Minister of KGG, repurposing is sustainable, cost effective, fast and has less impact on spatial planning (EZK, 2021a; K&E, 2023d). Transporting hydrogen through natural gas pipelines, however, is subject to certain conditions.

7.1 RIVM sets 14 conditions on repurposing

Pipelines cannot simply be switched from transporting natural gas to transporting hydrogen. An advisory report by the National Institute for Public Health and the Environment (RIVM) for the Minister of I&W identified 14 conditions that have to be met before the risks of transporting hydrogen are comparable to the risks of transporting natural gas (RIVM, 2021). If the conditions cannot be met, Gasunie/HNS must take additional measures to reduce the higher risks of transporting hydrogen. Gasunie/HNS claims it can meet all 14 conditions.

Crack growth biggest problem for repurposing

A key concern for the repurposing of natural gas pipelines is that cracks in the pipelines can grow if there are significant changes in pressure. Unlike natural gas, hydrogen can accelerate metal fatigue and shorten the life of pipelines owing to changes in pressure (AVIV, 2019; Bilfinger Tebodin, 2019). Cracks can eventually lead to such leakages that the pipelines are no longer suitable to transport hydrogen. The RIVM has set standards on the maximum permitted rate of crack growth. According to the RIVM, the pipelines must be inspected internally to detect cracks and other defects.

If a pipe does not meet the RIVM's conditions, if, for instance, cracks are present, the risk of transporting hydrogen is higher than the risk of transporting natural gas and Gasunie/HNS must take remedial measures, such as:

- repairing cracked pipes or laying new pipes;
- reducing the transport pressure.

Reducing the pressure would reduce the volume of hydrogen customers received and thus the amount of energy transported.

7.2 Uncertain percentage of repurposed pipelines

At the time of writing (September 2025), it is thought that repurposed natural gas pipelines will make up 63% of the hydrogen network (see figure 12 in § 6.1.2). It is uncertain what percentage of natural gas pipelines are suitable for hydrogen transport. This uncertainty is reflected in Gasunie/HNS's estimate of the investment costs. In its review of Gasunie/HNS's latest, proposed cost estimate (see § 5.4), the independent consultancy concluded that the suitability of existing natural gas pipelines was uncertain. In the worst case scenario, some of the reviewed pipelines are not suitable for hydrogen and Gasunie/HNS will have to lay new pipelines. The consultancy recommends that Gasunie/HNS give a conclusive answer as to the suitability of repurposed natural gas pipelines for hydrogen transport.

7.3 No independent evidence for repurposing

The Minister of KGG has assumed that the repurposing of natural gas pipelines is technically feasible based on information that originated from Gasunie/HNS. Gasunie/HNS is the lead author, co-author or data source of reports confirming the suitability of natural gas pipelines for hydrogen. These reports underpin the 2021 Hyway 27 report issued by PWC Strategy& on the suitability of the natural gas network for hydrogen transport (PWC Strategy&, 2021).

We conclude that the evidence provided in Hyway 27 lacks independence. An independent expert was not involved. The Minister of KGG received information from a party that had a direct interest in the policy.

8.

Information position of the House of Representatives

This chapter looks at how the Minister of KGG has informed the House of Representatives of hydrogen policy and network construction and cost, partly with a view to the House's right to approve the budget. The information must be correct, complete and timely.

8.1 Detailed information on network progress

We conclude that the Minister of KGG informs the House of Representatives about the network's progress in a timely manner. She regularly informs it in detail about a wide range of issues, including the measures taken by Gasunie, the financial instruments used and the hydrogen reserve formed in the Climate Fund.

8.2 Incomplete information on costs

We conclude that the Minister of KGG has not informed the House in full about the estimated cost of the hydrogen network. She based the grant decision (November 2023) on a cost estimate based on 2020 prices that took no account of the surge in inflation in 2022.

In June 2022 the minister informed the House that the total investment cost for the transport network was estimated at the time to be €1.5 billion. The minister knew from the first external validation review that the figure was dated but she did not have more recent information on the total investment cost. In later letters on the network's progress she did not refer to possible cost increases, even though Gasunie/HNS's grant application and the second independent review had informed

her about them. We therefore conclude that the information provided on expected investment costs was incomplete. Our audit also found that the Minister of KGG was unaware of the estimated range of €1.1-€2.3 billion.

In our opinion, the minister should have been more circumspect about the quality of the cost estimate because it determined the amount of the grant. The information the House received on the development of the hydrogen transport network was incomplete.

8.3 Incomplete information on repurposing conditions

We conclude that the Minister of KGG informed the House of Representatives in a correct, timely but incomplete manner about the repurposing of natural gas pipelines. She told the House that there were no restrictions on the safe repurposing of the pipelines for hydrogen. She wrote in 2021 (EZK, 2021a), 'Hydrogen can also be transported safely through these pipelines. The hydrogen molecule is a smaller molecule than methane (natural gas), but earlier studies have found that the pipelines can be technically modified so that hydrogen can be transported through them safely. Technical modifications include, for example, the replacement of valves and the cleaning of pipes.'

But in this and later letters to parliament (up to September 2025), the minister did not state that certain conditions had to be met before hydrogen could be transported in repurposed natural gas pipelines (see § 7.1). The minister referred to studies of the conditions in an appendix or footnote to the letters to parliament but did not consider their significance or the RIVM's advisory report. The minister's communications with the House expressed no hesitancy about the use of natural gas pipelines to transport hydrogen. She was thus more confident about the repurposing of the pipelines than the reports and studies she referred to.

What the minister told the House was correct but not complete. We therefore conclude that the minister did not present the whole picture and the House accordingly did not have full insight into the conditions applying to repurposing and the financial and non-financial consequences. Less or no repurposing would increase the cost of the entire network (see § 6.1.2). It could also lead to reduced pressure and thus lower transport volumes and less income for Gasunie/HNS.

8.4 Complete information on the risks of storage in salt caverns

The Minister of KGG's letters to parliament paid specific attention to the safety aspects of storing hydrogen in salt caverns. In 2021, her predecessor wrote, 'The safety of these activities will be at the forefront from the very start' (EZK, 2021a). The minister also sent the House a report entitled Risk assessment of hydrogen storage in a conglomerate of salt caverns in the Netherlands (Effects of Mining Knowledge Programme, 2024; KGG, 2024). In 2024, the Minister of KGG appointed an ambassador for underground energy storage to develop a strategy for the safe storage of hydrogen (K&E, 2024). The minister shared this strategy, the National agenda for underground hydrogen storage and the importance of salt mining, with the House on 4 July 2025 (KGG, 2025c).

9.

Conclusions and recommendations

9.1 Conclusions

The grant is not effective because of the significantly higher startup losses and the later than planned completion. The estimated startup losses represent a substantial risk to the public purse.

The Minister of KGG maintains that a hydrogen infrastructure is necessary for the Netherlands to become climate neutral by 2050 and to meet its 2050 climate goals. The hydrogen ambitions are a means to achieve these goals. The minister has provided sound reasons for the government's involvement in the construction of the network. She awarded a grant to prevent market failure (chicken and egg problem) holding back construction of the network. The Minister of KGG has tasked Gasunie/HNS with the construction and operation of the network. This is consistent with government policy on state-owned enterprises.

When deciding on the grant in 2023, the Minister of KGG made a maximum of €750 million available to cover startup losses until the network is completed and regulated in 2031. With an estimated transport volume of 4 GW and the fees set by the ACM, network operation would break even as from 2031. Our audit found that when Gasunie/HNS applied for a grant in 2023 it estimated the total loss compensation necessary to cover startup losses at €857 million, €107 million more than the available grant. In our opinion, the limits of the available funding were in sight from the very beginning. By 2025, estimated costs had risen to €3.8 billion and the transport volume was lower than estimated. Loss compensation will therefore be substantially higher than the available €750 million. Gasunie/HNS currently puts the total necessary loss compensation at €2.5 billion (all other things being equal).

Total startup losses would therefore be 3 times higher and €1.8 billion more than the maximum amount made available by the minister.

Definite agreements have not been made in the SGEI grant agreement on what to do if the €750 million grant is insufficient. It has been agreed though that the Minister of KGG and Gasunie/HNS will enter into talks. Ultimately there are two options: construction of the hydrogen network is delayed or additional funding is provided. It is uncertain how the costs will be shared between the Minister of KGG, the Minister of Finance, Gasunie/HNS and customers.

We conclude that the €750 million grant is not effective. It will not cover expected startup losses and the national network will not be completed by 2030. At the time of writing, completion is 2 years behind schedule. We also conclude that the estimated startup losses are a substantial risk to the public purse, regardless of whether they are incurred before or during the regulated period. The Ministers of KGG and Finance must manage this risk. Consultation on a solution is ongoing.

Construction of network sections under pressure from condition applying to investment decisions

The decision to construct the first section of the network in Rotterdam (WNR) was taken in 2023 owing to the available grant and because some of the transport capacity had already been contracted. The latter is important because Gasunie/HNS and its shareholder (the Minister of Finance) have agreed that demand for transport capacity will be taken into account when deciding on the construction of a section. If demand is insufficient, Gasunie/HNS will decide against investment and the section will not be built. In view of the lower than expected demand for transport capacity, we conclude that it is uncertain whether all sections of the network will be built. We also conclude that the individual sections have a chicken and egg problem, which the Minister of KGG thought she had resolved through the provision of a grant for the development of the national network.

Minister of KGG does not manage the efficiency of grant expenditure

In anticipation of the grant decision, the Ministers of KGG and Finance discussed several types of grant with Gasunie/HNS. The financial risks of each type were allocated differently to Gasunie/HNS and the Minister of KGG. Our audit found that the Minister of KGG had assumed financial risks that initially lay with Gasunie/HNS. In doing so, she took no account of the 3% risk surcharge in Gasunie/HNS's required rate of return. The minister could have insisted on Gasunie/HNS lowering its 6% required rate of return as it now had more assurance on its future income.

This would have made a difference in the amount of the grant: the Minister of KGG could have lowered the reserve in her budget by up to €268 million. We conclude that the minister did not design the grant with a view to efficiency. She did not weigh the risk exposure against the return she allowed Gasunie/HNS to earn during the unregulated period. This conclusion is important because the Minister of KGG must weigh the risks she takes against the return earned by the businesses involved in future energy transition projects, such as hydrogen storage (Hystock), carbon capture and storage (the Aramis project), heat networks (EBN) and nuclear energy. Prudent risk allocation prevents the inefficient use of public money.

Quality of cost estimates not suitable for the grant decision

Gasunie/HNS's €1.5 billion estimate in 2021 of the cost of investing in a hydrogen network was not robust enough for the Minister of KGG to take the grant decision and set the transport fee in 2023. The estimate had very limited predictive value, financial risks were not quantified and the price level was dated. The Minister of Finance received an updated estimate of €2 billion (2022 prices) but to our surprise did not share it with the Minister of KGG. The dated price level is particularly important on account of the surge in inflation in 2022. If the Minister of KGG had received an updated estimate she would have realised that the available €750 million grant was not enough. About €250 million more would have been needed to cover estimated startup losses.

Reviews of cost estimates did not prompt changes

Before the Ministers of KGG and Finance took their decisions, 2 independent consultancies reviewed the 2021 cost estimate. Criticisms of the dated price level, the rate of inflation and Gasunie/HNS's required rate of return during the unregulated period prompted little if any discussion. We conclude that the Ministers of KGG and Finance made too little use of the reviews. This is concerning because external reviews are a most appropriate means to ensure an estimate is of appropriate quality.

Minister of KGG does not provide the House of Representatives with complete information on certain matters

The Minister of KGG informed the House of Representatives in June 2022 that the investment was expected to cost €1.5 billion, yet she was aware that the price level was dated. In later letters on the hydrogen network's progress, she did not provide updates of cost increases even though she had received several indications that prices had risen. The minister informed the House that natural gas pipelines could

be safely repurposed to transport hydrogen but she did not reveal that repurposing was subject to strict conditions. We conclude that the Minister of KGG did not inform the House in full about these matters.

9.2 Recommendation

Several major projects in which the government will play an active role must be undertaken to achieve climate neutrality by 2050. They include the storage of hydrogen (Hystock), carbon capture and storage (the Aramis project), heat networks (EBN) and nuclear energy. These ambitious projects will bring about huge changes and have significant uncertainties, especially in an early design phase.

Recommendations to the Minister of KGG

- *Before awarding a grant for a major project carefully study the financial risks and have the calculation of the WACC take specific account of the allocation of risk to the government and the organisations concerned.*
- *After awarding the grant, monitor the progress of the business case and periodically inform the House of Representatives of actual and potential windfalls and setbacks in both financial and technical areas.*

We expect the Minister of KGG to understand and manage uncertainties in the energy transition projects she supports as effectively as possible. To use grants effectively, she should be fully informed of expected costs, revenues and risks. When grant funding a state-owned enterprise or another business, she should underpin the calculation of the WACC robustly and take specific account of the financial exposure of the government and the business concerned. This would minimise the size of the grant and achieve climate goals at the lowest possible cost. After awarding the grant, the minister should monitor the project for windfalls and setbacks in the business case and inform the House of Representatives of major financial or technical changes

Recommendation to the Ministers of KGG and Finance

- *Involve all stakeholders in decision-making on the future development and financing of the hydrogen network.*

Higher investment costs and the lower than expected demand for transport capacity have significantly increased expected startup losses. The Minister of KGG has made a maximum of €750 million available yet at the moment of writing estimated losses amounted to an additional €1.8 billion. Although this estimate is based on

assumptions and is shrouded in uncertainty, it is a substantial financial risk to the public purse. We recommend the Ministers of KGG and Finance consult each other to decide on the network sections, the fees charged to future users and/or the provision of financial assistance. They should involve all stakeholders in decision-making: Gasunie/HNS, future customers (producers and consumers) and the ACM.

10.

Response of the ministers and the Court of Audit's afterword

We received a joint response to our draft report from the Minister of Climate Policy and Green Growth and the Minister of Finance on 4 November 2025. It is presented in full below. We close this chapter with our afterword.

10.1 Response of the ministers

The government took note of the report 'Hydrogen network under severe pressure' with great interest. The Minister of Finance and I hereby send you our response to the report.

The government is extremely grateful for your report and its recommendations. It is heartening to read that you find both the utility and need to develop a transport network and the market failure are presented correctly, and you also support the need for financial support from the government. Your conclusion on the compatibility of using Gasunie, a state-owned enterprise, to develop the network with policy on state-owned enterprises is also welcome. Your further conclusions and three recommendations place emphasis on financial issues.

You first recommend that before awarding a grant for a major project a careful study should be made of the financial risks, and calculation of the weighted average cost of capital (WACC) should take specific account of the risk exposure of the government and the organisations concerned. Development of the hydrogen transport network is a precondition for the development of the hydrogen chain. Businesses have taken concrete initiatives to invest in the production of green hydrogen and there is an urgent need to develop the transport network. After taking

the grant decision, Gasunie was able to commence development of the transport network and initiate spatial planning procedures. Gasunie also signed a framework agreement with several customers (groups) to carry out new energy infrastructure projects, including the hydrogen network. You conclude that the quality of the cost estimate was inadequate for the grant decision. It is clear that the current estimate of the costs is considerably higher than the initial budget of €1.5 billion. For such a major infrastructure project as the development of a hydrogen network, in hindsight it would have been more advisable to work with a probabilistic budget so that uncertainties regarding the costs would have been better understood. Owing to the progress of the spatial planning procedures, the environmental factors that influence the costs have become more precise. Contact with contractors and customers has also made it possible to better estimate the investment costs. The budget now presented is a probabilistic budget with a wide range. At this stage, it is more appropriate for such a substantial project. The NCA writes that an external review requested by the government concluded that the expected investment costs were based on an outdated price level. The government accepts your conclusion that it would have been better to index the costs during the process in order to arrive at a financial instrument that would support development of the network.

The government takes to heart your second recommendation of monitoring the business case after a grant is awarded and periodically informing the House of Representatives of windfalls and setbacks in both financial and technical areas. In general, the NCA states that the government has informed the House about developments in the hydrogen network in a timely manner. The government regularly informs the House in detail about an array of topics, including the use of the state-owned enterprise Gasunie, the financial instruments and the hydrogen reserve in the Climate Fund. The NCA finds the information incomplete in certain areas, in particular with regard to cost movements. The report shows that the Minister of KGG herself did not have the right information. The NCA also notes that more attention could have been paid to communication of the technical conditions applying to the repurposing of existing natural gas pipelines, with the report also stating that Gasunie is able to meet the conditions.

The government accepts your third recommendation, in which you recommend that choices be taken on the future development and financing of the hydrogen network and that all stakeholders should be involved in decision-making. The award of a €750 million grant is intended to cover startup losses when there is little if any revenue during development of the transport network. This period will end when fee regulation of the transport network commences in mid-2033. During the unregulated

period, the available budget of €750 million is currently thought to be adequate and the financial instrument (the SGEI decision) to be effective to develop the transport network. Like the NCA, the government recognises that rising investment costs and lower than expected volumes are an issue if fees are to be affordable and Gasunie's risk profile acceptable over the entire economic life of the network. The government does not see this as a startup loss but in close cooperation with the ACM is investigating whether this issue can be resolved by means of an intemporal cost allocation (amortisation) mechanism within the fee system. Introduction of such a mechanism is not risk-free. In line with your recommendation, the government will make clear agreements regarding the risks the introduction would bring with it. Further to the NCA's recommendation, the government will reconsider the suitability of the WACC if there is a change in the risk profile.

10.2 Court of Audit's afterword

We appreciate the ministers' undertakings to improve budgeting of future large projects and to keep budgets up to date. The ministers also undertake to adjust Gasunie/HNS's WACC if there is a change in the risk profile. This will improve the efficient use of public money. Such active management is also important for the design of grants for future projects, such as carbon storage, hydrogen storage, heat networks and nuclear power stations. In these cases, too, the Minister of KGG must set a WACC that is appropriate for a business's risk exposure.

The ministers write that the grant is adequate and the grant instrument effective for the development of the transport network until mid-2033. Our audit did not come to the same conclusion; we conclude that the grant is not effective. The Minister of KGG wanted the €750 million to be applied to complete the entire network by 2030. This is no longer realistic in view of the construction delays; the additional measures needed to operate on a cost-recovery basis; and the uncertainty about whether the entire network will be built. The additional measures are needed to find a solution as the shortfall has risen to €1.8 billion.

The ministers' response does not consider our conclusion that construction of individual sections of the network is under pressure. It is not clear how the Minister of KGG will satisfy the Minister of Finance's condition that revenue must be contractually guaranteed before work begins on a section. At the time of writing, this condition will probably stand in the way of the Minister of KGG's ambition of completing the entire network. The extent to which it does will depend in part on future demand for transport capacity. At the time of writing it is uncertain what part of the network can be built by 2030.

Appendices

Appendix 1 Audit question and criteria

Key question

Is policy on hydrogen infrastructure – including the use of grants and state-owned enterprises – effective and efficient, are financial and non-financial risks managed and is policy accounted for in a full, timely and correct manner to the House of Representatives?

Audit questions

1. Is the Minister of KGG's hydrogen infrastructure policy, including the use of grants and state-owned enterprises, effective and efficient (fully substantiated)?
2. Is the Minister of KGG's hydrogen infrastructure policy consistent with other national energy policies?
3. Has the Minister of KGG ensured grants for the hydrogen network will be applied efficiently and that financial and non-financial risks will be managed?
4. Has the Minister of KGG informed the House of Representatives in full and in a timely and correct manner about the hydrogen network policy, including the use of grants and state-owned enterprises?
5. To what extent do Gasunie/HNS's cost estimates meet the standards set for policy information and do they serve as a management tool for the Minister of KGG?

Criteria

The Court of Audit applies a set of criteria to answer its audit questions. Listed below are the criteria we have taken from the literature and the Court of Audit's basic standards for use in our performance audits.

Criteria for audit question 1: The Minister of KGG's hydrogen infrastructure policy, including the use of grants and state-owned enterprises, is effective and efficient (fully substantiated).

Criteria for national infrastructure

- The minister demonstrates how the 5 conditions central government applies for energy security are served by policy on the hydrogen infrastructure (Netherlands Court of Audit, 2021). Energy supply must be clean (carbon-free), secure, reliable, affordable and have a good spatial planning fit.
- Policy on hydrogen infrastructure is based on reliable studies that conclude that the development of hydrogen infrastructure – and the preferred solutions – is necessary and feasible with support from central government, or the minister personally demonstrates that this is the case (Netherlands Court of Audit, 2012).
- Policy on hydrogen infrastructure is based on several reliable scenarios of the development of the hydrogen market and has the flexibility to adapt to the scenario in practice (Netherlands Court of Audit, 2012).
- The minister demonstrates that there is market failure and government intervention is necessary to overcome the market failure and develop the hydrogen infrastructure in a timely manner (Communication of the European Commission 2022/C 80/01).
- The minister demonstrates that the grant instrument is the most suitable policy instrument in comparison with other policy instruments, including the option of doing nothing, to develop the hydrogen infrastructure in a timely manner (Communication of the European Commission 2022/C 80/01).
- The minister weighs the grant instrument against other support measures, such as a loan or guarantee, and shows that other support measures are unsuitable or less suitable to develop the hydrogen network in a timely manner (Communication of the European Commission 2022/C 80/01).

Criterion for the use of state-owned enterprises

- The minister demonstrates that the market cannot adequately protect public interests that are served by the development of hydrogen infrastructure (Finance, 2022).

Criterion for audit question 2: The Minister of KGG's hydrogen infrastructure policy is consistent with other national energy policies and with the policies of neighbouring countries and the EU?

- The Minister of KGG's hydrogen infrastructure policy is consistent with other national energy policies, or the policy does not conflict with other national energy policies.

Criterion for audit question 3: The Minister of KGG ensures that grants for the hydrogen network is used efficiently and that financial and non-financial risks are managed.

Criteria for grant calculation and grant assistance

- The minister checks or has a third party check whether completion of the project is plausible given the outcome of the grant calculation (National EZK and LNV Grants Scheme, 2014; Renewable Energy Grant Scheme, 2024).
- The grant takes account of alternative scenarios of the development of the hydrogen market and can be adjusted in the interim if a lower grant is needed (Netherlands Court of Audit, 2024; Suitable Incentive and Cumulation Rules under the Renewable Energy Grant Scheme, 2022).
- Proportionality: the grant amount is limited to the minimum necessary to build and operate the hydrogen infrastructure (Communication from the Commission 2022/C 80/01).
- The grant has a clawback mechanism should the hydrogen infrastructure prove more profitable than foreseen (Communication from the Commission 2022/C 80/01; Communication from the Commission 2021/C 528/02).
- The minister has built periodic flexibility options such as tranching into the grant award to prevent unnecessary grant payments and modify performance as and when different scenarios arise (CPB, 2016).
- By means of annual monitoring, the minister oversees the development of costs, revenues and profitability. The minister uses the grant recipients' annual accounts and the audit opinion issued on them to monitor costs and performance (Uniform Grant Framework 2012).

Normen voor risicoverdeling

Criteria for risk allocation

- The minister analyses the grant's main positive and negative financial and non-financial risks to the government and the potential consequences for the public purse and documents the main conclusions (Netherlands Court of Audit, 2012;

Netherlands Court of Audit, 2021; Netherlands Court of Audit, 2024).

- The minister makes agreements on the allocation of risks to the government and the grant recipient and formally documents them, for instance in a contract with the grant recipient (Netherlands Court of Audit, 2002).
- The minister allocates positive and negative financial and non-financial risks efficiently. The risk exposure to the government is proportionate to the social and other benefits the grant can deliver for the government (Netherlands Court of Audit, 2024).

Criterion for audit question 4: Has the Minister of KGG informed the House of Representatives in full and in a timely and correct manner about the hydrogen network policy, including the use of grants and state-owned enterprises?

- The minister periodically informs the House of Representatives of the policy's progress. The minister in any event checks developments (finances and performance) against the plans and any changes in the policy environment that can influence achievement of the goal (Netherlands Court of Audit, 2012).

Criteria for audit question 5: To what extent do Gasunie/HNS's cost estimates meet the standards set for policy information and do they serve as a management tool for the Minister of KGG?

- Estimates meet the set functional and technical standards and are prudent. Besides professionalism, quality assurances are also necessary in the form of, for instance, internal controls, external audits and second opinions.
- Estimates have significant predictive value. Uncertainties and financial and non-financial risks attaching to a project must be described as fully as possible so that management measures can be taken and reserves can be formed.
- Estimates are transparent. Transparency is enhanced by unambiguous terminology, uniform structure of underlying item-by-item estimates, comparability of successive versions, clear descriptions of movements through the preparation of difference reports, specific statement of the price level, clarity regarding the calculation and inclusion of VAT. To strengthen understanding of the method's reliability, a post hoc calculation must be made of every estimate wherever possible.

Appendix 2 Methodology

Interviewees

We held interviews with staff at the Ministry of KGG, Ministry of Finance, Ministry of I&W, RVO, ACM, Gasunie/HNS, SodM, universities, industry, the European Court of Auditors and the supreme audit institution of Germany (Bundesrechnungshof).

Data

Financial data on the hydrogen network are taken from the Excel files used by Gasunie/HNS for its SGEI grant application and to inform the Minister of KGG of the increase in investment costs. The files present the expected costs and benefits of the hydrogen network and expected size of startup losses. To process and analyse the data correctly, we held interviews with Gasunie/HNS, the Ministry of KGG, the Ministry of Finance and the ACM.

Disclosure of data to third parties

Under section 2.2 (1)(e) of the Open Government Act (WOO), the Netherlands Court of Audit is subject to the WOO. Under section 7.41 (2) of the Government Accounts Act 2016, information that the Court collects in the performance of its statutory duties (e.g. audit) is exempt. Requests for such information are passed on to the body, person or board that provided the information.

Expected startup losses are the sum of nominal amounts

For this audit, we mapped out the expected startup losses of the hydrogen network and presented them as nominal amounts, i.e. before adjustment for inflation. This departs from the principle that amounts at different price levels (for instance amounts in 2026 and 2028 prices) should not be aggregated.

We did so because the SGEI grant is stated at a nominal amount of €750 million. Comparing the nominal amount of the startup losses with the available nominal amount of the grant, €750 million, provides an insight into the grant's expected shortfall or surplus.

Appendix 3 Timeline of the policy goals

Target 3-4 gigawatts (GW) of electrolysis production by 2030

The first document to present the government's green hydrogen targets was the 2019 National Climate Agreement: electrolysis production of 3-4 GW by 2030 for use in industry, electricity generation, mobility and the built environment, with the repurposing of natural gas pipelines and imports. Sustainable offshore wind electricity can be used onsite for the electrolysis as the transport of hydrogen to land is less expensive than the transport of electricity and makes no additional burden on the electricity network. The National Climate Agreement names blue hydrogen (hydrogen produced from natural gas, with carbon capture and storage (see figure 4)) as a temporary solution until sufficient green hydrogen is available.

Government strategy: retain energy-intensive industries and energy hub function

The government announced its strategy for hydrogen in March 2020. It states that the Dutch economy has a large proportion of energy-intensive industries. The government's goal is not only to retain those industries but also to make them sustainable. This will require carbon-free energy carriers, such as hydrogen. The government also recognises the strategic importance of retaining the current energy hub function in the Port of Rotterdam.

Repurposing of natural gas pipelines is technically possible and safe

The June 2021 HyWay 27 report – the product of a joint study by the Ministers of Economic Affairs and Climate Policy (EZK) and Finance, Gasunie and Tennet – concluded that hydrogen was an essential constituent of a climate-neutral economy. As pipelines are the most efficient means to meet transport needs, natural gas pipelines could be repurposed for the safe transport of hydrogen (PWC Strategy&, 2021).

Phased rollout allows for evolution of demand for transport capacity

The Minister of KGG sent the first rollout plan for the hydrogen network to the House of Representatives in June 2022 (K&E, 2022). The rollout plan gives the minister the option of building the hydrogen network in phases in order to respond to the evolution of demand for transport capacity.

House of Representatives requests doubling of electrolysis target to 6-8 GW by 2032

The National Hydrogen Programme (NWP, with representatives from the entire hydrogen sector and relevant civil servants) published the Hydrogen Roadmap in November 2022. It doubled the target for electrolysis production to 6-8 GW by 2030. The House of Representatives submitted a motion in December 2022 asking for the national production of hydrogen to be raised to 8 GW by 2032 or so much earlier as possible (House of Representatives, 2022). Despite his reservations, the minister raised the electrolysis production target to 8GW by 2032 on 20 June 2023 (K&E, 2023c).

European Court of Auditors: targets too ambitious and politically motivated

In the European Court of Auditors' opinion, European hydrogen targets (40 GW electrolysis capacity, 10 megatonnes of production and 10 megatonnes import in 2030) are politically motivated rather than based on sound analyses (European Court of Auditors, 2024).

PBL 2024: National Climate Agreement target will not be met by 2030

In the Climate and Energy Strategy (PBL et al., 2024), PBL writes, 'In total, we expect an electrolysis capacity of between 1.2 and 1.5 GW in 2030, including scheduled policies. This is not sufficient to meet the target in the National Climate Agreement of 3 to 4 GW.'

Minister's letter to parliament: construction of hydrogen network behind schedule

Finally, the minister announced in December 2024 that construction of the hydrogen network was behind schedule and presented revised plans for its completion.

Appendix 4 Timeline of the cost estimate

2021: first estimate: €1.5 billion

The first estimate Gasunie/HNS sent to the Ministers of KGG and Finance put the cost of investing in a national hydrogen transport network at approximately €1.5 billion (2020 prices).

2022: WNL investment decision based on €2 billion estimate

In February 2022, the Ministers of KGG and Finance received the findings of an external review of the first cost estimate (see § 5.3.2). The Minister of Finance based the WNL investment decision on Gasunie/HNS's estimate that network development would cost €2 billion. The increase in the investment cost was due to the indexation of 2022 prices. It is a P50 estimate, which means there is a 50% probability that the actual costs will be 50% higher or lower. A P50 estimate allows for project uncertainties and risks. However, the higher estimate and the project uncertainties and risks were not shared with the Minister of KGG. In July 2022, the Minister of Finance approved the investment in a national hydrogen network. The minister noted that investment decisions on each section of the network had to have his approval.

2023: WNR investment decision

The Minister of Finance received a P90 estimate for the decision to invest in the Rotterdam section of the network (WNR). There was a 90% probability that the investment cost would not be overrun. Gasunie/HNS also issued an updated P50 estimate of €1.9 billion for the WNL (2023 prices). The Minister of Finance took the investment decision for the WNR and the preparatory budget for the WNL in June 2023.

2023: KGG receives €1.5 billion estimate for grant application

Gasunie/HNS sent KGG the €1.5 billion cost estimate (2022 prices) for the grant application for the entire network in May 2023. The Minister of KGG had a second external review carried out of the business case and the chosen grant form, in which the Minister of KGG covers all startup losses during the unregulated period. The Minister of KGG took the grant decision in November 2023 and designated Gasunie/HNS as the operator of the hydrogen network.

2025: KGG announces more than doubling of cost estimate for hydrogen network

The Minister of KGG informed the House of Representatives on 21 February 2025 that construction of the transport network would cost considerably more (KGG, 2025a). Gasunie/HNS estimated the cost at between €2.8 and €4.9 billion. The estimate is a P50 estimate again, at 2024 prices (see § 5.4). The minister also announced, 'the new cost estimate is surrounded by uncertainties because spatial planning procedures for the transport network are still ongoing and many costs still have to be incurred' (KGG, 2025a).

Appendix 5 Alternative grant options

Option 1: volume risk partly for Gasunie/HNS

Gasunie/HNS worked out the option of covering investment costs by means of a grant in an investment proposal (Gasunie, 2021). The option's characteristics are:

- the €750 million grant is necessary to set up the business case;
- Gasunie/HNS bears the volume risk below a transport volume of 2.5 GW (negative) and above a volume of 5 GW (positive). Customers will pay a flexible transport fee depending on the volume transported. Owing to the flexible transport fee, customers will bear the volume risk between a volume capacity of 2.5 GW and 5 GW;
- a return of 6% after tax.

The proposal to cover investment costs with a grant was rejected because the grant form was less suitable to cover startup losses. The grant is suitable, however, to resolve funding problems. During the unregulated period, Gasunie/HNS wanted cover for the startup losses and earn a reasonable return. Gasunie/HNS, the Minister of KGG and Finance then discussed 2 options to use a grant to cover startup losses, option 2 and option 3.

Option 2: cost risk partly for Gasunie/HNS

In May 2022, the minister of KGG and Gasunie/HNS discussed an alternative proposed by the Ministry of KGG. According to the Minister of KGG, if Gasunie/HNS bore the cost risk it would have an incentive to control costs and work efficiently. This will also be the case when the ACM regulates the market in the future. To cover the cost risk, the WACC would have to be significantly higher than in the regulated period. There would be a risk surcharge of 3%, which was also included in option 1.

The main characteristics of this option are:

- the grant is based on transported volumes up to a maximum of €750 million;
- the Minister of KGG covers only the volume risk during the startup period, as from 2025 until the regulated period commences. The reason for this is that volume developments are largely outside Gasunie/HNS's control and the onus is on the government to develop policy;
- Gasunie/HNS bears the risk attaching to all investment costs and operating costs. The parties want the costs to be budgeted and adopted in advance. Gasunie/HNS can then manage the cost risks and cost increases can be treated as a normal business risk;

- part of the grant is clawed back if Gasunie/HNS's return is higher than 6% after tax. This is required under EU state aid rules on compensation for the performance of services of general economic interest.

In the talks between the Minister of KGG and Gasunie/HNS, Gasunie/HNS rejected the proposal and proposed another incentive to manage costs and work efficiently: have an external party carry out an ex post efficiency review of every investment and project. Inefficient investments would have consequences for the grant and transport fees.

Appendix 6 WACCs in SDE++-rounds 2022 and 2023

Table 5 WACCs by SDE category

SDE ++ category	2022 (March)	2023 (February)
Photovoltaic solar panels	1.9%	4.2%
Wind energy	2.4%	5.1%
		WNL 6%
Water power	4.2%	6.5%
Solar thermal, PVT and daylight greenhouses	4.2%	6.5%
Electric boiler, CCU, industrial heat pump	4.3%*	6.8%
Biomass gasification	5.7%	7.3%
Geothermal	5.7%	7.3%
Advanced renewable biofuels	5.7%	7.3%
Residual heat	–	7.3%
Osmosis	5.8%	7.3%
Aquathermal	5.8%	7.5%
Biomass incineration	5.8%	7.5%
Fermentation and sludge digesting	5.8%	7.5%
Other low carbon options	5.8%	7.5%
		WNL 6%

* In the 2022 SDE++ round this category consisted of electric boilers only.

Appendix 7 Dutch funding for hydrogen

Table 6 Funding 2019-2014

Scheme	Ministry	Amount (€ x 1,000)	%	Production	Import	Transport	Storage	Consumption
SDE++ 2020-2024	KGG	6,755,116	60%	x				
OWE-1 +2	KGG	1,243,900	11%	x				
IPCEI wave 1-2-3-4	KGG	809,844	7%	wave 2	wave 3+4		wave 1	
Hynetwork - Gasunie	EZK	750,000	7%			x		
Tailor-made grants	KGG	460,000	4%	x				
EIA	Fin	315,769	3%	x		x	x	x
H2Global	EZK	300,000	3%					x
HyStock-Gasunie	EZK	264,000	2%				x	
MIA\Vamil	Fin	91,738	1%					x
Invest International	BHOS	60,080	1%		x			
H2 Hydrogen offshore network	EZK/KF	50,000	0%			x		
DEI+	BZK +KGG	42,793	0%	x			x	x
SWIM	I&W	27,820	0%					x
MOOI	KGG	14,562	0%	x				
DKTI	I&W	13,607	0%			x	x	x
PPS surcharge	KGG	10,500	0%	x			x	x
PAW pilot scheme 2	BZK	9,976	0%					x
Invest national	Fin	8,200	0%	x			x	
TSE industrie studies	KGG	5,470	0%	x		x		
SPUK	KGG	4,300	0%					x
Hydrogen tender (2019)	KGG	2,851	0%	x				x
TSE Industrie O&O	KGG	1,927	0%	x				
TKI Urban Energy	KGG	291	0%					x
MIT	KGG	20	0%					x
Totaal		11,242.765	100%					

Table 7 Notes to the schemes

Scheme	Description
1. DEI+	Demonstration Energy and Climate Innovation: a grant scheme to test an innovation or demonstrate that it reduces carbon emissions. www.rvo.nl
2. DKTI	Demonstration Climate Technologies and Innovations: a grant scheme to stimulate low-emission and no-emission transport solutions. www.rvo.nl
3. EIA	Energy Investment Allowance: a scheme to stimulate investments in energy-saving assets or in sustainable energy. www.belastingdienst.nl
4. Hydrogen network H2opZee	Demonstration offshore hydrogen project. H2opZee RWE in de Benelux
5. H2Global	Project to import hydrogen, launched by Germany. Germany and the Netherlands strengthen cooperation in hydrogen Nieuwsbericht Rijksoverheid.nl
6. Hynetwork Services	Construction of a national hydrogen network. www.hynetwork.nl
7. HyStock	Large-scale underground storage of hydrogen in salt caverns in the Netherlands. www.hystock.nl
8. Invest International	Investment in Dutch solutions to worldwide challenges, also in the field of energy and thus hydrogen. https://investinternational.nl/nl/
9. Invest-NL	As an impact investor, Invest-NL invests in promising, innovative businesses, funds and projects. https://investinternational.nl/nl/wat-we-doen/
10. IPCEI wave 1-4	Important Project of Common European Interest: an integrated European project initiative consisting of multiple national projects of businesses and/or research institutions in various EU member states, in this case hydrogen projects. Important Project of Common European Interest (IPCEI) (rvo.nl)
11. Tailor-made awards	KGG grants for electrolysers in Delfzijl and the North Sea
12. MIA/Vamil	Environmental investment tax credit (MIA) and Arbitrary Depreciation of Environmental Investments (VAMIL) schemes to promote investments in environmentally-friendly assets. (www.belastingdienst.nl)
13. MIT	Regional SME innovation stimulus and Top Sectors stimulus (MIT): a transregional scheme to encourage innovation at small and medium-sized enterprises (SMEs). www.rvo.nl
14. MOOI	Mission-driven research, development and innovation: a consortium working on innovative solutions to the climate goals for electricity, buildings, industry and biobased circular. (www.rvo.nl)
15. OWE-1+2	Grant scheme for large-scale production of fully renewable hydrogen by means of electrolysis. www.rvo.nl
16. PAW proeftuinen 2	Until 2023 Hydrogen will be used in the built environment only in pilot projects to gain experience. Warmtebronnen Nationaal Programma Lokale Warmtetransitie (nplw.nl)

Scheme	Description
17. PPS surcharge	Private-public partnership surcharge: a surcharge from EZK for R&D on top of a business's own contribution. www.rvo.nl
18. SDE++ 2020-2024	Sustainable Energy Production and Climate Transition Incentive Scheme (SDE++): a grant scheme for businesses and non-profit organisations for the large scale generation of renewable energy or carbon reduction. www.rvo.nl
19. SPUK	Specific benefit paid to municipalities.
20. SWIM	Grant scheme to encourage the use of hydrogen for mobility: partnership investments in hydrogen filling stations and hydrogen vehicles. www.rvo.nl
21. TKI Urban Energy	Top consortium for knowledge and Innovation (TKI) Urban Energy connects and supports businesses and knowledge institutions in the development and use of energy innovations for sustainable housing, non-residential buildings, housing estates and business parks. TKI Urban Energy (topsectorenergie.nl)
22. TSE Industrie O&O	Top sector Energy Industry Research and Development: a scheme to support partnership research and development opportunities for less expensive climate-neutral and/or circular products and services. www.rvo.nl
23. TSE industrie studies	Top Sector Energy industry studies: to test or demonstrate innovation in developed technologies to reduce carbon emission of Dutch industries. www.rvo.nl
24. Hydrogen tender (2019)	For businesses and partners working on hydrogen as an energy carrier. www.rvo.nl

Appendix 8 Terms and definitions

Service of general economic interest (SGEI): economic activities in the public interest that market forces alone would not pick up or at least not in the form of an affordable service available indiscriminately to all. Examples of SGEI are government grants for the operation of unprofitable public transport services or public broadcasting services.

Weighted average cost of capital (WACC) is a minimum required rate of return a business must earn to satisfy its capital providers (shareholders and creditors). Or it is the required rate of return on equity and on debt. Gasunie/HNS's multiannual budget for the hydrogen network uses a nominal WACC because expected costs and revenues are expressed at the price levels of the year to which they relate.

The **nominal WACC** is based on expected costs and revenues at the price levels for the year to which they relate. A **real WACC** is adjusted for price movements (inflation).

Capacity risk is the risk that demand for hydrogen will lag the sales volume expected when the investment decision was taken. The lower the demand for transport capacity, the lower Gasunie/HNS's revenue (in the form of transport fees).

A **business case** weighs the expected costs against the expected benefits.

A **cost estimate** estimates or projects the cost of a particular project or process.

Appendix 9 Abbreviations

ACM	Authority for Consumers and Markets
DRC	Delta Rhine Corridor
ECA	European Court of Auditors
EU	European Union
EZK	Ministry of Economic Affairs and Climate Policy
Gasunie/HNS	Hynetwork Services (Gasunie subsidiary)
GW	gigawatt
IEA	International Energy Agency
IPCEI	Important Project of Common European Interest
K&E	Ministry of Climate and Energy Policy
KEM	Knowledge Programme on the Effects of Mining
KGG	Ministry of Climate Policy and Green Growth
MW	megawatt
NPE	National Energy System Plan
PBL	Netherlands Environmental Assessment Agency
RIVM	National Institute for Public Health and the Environment
RVO	Netherlands Enterprise Agency
SGEI	Service of General Economic Interest
SodM	State Supervision of Mines
VNCI	Association of the Dutch Chemical Industry
WACC	Weighted average cost of capital
WNL	Hydrogen Network Nederland
WNR	Hydrogen Network Rotterdam

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Appendix 11 Endnotes

1. The Minister of KGG issued a SGEI decision amounting to €745,800,000. This is the maximum amount available of € 750 million from KGG less development costs already incurred by Gasunie/HNS of €4.1 million. In this report, we refer to the sum of €750 million.
2. The Netherlands' annual carbon equivalent emission in 2023 was approximately 146 megatonnes.
3. This does not apply to the Delta Rhine Corridor (DRC).
4. This relates to an analysis of the WACC for the Hystock project, KGG also used the analysis to assess the hydrogen network's WACC.

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