gasunie transport services

GTS Investment Plan 2024 - 2033

5 April 2024

Foreword

We present to you our 2024 Investment Plan. In this new investment plan, we provide an up-to-date overall view of all planned expansion and replacement investments. We also look back at the 2022 Investment Plan and explain variances between forecasts and actual investments where necessary.

For us at GTS, the new investment plan is a valuable document. Compared to two years ago, the Dutch energy market has seen unprecedented dynamism. The year 2022 was marked by the Russian invasion of Ukraine. The drop in the supply of Russian gas caused by this political situation has completely changed the north-western European gas market.

What has changed, for example, is that gas currently flows in the opposite direction through our network, i.e. 'from south-west to north-east' instead of 'from north-east to south-west'. Thanks to the favourable location of our infrastructure, the robust design of our transport and transmission system, and sufficient entry and exit capacity at relevant points, GTS has been able to facilitate this sudden change in dominant gas flow direction. Besides this, we were also able to facilitate EemsEnergyTerminal in the port of Eemshaven in less than six months by constructing a pipeline covering several kilometres to allow the imported LNG to actually be fed into the GTS transmission network. Such additional LNG import capacity is essential for the security of gas supply in north-western Europe.

This additional security of supply is essential not in the least because gas extraction in Groningen ceased on 1 October 2023. GTS has been able to contribute to reducing the production level to zero in several ways, including through the recent, step-by-step delivery of the Zuidbroek II nitrogen installation. With the end to production from the Groningen field, the new reality is that the Netherlands has now become an 'conventional gas-consuming country'. Where in the past the Groningen field was our guarantee of security of gas supply to north-western Europe, this security of supply is no longer a given in the current circumstances. In the coming years, we as GTS and the Dutch gas sector as a whole will have to find our 'new normal' in this regard.

At the same time, ever more concrete steps are being taken in the field of the energy transition. Given the current state of the energy market, it is even more imperative that we facilitate the feed-in of sustainable gases. The future blending obligation for green gas also requires investment in infrastructure connections or facilities for small-scale compression in our infrastructure for the sake of the distribution networks of the regional transmission system operators. In addition to green gas, hydrogen will also form part of the energy mix in the Netherlands in the near future (and its share will only grow over time). Gasunie subsidiary Hynetwork Services (HNS) has been commissioned by the Minister of Economic Affairs and Climate Policy to develop and manage a national hydrogen transmission network. The starting point is that existing GTS natural gas pipelines (which will be transferred to HNS) will be used as much as possible for this new grid. By facilitating green gas production and making pipelines available for the development of the Dutch national hydrogen grid, our existing natural gas infrastructure will increasingly contribute to making the Dutch energy system more sustainable.

In early November 2023, we submitted our draft investment plan to gas market participants for consultation. Where possible, we have incorporated the responses from the various market parties in this Investment Plan. The design has been reviewed by the Ministry of Economic Affairs and Climate (EZK) and the Netherlands Authority for Consumers and Markets (ACM), so that we can now publish the definite Investment Plan 2024.

Bart Jan Hoevers
Managing Director

Summary

Gasunie Transport Services (GTS) owns and operates the national gas grid in the Netherlands, meaning that GTS is responsible for the management, functioning and further development of the Dutch gas grid.

Under the Dutch Gas Act, GTS has a statutory duty to draw up an investment plan ('IP') on a periodic basis. The IP gives a rundown of all intended expansion and replacement investments over the period, including the background and supporting information. From a statutory perspective, the IP contains three elements: developments in the energy market, a bottleneck analysis to identify capacity and quality bottlenecks, and details of the investments. It will be submitted to the Dutch Ministry of Economic Affairs and Climate Policy and the Netherlands Authority for Consumers and Markets (ACM) for inspection.

Scenario developments

The IP presents three scenarios. These have been compiled jointly by the national and regional grid operators, based on the European Climate Law, which requires EU Member States to reduce their average greenhouse gas (GHG) emissions by at least 55% by 2030 compared to 1990. In the 2021 Coalition Agreement reached by the parties forming the Dutch government, the Dutch ambition level for reducing GHG emissions was increased from 49% to at least 55% by 2030. The qualitative storylines of the scenarios are comparable to the storylines as described in the 2022 IP. Taken as a whole, the scenarios delineate the upper and lower limit within which supply and demand are likely to remain up to the end of 2035. This concerns the following scenarios:

Dutch Climate Ambition (DCA) scenario: this is the central scenario based on the aggregate of existing and proposed energy and climate policy (Climate and Energy Outlook 2022), supplemented with the Dutch government's ambition from the Coalition Agreement concerning additional policy to be put on the agenda.

National Driver (ND) scenario: this is a flanking scenario that, compared to the DCA scenario, places the emphasis even more strongly on electrification of demand and onshore renewable energy generation.

International Ambition (IA) scenario: this is a flanking scenario that focuses more on sustainable gases (molecules) compared to the DCA scenario. In this scenario, in addition to direct electrification, more use is being made of green gas and hydrogen.

The key conclusion for GTS is that the volume of gas to be transported in 2030 will have decreased by at least 50% in all scenarios compared to the reference year 2019. By 2030, the export of L-gas will disappear completely, and domestic demand will decrease as a result of sustainability and energy savings. Because peak demand falls less quickly than the annual volume of gas to be transported, the required transmission capacity decreases less quickly than the annual volume of gas to be transported.

Additionally, production in the Netherlands is being phased out faster than the decline in domestic gas demand. Gas extraction in Groningen stopped on 1 October 2023 and production from small fields will, in all scenarios, have decreased by at least 66% in 2030 compared to the reference year 2019. To compensate for the lost production, imports, including of LNG, will continue to play an important role in meeting gas demand on the way to 2030. Besides this, additional green gas will be produced.

Recent developments in the market

The European gas market has changed drastically. Since the summer of 2022, the supply of Russian gas, which until recently accounted for a third of the H-gas supply in north-western Europe, has completely disappeared. The loss of Russian gas flows has been compensated in part by additional supplies of LNG and by a significant reduction in demand, mainly as a result of high gas prices.

The loss of Russian gas flows has caused a reversal in the direction of the dominant gas flows, from east-to-west to west-to-east. This reversal has a significant impact on the way in which GTS' gas transmission network is deployed. As a result of this reversal, GTS will have to invest in measures to deal with the bottlenecks that have emerged at several compressor stations. Furthermore, after Gasunie's completion of EemsEnergyTerminal (EET) last year, Gate terminal has now made a final investment decision on the development of a fourth tank. To accommodate the requested entry capacities, GTS needs to invest in expanding the gas grid. GTS has included and described these investments, as well as the investment required to connect EET to the gas grid, in two addenda to the 2022 IP.

The changes in the gas market also have an impact on security of supply. With the loss of Russian gas flows, combined with the end of production from the Groningen field, the importance of gas storage has increased further. The gas storage facilities can follow fluctuations in market demand and absorb interruptions in supply. The supply shortfall that has arisen is only partially covered by the current LNG supply, meaning there is still a shortfall. Given that the LNG supply also has a less predictable profile compared to the Russian gas supply, this further increases the importance of the flexibility offered by gas storage.

New legislation also has an impact on GTS' investments. There is, for example, the EU's planned Methane Emissions Regulation, which states, among other things, that parties in the gas sector must trace their emissions and take appropriate mitigation measures to prevent and minimise methane emissions in their operations. In this context, GTS anticipates a growing number of quality bottlenecks in relation to cutting carbon emissions in the coming years and is currently initiating study programmes in response. Furthermore, the Minister of Economic Affairs and Climate Policy has sent the draft Energy Act to the Dutch House of Representatives. The proposed Energy Act offers GTS the option of taking in biogas, for example, provided that this can be blended to the correct delivery specifications for natural gas. The Ministry of Economic Affairs and Climate Policy expects that the Energy Act, including the secondary legislation, will come into force in the course of 2025 or 2026. The Ministry of Economic Affairs and Climate Policy has also submitted a bill that regulates the final closure of gas production from the Groningen field (following the former legislative amendment 'After zero, what then?'), which, if passed, would ban the extraction of Groningen gas from 1 October 2024. With the closure of the Groningen field, GTS' legal obligations regarding providing advice on the required Groningen capacities and volumes needed for security of supply also cease. Instead, GTS will be given the statutory duty of reporting annually on the security of gas supply in the Netherlands.

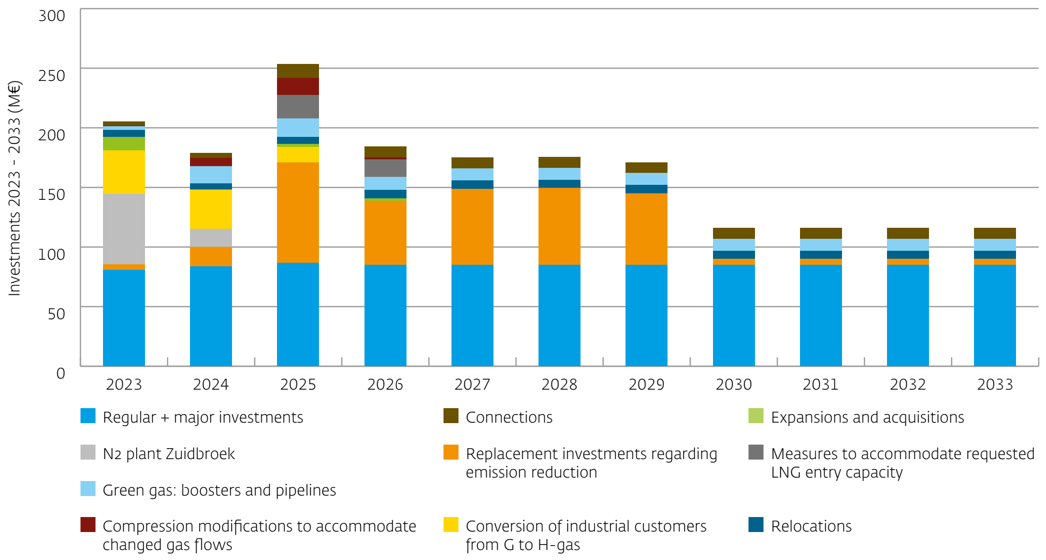
GTS expects to see green gas and hydrogen taking on an increasingly important role. To facilitate the growing demand from parties wanting to feed in green gas, GTS is investing in gathering pipelines and boosters. It is expected that, in line with the climate target of 2 bcm (approximately 20TWh) of green gas production in 2030, more requests will follow, meaning continuing investments. In light of the anticipated increasingly important role of hydrogen as a sustainable energy carrier and feedstock, partway through 2022 the Minister of Economic Affairs and Climate Policy tasked Gasunie subsidiary Hynetwork Services (HNS) with the development and management of a national hydrogen transmission network. For GTS, this means that, in the future, existing natural gas pipelines will be transferred to HNS and used for the transmission of hydrogen, on the understanding that GTS must still be able to perform its statutory duty with regard to natural gas transmission. This move is attractive for GTS customers because the costs of the remaining natural gas network will be lower after the transfer, and reuse of existing natural gas pipelines is also attractive for HNS and its customers given that this is a cheaper alternative to installing new pipelines and the pipelines will, in general, be available sooner. The FID has now been made, on the basis of which HNS will start constructing the first part of the hydrogen transmission network at the Port of Rotterdam.

Assessment of bottlenecks & GTS investment portfolio

GTS checks for two potential bottlenecks: capacity bottlenecks and quality bottlenecks. Capacity bottlenecks are determined using gas transmission calculations based on the identified scenarios; this has revealed that there are no capacity bottlenecks. Quality bottlenecks prompt replacement investments and are identified through risk analyses or findings during management and maintenance work. This concerns bottlenecks that contravene one or more of the company's values or are required under legislation and regulations. In addition to the annual standard replacement investments to resolve quality bottlenecks, GTS anticipates a growing number of quality bottlenecks in relation to cutting carbon emissions in the coming years, partly due to the EU's planned Methane Emissions Regulation.

Figure 0.1 shows the total overview of GTS' expected investment portfolio up to the end of 2033. This shows investments for the 2023-2026 period in the context of the changing gas flows, completion of the Zuidbroek nitrogen plant, green gas investments, and the conversion of G-gas to H-gas for industry. For the 2025-2029 period, the expected large-scale replacement investments in the context of cutting carbon emissions are presented. From 2030, GTS mainly expects standard replacement investments necessary to guarantee safe, reliable and efficient gas transmission, supplemented with investments arising from connections, diversions and the feed-in of green gas.

Figure 0.1: Total investments proposed for 2023-2033



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Introduction

Gasunie Transport Services (GTS) owns and operates the national gas grid in the Netherlands. Being the operator of the national gas grid, GTS is responsible for the management, functioning and further development of the Dutch gas grid. Other duties include connecting customers to the network, monitoring gas quality, balancing, gas intake from small fields, connections to other national and international networks, guaranteeing sufficient transmission capacity, public duties with respect to security of supply (including peak supply and emergency supply). With the closure of the Groningen field per 1 October 2024, GTS' legal obligations regarding providing advice on the required Groningen capacities and volumes needed for security of supply also cease. Instead, GTS will be given the statutory duty of reporting annually on the security of gas supply in the Netherlands.

Mission

We deliver gas transport services in a customer-focused and transparent way. Safety, reliability, sustainability and cost-effectiveness are central in everything we do. We serve the public interest, and work as professionals to create value for our stakeholders.

Vision

We aim to be an organisation that best serves the market, responds flexibly to changes in its surroundings, enables new gas flows, facilitates the introduction of sustainable energy and thus plays a key role in the north-western European gas market.

To be able to fulfil these ambitions and duties with the required level of quality, GTS needs to invest in the maintenance and, where opportune, expansion of the gas transmission network. This draft investment plan (IP) details the investments that we deem necessary.

Statutory basis of the investment plan

Under the Dutch Gas Act, GTS has a statutory duty to draw up a draft IP on a periodic basis. The draft IP gives a rundown of all intended expansion and replacement investments over the period, including the background and supporting information. To comply with the law, the draft IP must cover three elements: developments in the energy market, a bottleneck analysis to identify capacity and quality bottlenecks, and the details of the investments. The law goes on to state that the information concerning investments must be further broken down into three parts: a look back on the progress and realisation of investments scheduled to be carried out over the previous two years, a quantitative look ahead to the investments planned for the 2024-2028 period, and a qualitative look ahead to investments planned for the 2029-2033 period.

With regard to the IP, in addition to the Gas Act, both an Order in Council (the 'Decree'[1]) and a Ministerial Regulation (the 'Regulation'[2]) have been adopted. Both the Decree and the Regulation specify further rules concerning the investment plan. One of the main rules concerns the assessment of the draft IP: GTS must submit the draft IP to the Ministry of Economic Affairs and Climate Policy and the Authority for Consumers and Markets (ACM) for review. ACM assesses

1 *https://wetten.overheid.nl/BWBR0041487/2021-01-01*
2 *https://wetten.overheid.nl/BWBR0041543/2023-04-18*

whether GTS can in all reasonableness be deemed to have been able to put together the draft IP, while the Ministry of Economic Affairs and Climate Policy verifies whether GTS has rendered sufficient account on developments in the energy market. Both these assessments are made within 12 weeks of the date the draft IP is submitted.

GTS considers the draft IP to be a guiding document when it comes to assessing the necessity for investments by GTS. The manner in which capital costs (including those involved in new investments) are compensated is set out in the Method Decision. GTS only includes investments in this plan on the condition that it will be able to recover the efficient costs of these investments.

GTS submits a draft IP to ACM and the Ministry by no later than 2 January every other year (in even years). GTS definitively adopts the IP after approval by the authorities. The investment plans are valid for two years; the current draft IP covers the period from 1 January 2024 to 31 December 2025. Should significant changes occur in the interim, the IP may be revised through an addendum at any time.

In addition to the obligation to submit a draft IP every two years, GTS has been tasked by the Ministry of Economic Affairs and Climate Policy with drawing up an annual security of supply report. Given the overlap between the IP and the security of supply report, this draft IP meets both these statutory requirements. Two components of the security of supply report are not addressed in the main body of the draft IP, i.e. peak supply and emergency supply. These are discussed separately in Appendix VII.

Scope

This draft IP concerns the CAPEX investments for which a final investment decision (FID) is currently expected to be made in the period 2024 to 2033. Investments to meet a need identified in another process, such as investments required to connect small fields to the network or facilitate incremental capacity, are outside the scope of this draft IP. The need for these investments is determined by national legislation or in European legislation. However, given that GTS wants to present its full investment portfolio, these investments, where present, are also included in our draft IP for information purposes.

Document arrangement

The first section of this draft IP explains the methodology and the second describes and explains the various scenarios. Section 3 expounds on developments on the gas market both inside and outside the Netherlands. Following this, the results of the bottleneck analysis are described in Section 4. Section 5 then presents an overview of the required investments and, finally, Section 6 details the progress of major investments and provides a retrospective of investments realised in 2021 and 2022.

Coordination with other network operators and stakeholders

GTS has, like in previous years, teamed up with TenneT and all the regional TSOs in developing three scenarios for the draft IP to provide a comprehensive picture of developments in the Dutch energy system.

In the run-up to the 2024 IP, over the past two years the grid operators trade association Netbeheer Nederland has, for the first time, worked on shaping scenario development by holding stakeholder sessions and applying the input from these. In the second half of 2022, over the course of three stakeholder sessions, the frameworks of the new scenarios, new storylines and quantification per sector were assessed with various grid operators' stakeholders. The result was the three IP scenarios that grid operators use for the 2024 IP.

In this draft IP, the three scenarios have been completed with import/export and transit flow data based on the 2022 Ten Year Network Development Plan (TYNDP)[3] of the European Network of Transmission System Operators for Gas (ENTSOG).

Consultation

GTS organised two information sessions for the various parties that operate in the energy market. The first information session about the process and the scenarios for the draft IP was held in the autumn of 2022, while the second focused on the investments and was held in the autumn of 2023. Dutch legislation furthermore provides for a market consultation process that spans four weeks. The members of grid operators trade association Netbeheer Nederland have agreed to submit all draft IPs for consultation at the same time wherever possible, over the period from 1 to 29 November 2023. Feedback from these public consultations will be appended to this document.

3 *https://www.entsog.eu/tyndp#entsog-ten-year-network-development-plan-2022*

1. Methodology

1.1 Process for adopting the investment portfolio

This section describes the methodology used to compose and adopt the investment portfolio.

The investment portfolio is made up of two types of investments:

- expansion investments to increase the available capacity, acquisitions, and connections for current and new and customers;
- replacement investments to maintain the quality of the network and for pipeline diversions. Pipeline diversion is when a pipeline is moved to another location at the request of a third party, such as Rijkswaterstaat.

As part of GTS' current investment portfolio process, GTS sets the budget required for year n+1 in mid-August of every year. In addition to the annual plan for 2024, data on current expansion and replacement investments is available for the period 2025 to 2028 inclusive. This data has been included in this draft IP.[4]

1.2 Scenario design

The development of scenarios roughly consists of two steps. This process starts with drawing up storylines, i.e. qualitative descriptions of what the world might look like in the future. An important criterion is that the storylines for the various scenarios must cover the most important uncertainties. This mainly concerns the uncertainties that are relevant for the development of the energy infrastructure.

In the second step the storylines are quantified, meaning that the specifics of the supply and demand of energy (gas, electricity, etc.) are accurately determined and documented.

Scenario development for the 2024 IP started in August 2022. The starting point has been the 2022 IP scenarios, the update of II3050, and new information that has become available since 2022 (including tightened policy and further acceleration of the energy transition). In addition, the views of stakeholders collected during the 2022 IP consultation process and the 2022 IP evaluation meetings have been taken into account, and ACM's suggestions regarding scenario development (in response to the 2022 IP) have been taken to heart.

Drawing up the storylines and quantifying them was, essentially, carried out by a working group at Netbeheer Nederland consisting of representatives from all grid operators (2024 IP Scenario Working Group). A broad group of external stakeholders, including representatives of provincial authorities, the energy sector, industry, construction and ACM, has been engaged in the process at three points.

Sub-working groups within the 2024 IP Scenario Working Group worked on the quantification of the sub-topics within the scenarios. These sub-working groups discussed the topics (supply and demand categories) in detail with the aim of tightening the parameters (e.g. supply and demand of natural gas), for which purpose they used public sources, input from stakeholders and relevant information provided by companies.

4 *See Section 5.1 General for a summary of the investment data that GTS has included in this draft IP.*

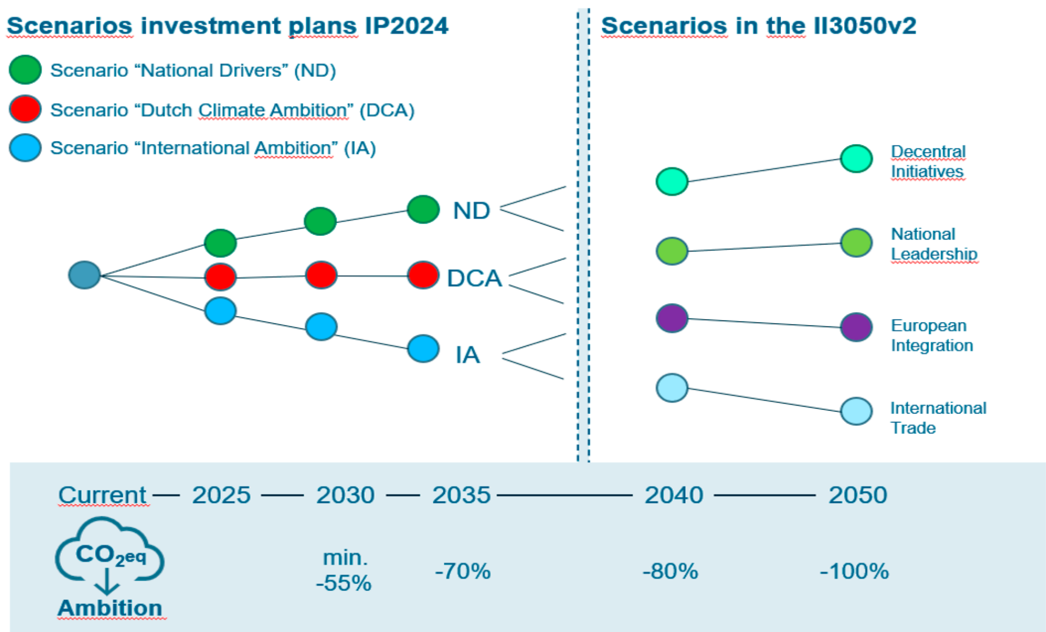
The quantification was discussed in detail in the second and third stakeholder sessions (in October and November 2022). During these sessions, both the overall picture and the details of the quantification emerged and were passed on to the 2024 IP Scenario Working Group for processing in the scenarios.

1.2.1 Storylines

This draft 2024 IP presents three scenarios. The storylines of these scenarios are a further development of the scenarios from the previous 2022 IP. All scenarios assume that the Dutch climate targets (carbon emissions cut by 55% in 2030 and 70% in 2035) will be achieved, though the way in which this is done varies per scenario. The Dutch Climate Ambition (DCA) scenario assumes that the existing and proposed energy and climate policy, as set out in the Dutch Coalition Agreement, will be implemented in full.[5] In addition to the DCA scenario, two flanking scenarios have been drawn up: the National Driver (ND) and International Ambition (IA) scenarios. These two flanking scenarios have been defined in alignment with the final visions of the Integral Infrastructure Survey for 2030-2050 (II3050)[6], as also illustrated in Figure 1.1 below. In addition, where available, information has been drawn from the Regional Energy Strategies (RESs) and included in this draft IP[7].

Both flanking scenarios assume acceleration at certain points along the energy transition pathway, while advancement slows at other points. For example, the ND scenario focuses on maximum roll-out of solar and wind energy, combined with more far-reaching electrification and electrolysis, while the focus in the IA scenario is more on green gases and CCS (domestic or import). The three scenarios together reflect the key potential developments and uncertainties that affect the design of the grids.

Figure 1.1: Correlation of 2024 IP and II3050 scenarios



5 https://www.rijksoverheid.nl/regering/coalitieakkoord-omzien-naar-elkaar-vooruitkijken-naar-de-toekomst/2.-duurzaam-land/klimaat-en-energie
6 www.netbeheernederland.nl/dossiers/toekomstscenarios-64
7 For more information (in Dutch), see www.regionale-energiestrategie.nl/default.aspx.

1.2.2 Quantification for the Netherlands

The three scenarios have been quantified for the Netherlands using the Energy Transition Model (ETM) developed by Quintel Intelligence8. Using the ETM, volume balances of annual demand for gas, electricity and other energy carriers like oil, coal, hydrogen and biomass were defined for each of the three scenarios. Where possible, external sources have been used to provide support for the assumptions used in the scenarios. Where a supporting external source was not available, the network operators used their own analyses to provide support for the assumptions applied. The data freeze date for the quantification of the scenario assumptions was 1 December 2022.

From this quantified data, TenneT subsequently extrapolated demand in the electricity market on an hourly basis. RES information up to spring 2023 was included in this analysis, however. This analysis allowed TenneT to determine gas demand from power stations and other users, which has been included in this draft IP. GTS furthermore used the quantification to estimate peak gas capacity for end user sectors. When it comes to cross-border gas flows, this draft IP is based on supply and demand figures and flow simulations from the ENTSOG 2022 TYNDP.[9]

1.3 From scenarios to bottlenecks

1.3.1 Bottleneck definition

This draft IP uses the definition of bottleneck as specified in Article 1.1 of the Regulation, i.e. '... parts of the grid or gas transmission network that are expected to pose a considerable risk to the adequate fulfilment of the duties assigned to the network operator by or under the Dutch Electricity Act of 1998 or the Dutch Gas Act'. For capacity and quality bottleneck, GTS applies the following definitions.

- In the case of a capacity bottleneck, 'considerable risk' is defined as a situation ensuing from one or multiple pressure drop calculations (as specified in section 1.3.2 Identifying capacity bottlenecks), where the entry and/or exit capacity cannot be transported, while factoring in entry and exit specifications.
- In the case of a quality bottleneck, 'considerable risk' is defined as a breach of one or several of the company values, determined based on the combination of the frequency of occurrence of the unwanted event and the potential severity of the impact. This risk is measured in financial terms.

1.3.2 Identifying capacity bottlenecks

GTS has been tasked with facilitating the transmission of gas to consumers connected to the grid in an economically effective manner and, to make this possible, developing the national gas grid in a safe, efficient and reliable manner. Under EU regulations, GTS operates its network as a decoupled entry-exit system, which gives grid users the right (and freedom) to use the available capacities independently of each other, provided that gas quality and system balance are secured.

8 https://energytransitionmodel.com/
9 https://tyndp2022.entsog.eu/

Simultaneous combinations of entry and exit capacity may occur that generate a high level of activity on the grid. GTS sets up the network in such a way that it can accommodate these kinds of peak transmission situations, taking into account grid users' behaviour – realistically speaking – at entry and exit points, so as not to have to invest to cover unrealistic extremes. This approach makes it possible to set up the national gas transmission network in a targeted manner.

GTS conducts the bottleneck analysis based on forecasts of capacity at entry and exit points. These forecasts are based on current contracts and anticipated developments in these contracts.

Main gas grid and regional distribution network

GTS' network has two components. The high-pressure gas grid (HPGG) transports gas over long distances and operates at pressures ranging from 40 to 80 bar, meaning that the HPGG is used as a transit network for transmission from and to other countries, while also transporting gas to high-volume consumers such as large industrial companies and power stations. The regional distribution network (RDN) is made up of branches from the HPGG that operate at pressures ranging from 8 to 40 bar. The RDN is a distribution network that supplies directly to smaller industrial companies and distribution network operators that supply to the small-scale consumers market.

The HPGG is split up into two networks, one for transmission of high-calorific gas and one for low-calorific gas (originally known as Slochteren gas). High-calorific gas can be converted into low-calorific gas at several points in the system by blending different gases or adding nitrogen. The RDN distributes virtually exclusively low-calorific gas.

The largest gas flows and the most dynamic part of the entry-exit system are found in the HPGG. The major import and export flows, industrial demand, the alternating filling of and withdrawal from storage facilities, and the blending of different gas qualities all converge in the HPGG. The HPGG has long pipelines with large diameters of up to 48 inches, compressors to increase the pressure, and blending stations to convert high-calorific gas to low-calorific gas by injecting nitrogen. The RDN is of an entirely different nature, as it accommodates smaller gas flows over average distances of only a few kilometres from the HPGG. The RDN pipelines have smaller diameters (typically between 4 and 20 inches), while compressors and blending stations are not needed due to the small transmission distances.

Capacity testing

Models are used to test network capacity. Given the differences between the HPGG and the RDN, a different testing method is used for each network. However, what both have in common is that pressure drop calculations are made for the key extreme transmission situations for each of them. Pressure drop calculations are made using the Multi-Case Approach (MCA) tool.

Capacity testing for the HPGG starts by generating a complete set of realistic heavy-load transmission situations in a certain forecast year. These situations are based on a broad range of possible circumstances (summer versus winter, high and low temperatures, technical outages at entries and exits, etc.), as well as on relevant combinations of expected entries and exits. Owing to the temperature dependence of part of the demand, calculations for each month are based on the lowest possible temperature that can occur in that month (as shown by weather and climate analyses). In addition, the following parameters are used in the analyses: the risk of technical unavailability of major supply points; behaviour of storage facilities; possible correlations between various entry and exit points; and the latest insights with respect to the phase-out of the Groningen field. In each of the forecast years, this has led to roughly two hundred balanced entry and exit combinations that were tested for transmissibility by performing the associated pressure drop calculations. Tests are subsequently performed to assess transmissibility within the network's pressure and flow limits. If pressure remains under the minimum or the flow limit is exceeded at a point or in a pipeline during one or several of the tested transmission situations, this constitutes a capacity bottleneck.

Capacity testing on the RDN is based on an analysis of network load at the peak time of a day in January or February with an average effective 24-hour temperature of minus 17°C.[10] If transmission can be accommodated in these extreme conditions, this means there are no transmission bottlenecks. This basically covers all possible transmission situations. Recent developments, such as green gas feed-in at specific points of the RDN, could lead to other types of bottlenecks.

The severity of any transmission capacity bottleneck identified will be determined through a follow-up test. The criteria used are the expected frequency of occurrence and the degree by which the capacity limit is exceeded and/or pressure remains below the minimum. Some transmission capacity bottlenecks can be resolved by switching the network differently, for example by setting a valve or coupling piece differently (possibly temporarily). To eliminate larger transmission capacity bottlenecks, more substantial measures may be needed, such as laying a new pipeline section, expanding a compressor station, or installing a new connection.

Especially in the HPGG, but sometimes also in the RDN, the cause of a capacity bottleneck may be elsewhere in the network, i.e. not where the capacity limit is actually exceeded or where pressure actually stays below the minimum level. The location of a transmission capacity bottleneck is generally not a good indicator for the place where it would be most efficient and effective to take measures.

For the purposes of this draft IP, a bottleneck analysis was conducted for the three scenarios, i.e. the Dutch Climate Ambition (DCA), National Driver (ND) and International Ambition (IA) scenarios, for the forecast years of 2025, 2030 and 2035. It should be noted that these are 'gas years', which means that 2035, for example, runs from 1 October 2034 to 30 September 2035.

The methodology that GTS uses for capacity assessment is also described on the GTS website.

10 In accordance with Article 10a(1) of the Dutch Gas Act, GTS has a general duty to ensure security of supply. Article 10a(4) then refers to the Security of Supply (Gas Act) Decree, where Article 2(1) includes the peak delivery duty at a temperature of minus 17°C or higher.

1.3.3 Identifying quality bottlenecks

GTS manages its operating assets based on the philosophy of risk-based asset management. This means that whenever a decision is needed on expenditure, the required outlay will be weighed against the level of risk mitigation that it would deliver. To simplify this comparison, risks are expressed in monetary terms, specifically the potential expenditure over a 25-year period expressed as a net present value. Appendix VII describes the detailed calculation of the corresponding discount rate. Risks are assessed based on the four company values that GTS goes by:

- safety
- transport security
- sustainability
- financial loss acceptance.

Product quality, i.e. the quality of the gas, is part of the company values of safety and transport security.
For determining gas quality, GTS takes the Ministerial Regulation on Gas Quality (hereinafter called 'MR') as its starting point. The total risk is the sum of the scores on these four company values, each of which have the same weighting.

As stated in our mission and vision, we aim to best serve the market by delivering our transport services in a customer-focused and transparent way.
In the domain of management and maintenance, this makes it possible to choose from different maintenance strategies. The costs of a measure (a procedure measure or a project) for solving each bottleneck must be estimated. It may emerge that a measure will not mitigate the entire risk, in which case the residual risk must also be determined.

The efficiency of a measure is defined as the expected risk reduction (the original risk minus the residual risk expressed as present value) divided by the costs of the envisioned measure:

$$\eta = \frac{\Delta R[€]}{K\,[€]}$$

The measures for the various risks are prioritised by choosing the measures with the highest efficiency.
There are two prioritisation rounds:

1. When risks are ranked. For risks that are not acceptable, measures are taken right away. For risks that are undesirable, measures are taken in a systematic and structural manner, while risks that are acceptable on certain conditions are monitored based on the ALARA (as low as reasonably achievable) principle. Measures for risks that need to be resolved are scheduled and carried out in the relevant implementation year.

2. The second round involves drawing up the plans/timeline for a particular year of implementation. In this round, the following aspects are decisive:
   - technical gas transmission possibilities;
   - permit procedures;
   - economies of scope and synergy with other activities that can cut costs, reduce the impact on safety and gas transmission, etc.;
   - the organisation, availability of technical and other staff;
   - the budget;
   - impact of and on regular maintenance;
   - the energy transition.

See also Appendix IX for an overview of the key risks.

1.3.4 Identifying IT investments

Given that GTS makes use of IT assets owned by Gasunie, GTS is not submitting any CAPEX IT investments in the 2024 IP.

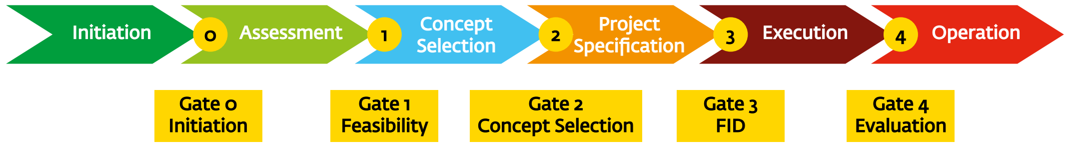
1.4 Measures

1.4.1 Project governance and project phases

The governance of technical projects is based on the Project Governance System. This system details all stages of project development, from initiation (determination/documentation of market, technical and/or business case), the study and alternatives analysis through to approval and final investment decision, actual construction and commissioning, and, finally, project evaluation.

The project governance process is set up as a 'phase-gate process' with 'gate passages' (see Figure 1.2. Phase-gate process). It is an integrated working process with clearly defined roles and responsibilities.

Figure 1.2: Process gates



Gate details:

- Gate 0 – Project initiation: definition of the project drivers, specification of the need and start of studies
- Gate 1 – Feasibility: study into the feasibility of the proposed solutions
- Gate 2 – Concept Selection: evaluation of possible alternatives and selection of the preferred alternative, including establishing functional principles (functional specification)
- Gate 3 – FID: approval of the project, including the scope, schedule and costs based on project specifications
- Gate 4 – Evaluation: completion and project evaluation, after RFO (ready for operation).

Through the Project Governance System, GTS ensures that projects are developed and executed in a controlled and cost-effective way. Depending on the nature and size of a project, one or more of these gates may be omitted. Relevant information relating to a project is recorded in a project file and in reports from the project board.

1.4.2 Budgeting methodology

The costs involved in an investment project are both the primary costs, including material costs and work by third parties, and secondary costs such as hours worked by GTS employees. Projects are approved based on the basic budget for the project, which comprises the following cost components:

- indirect engineering and land-use/real-estate matters
- management, design and supervision
- materials, and
- construction.

The basic project budget does not include allowance, indexation, contingency or management reserve.

The Final Investment Decision (FID) for a project provides insight into the risk of a budget overrun through the 'contingency' (P50 estimate) and 'management reserve' (P90 estimate) items.[11] The size of these items is based on the inaccuracy of the basic budget and the budget overrun probability.

The costs of projects for which an FID has not yet been made are based on study estimates or indicators with an uncertainty margin of 40%.

As soon as an FID has been made, the development of the financial aspects of a project is monitored and recorded, which ultimately results in production on a project that is the basis for capitalisation of projects.

1.4.3 Portfolio and budget

The investment portfolio includes investments relating to expansion (capacity and connections), replacement (quality) and rerouting of infrastructure (diversions). Measures (investments) may be needed to address the following matters:

- quality bottlenecks resulting from policy or from periodic risk analyses and corrective actions arising from the quality assurance system (QAS);
- capacity issues that arise due to market demand;
- external drivers (including spatial planning developments and legislation);
- efficiency measures (business cases); and/or
- CSR initiatives, including emission reduction measures.

11 The P50 estimate includes the Basic estimate + Allowance + Indexation + Contingency. The sum of these four items is the most probable level of capital investment needed to carry out the project (50/50 value). With a P50 estimate, there is a 50% chance of either exceeding the budget or remaining below budget. The P90 estimate is the P50 estimate plus the management reserve (overrun allowance). The management reserve is an unallocated sum set aside to cover parts of a project or events that occur during a project that cannot be predicted, the 'unknown unknowns'. With the P90 estimate, there is a 90% probability of staying under budget and only 10% of exceeding it.

There are four factors that complicate multi-year forecasts for the investment portfolio, as explained below.

Investment portfolio adoption process

As part of GTS' investment portfolio process, GTS sets the budget required for year n+1 in mid-August of every year.

GTS has accordingly noted that the portfolio process for GTS' technical investments is not effectively aligned with the approval period under relevant legislation governing the draft IP. This complicates the multi-year forecast.

Asset management

In GTS' mission, vision and strategy, we express our aim to serve the market well with due care for safety, reliability, sustainability and cost awareness, which we do by managing our operating assets based on a risk-based asset management philosophy. This means that GTS regularly inspects its assets and invests only when necessary; as a result, a small portion of the replacement investments is made up of preventive (and therefore predictable) measures. The majority of the replacement investments are made based on an asset's current condition and can therefore be planned ahead to a limited degree only. Experience with similar operating assets gives GTS an idea of how many replacement investments will be needed in the long term and of the funds involved. Based on the risk scores, GTS will decide in the short term whether assets need replacing, and if so, which ones.

The risk-based asset management philosophy enables GTS to make the most of its operating assets and limit the investment levels (and the ensuing tariffs), while at the same time offering its customers a reliable, future-proof gas transmission grid.

Developments prompted by third parties

Part of the portfolio is determined by developments prompted by third parties rather than driven by GTS itself, such as connection requests and diversions.

Network disruptions

GTS factors in that the investment portfolio and ultimate financial realisation during the year may be subject to change as a result of contingencies and disruptions in the system and other (unforeseen) circumstances.

1.4.4 Divergence during realisation

There are numerous factors, both internal and external, that could lead to the planned investment project not staying on schedule,

with the result that it may not be possible to complete the project within the allotted time frame. Appendix V and section 6 go into the main factors that could lead to delays, as well as into measures to prevent or mitigate delays.

2 Developments and scenarios

2.1 Introduction

All the networks of the national and regional network operators together form the transport and transmission infrastructure of the energy system, which is why the scenarios for the 2024 investment plans (2024 IP) have been drawn up jointly by the national and regional TSOs. The qualitative storylines of the scenarios are comparable to those for the 2022 investment plans (2022 IP), though with an extensive update based on the most recent insights into energy and climate policy and sectoral plans that have been further elaborated. To update these scenarios, collaboration has been sought with external stakeholders, more so than with previous investment plans. Stakeholders contributed ideas and provided input on many topics present in the scenarios.

The development of the joint scenarios under the banner of Netbeheer Nederland resulted in a comprehensive document (Scenario's investeringsplannen 2024 [2024 scenario investment plans])[12], which was shared with the stakeholders. Netbeheer Nederland published this on their website on 20 February 2023.

A high-level summary of this document is provided below.

2.2 High-level summary of Netbeheer Nederland's scenario document

Network operators ensure good, reliable, well-functioning networks for the transmission and distribution of electricity and gas and continuously invest in the quality and, where desired, expansion of the networks. To ensure that the grid operators are well prepared for what the energy transition and other developments in the energy system will bring, future scenarios, among other resources, are used. These scenarios help the grid operators form a picture of the future energy supply and demand. The TSOs and DSOs use the insights the scenarios provide into expected future supply and demand to anticipate the transmission and distribution needs and, with this, the energy infrastructure required to meet those needs. Then, based in part on this information, the grid operators determine which investments are needed and when the project or process needs to be completed.

The scenarios are an as accurate as possible description of various possible, realistic future scenarios, each with a different anticipated impact on the energy infrastructure. Accordingly, these scenarios are not a 'prediction of the future' but rather predictions of possible future developments.

12 *Scenario's investeringsplannen 2024: Scenario's voor de ontwikkeling van het energiesysteem in de jaren 2025-2030-2035, ten behoeve van de investeringsplannen van de Nederlandse netbeheerders elektriciteit en gas. Versie 1.01 – publiek 20 februari 2023 [2024 scenario investment plans: scenarios for the development of the energy system between 2025-2030 and 2030-2035, for use in the investment plans of the Dutch electricity and gas grid operators, version 1.01 – public, 20 February 2023], available for download at: https://www.netbeheernederland.nl/_upload/RadFiles/New/Documents/Netbeheer_NL_Scenarios_IP2024_v1.01_final%20(1).pdf*

2.2.1 Requirements for the scenarios

For the purpose of investment planning, the scenarios must be current, relevant and realistic (i.e. plausible). For the development of relevant, realistic future scenarios, the relatively certain developments are included in all scenarios, while the less certain developments – insofar as these are relevant and realistic (plausible) for the planning of infrastructure development – are included in at least one of the scenarios. For the time window covered in the scenarios, it is important to look both at the infrastructure measures included in the 2024 IP (ten years ahead) and the further development of the energy system in the period thereafter. In the scenarios for the 2024 IP we look at the period up to the end of 2035. The scenarios from the 2030-2050 Integral Infrastructure Survey (II3050-2), which relate to the transition to a fully climate-neutral energy system by 2050, have also been a source for developing the scenarios up to the end of 2035 and for linking these to the 2050 scenarios.

2.2.2 Climate policy as input for the storylines

The European Climate Law came into force on 30 June 2021[13]. This law requires EU Member States to, by 2030:

1. reduce their average greenhouse gas (GHG) emissions by at least 55% compared to 1990;
2. increase the share of energy from renewable sources to at least 32%;
3. realise a 32.5% improvement in energy efficiency (this is a new, higher target);
4. endeavour to meet an annual energy savings obligation at an increasing rate, starting from 0.8%.

In line with the European Climate Law, in the 2021 Coalition Agreement reached by the parties forming the Dutch government, the Dutch ambition level for reducing GHG emissions was increased from 49% to at least 55% by 2030. To create the greatest likelihood that this target of 55% will actually be achieved, policy measures are being developed that should result in a total reduction of 60%. This scope is needed given that otherwise, in practice, setbacks would almost inevitably result in the Netherlands falling short of the 55% target. The ambition level in the scenarios for the 2024 IP has been brought into line with this adjusted national GHG reduction target of at least 55% by 2030.

2.2.3 Storylines

The future is uncertain, and to address this uncertainty three scenario storylines have been developed. The scenarios outlined are similar in design to those of the 2022 IP, but the content has been updated and refined. Together they outline the likely upper and lower limits for energy supply and demand for each sector and source in the next decade.

13 *https://eur-lex.europa.eu/legal-content/NL/TXT/?uri=celex:32021R1119*

The three scenario storylines are:

- The Dutch Climate Ambition (DCA) scenario – central scenario: this scenario is based on the aggregate of existing and proposed energy and climate policy (Climate and Energy Outlook 2022), supplemented with the Dutch government's ambition from the Coalition Agreement concerning additional policy to be put on the agenda. The scenario assumes energetic implementation of the climate programme from the Coalition Agreement, with strong government control; however, regional and sectoral developments, such as the Regional Energy Strategies (RES), National Charging Infrastructure Agenda (NCIA) and Cluster Energy Strategy (CES) are also decisive in this. The plans and ambitions have an impact on all sectors in the Netherlands: all sectors participate, often applying a mix of methods and technologies.

- National Driver (ND) scenario – flanking scenario: this scenario also has significant governmental control. In this scenario, the Netherlands aims for a high degree of self-sufficiency, to be achieved through more 'home-grown' renewable energy and transitioning to a circular economy, among other measures. In this scenario, however, energy savings and efficiency improvements bring about a decrease in energy demand. Due to the key role electricity plays in the energy system, this scenario foresees a rapidly increasing importance of flexibility in supply and demand. Compared to the DCA scenario, the ND scenario places the emphasis even more strongly on electrification of demand and on even more onshore renewable energy generation.

- International Ambition (IA) scenario– flanking scenario: this scenario is characterised by strong global collaboration, free market forces and the Netherlands having higher energy imports. This scenario envisions the Netherlands remaining a trade-oriented and industrial economy, and one that functions as a transit country for biofuels, CO_2 and hydrogen. More so than in the DCA scenario, the focus in this scenario is on renewable gases (molecules): in addition to direct electrification, there is also a strong focus on hydrogen and green gas.

This differentiation was chosen because each scenario requires a different type of energy infrastructure. Insight into all three pathways is desirable. This scope of solutions is valuable for the investment plans given that region A may focus more on electrons and region B more on molecules. It is up to each grid operator to select an investment strategy for its own region that best aligns with the scope outlined by the scenarios.

2.2.4 Working process

Drafting the 2024 IP scenario storylines and scenarios was an iterative process. This process was completed by the Netbeheer Nederland scenario team, a team comprising scenario and sector experts from the Dutch grid operators and supported by external scenario and sector experts.

Explanation of the steps followed:

1. Assumptions for the scenarios and storylines: the first step of scenario development is drawing up the frameworks (assumptions) for the scenarios as well as the scenario storylines, as explained in the previous section.

2. Transition pathways per sector: the team then assessed the situation for each sector and examined the main developments (certainties and uncertainties), expectations and policy ambitions that should enable that sector to transition over the coming years. Stakeholder input was also used in this regard. The individual transition pathways of the various sectors have been logically combined in scenario storylines.

3. Quantification of scenarios via bottom-up, regional and sector plans: the team then worked out the quantitative aspects of the various sector plans and forecasts for each scenario. The data was entered into the Energy Transition Model (ETM) to chart the transition pathway in the period 2019-2035 for each scenario. The reduction in carbon emissions achieved through the scenario choices was calculated for each sector; these results have been compared with the indicative sectoral residual emissions from the draft Dutch Climate Policy Programme from June 2022. The intention of this assessment is to validate whether the transition of a sector, as elaborated by the network operators in the scenarios, sufficiently aligns with the ambition level of the Dutch government.

4. Stakeholder sessions: during the first stakeholder session, key principles, storylines and initial outlooks derived from the various scenarios were discussed with representatives from a large number of sectors, with a focus on the target year 2030. The feedback from the sectors represented at the session was incorporated into a report and used to recalibrate the ETM scenario parameters and/or adjust the scenarios per sector.

5. Three iterations: after the first stakeholder session held in mid-September 2022, the various experts continued to work on determining and substantiating the ETM scenario parameters. An '80% ready' version was discussed in a second stakeholder session in mid-October 2022, and input from this stakeholder session was again processed to arrive at a '95% ready' version. This version also included the 2035 scenarios and was discussed in a third stakeholder session at the end of November 2022.

6. Completion and regionalisation: after the third stakeholder session, the final adjustments were made and a final analysis was carried out to quantify the flexible resources (storage, conversion, supply/demand management) needed to match the expected development of supply and demand. The ETM analysis, the resulting quantitative elaboration of the scenarios and the regionalisation of the scenarios were all paused at the beginning of December 2022 so that TenneT, GTS and the regional grid operators could get started with their analyses and calculations.

2.3 Developments

This section describes the developments relevant to GTS in three scenarios that GTS drew up jointly with TenneT and the regional grid operators. This section is divided into four parts: Part 1 deals with the demand for gas on a national level. Part 2 covers the gas supply in the Netherlands. Part 3 describes developments in surrounding countries. And lastly, part 4 provides an overview of the gas flows and the utilisation of the GTS network.

This section makes a distinction between volume developments and peak capacity developments. Volume in this case means the total volume of gas consumed in one year, based on a year with average weather and temperature conditions[14]. The annual volume is expressed in terawatt hours (TWh), based on the upper calorific value for natural gas. Peak capacity represents the peak hourly demand in a particular year, i.e. the demand that arises during a period of extremely cold weather. In line with the Security of Supply (Gas Act) Decree, the assumption is the peak hourly demand on a day with an average effective temperature of minus 17°C, as measured at the Royal Netherlands Meteorological Institute in De Bilt. Capacity is expressed in gigawatts (GW), based on the upper calorific value for natural gas.

In this section, gas means methane (natural gas and green gas), unless explicitly stated otherwise.

2.3.1 Gas demand in the Netherlands

The charts below illustrate the volume and capacity trends for domestic demand in each of the 2024 IP scenarios. These have also been compared with the historical trend according to Statistics Netherlands (CBS) and with the 2022 Climate and Energy Outlook (C&EO) published by the Netherlands Environmental Assessment Agency (PBL)[15]. Gas demand in the recent past has varied from year to year, partly due to the variation in weather conditions, though, in general, a slight downward trend can be seen.

Due to the relatively high gas prices, 2022 saw a sharp decline in domestic gas demand. Significantly less natural gas was consumed, particularly in the chemical industry and refining, and various companies that consume a lot of natural gas or electricity partially or completely shut down energy-intensive installations. The C&EO assumes that, in the coming years, production, and with this the demand for natural gas for energy-intensive installations, will return to the level of recent years. With regard to the total domestic gas demand, due to the uncertainty regarding the gas that will be used to generate electricity and the volume of electricity that will be exported, the C&EO applies an upper and lower limit for the anticipated gas demand. On this point, the 2024 IP scenarios are in line with TenneT's calculations.

14 The calculations were based on the 2012 climate year. In terms of outdoor temperatures, this was a fairly normal year. This climate year also includes periods of dunkelflaute (dark doldrums), as the Germans call this: periods of little wind and sun and, accordingly, little wind and solar energy generation.

15 Estimate based on current and proposed government policy. https://www.pbl.nl/publicaties/klimaat-en-energieverkenning-2022

Figure 2.1: Domestic natural gas demand

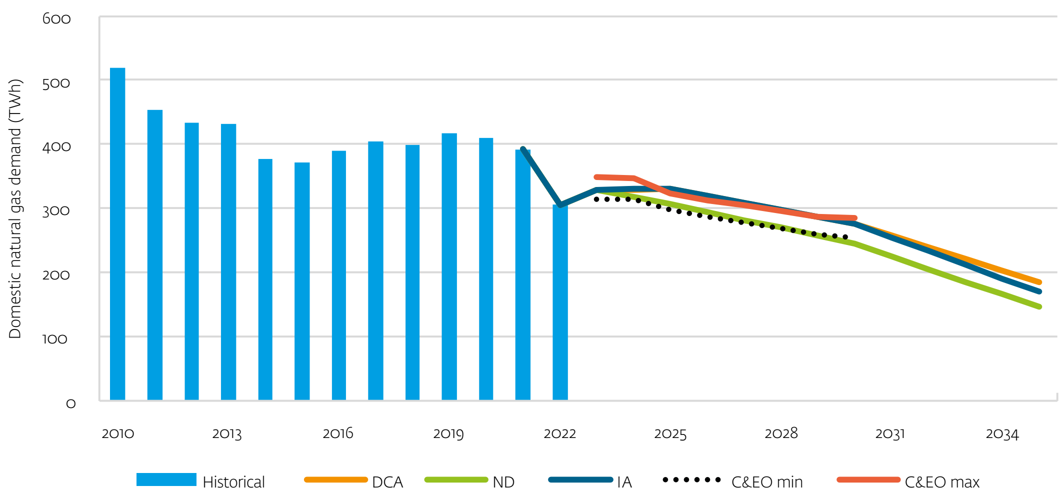


Figure 2.2: Annual volume domestic natural gas demand IP2024 scenarios

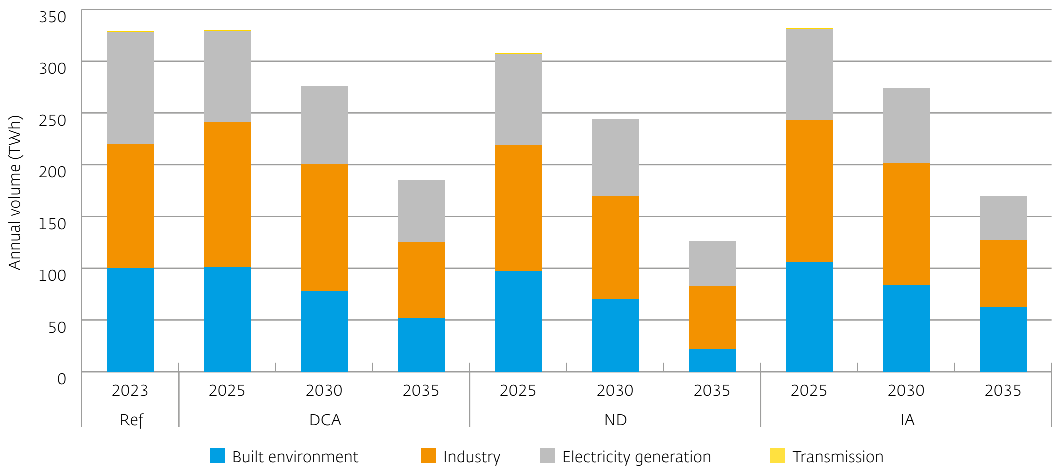
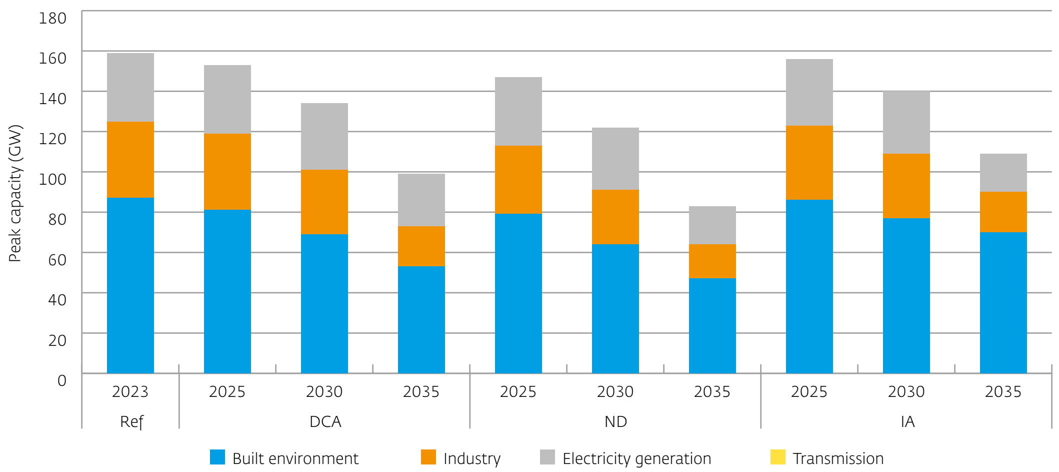


Figure 2.3: Peak capacity domestic natural gas demand IP2024 scenario's

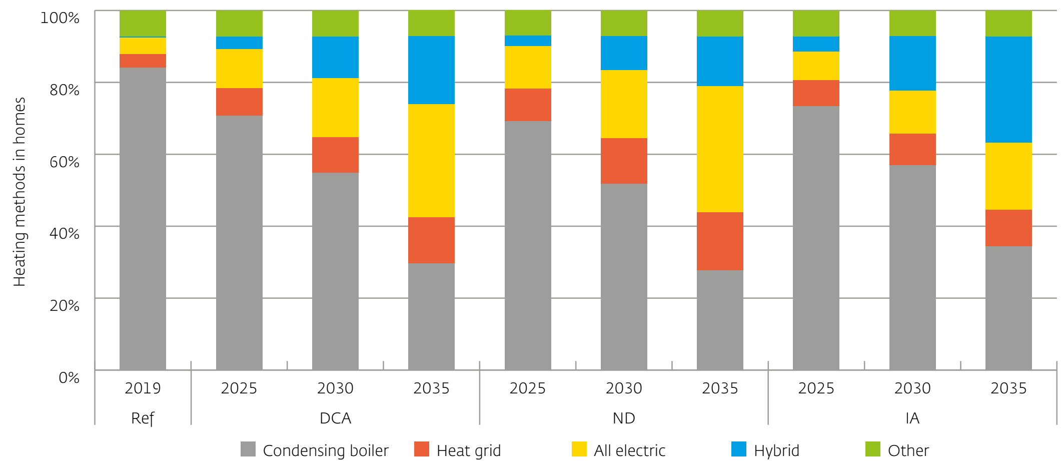


The charts above show that both annual consumption and peak capacity are set to decrease in the coming years. Given that the developments that have led to this decrease vary per sector, below we explain the developments in each sector individually.

Built environment

The built environment encompasses all residential and commercial buildings in the Netherlands[16]. In these homes and buildings, natural gas is used for heating and/or cooking. The gas demand in these sectors is influenced by two factors: the demand for heating and so also for gas is decreasing thanks to the energy savings realised through better insulation; and the scenarios also assume a transition to alternative ways of heating. The bar chart below illustrates the distribution of residential heating methods and how this changes in each scenario[17]. The distribution and development is similar for residential and commercial buildings[18].

Figure 2.4: Heating methods in homes



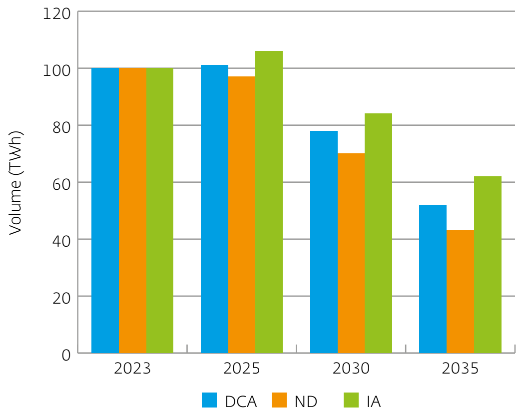
Depending on the type of heating, homes and commercial buildings will use less gas or none at all. Hybrid heat pumps heat with electricity for much of the year, but still use gas in peak demand situations and to supply hot water. For district heating networks, part of the peak demand is supplied with auxiliary gas boilers in the districts. The other types of heating (all-electric, pellet stoves, etc.) do not use gas at all. The charts below show how annual volume and peak capacity are expected to develop in the built environment. In both charts we see a downward trend, with the annual volume declining by between 38% and 57% between 2023 and 2035. In the IA scenario, a certain amount of growth in gas demand is anticipated between 2023 and 2025. This is partly because, in this scenario, a lot of gas is still used for heat grids in the first few years. Peak capacity will decrease by between 20 and 45% by 2035, meaning the peak capacity will decrease slower than the annual volume. This is because, for hybrid applications and district heating networks, gas is then still being used to handle peak demand situations.

16 Households correspond to the households in the ETM. Of the 'Buildings' segment in the ETM, a portion concerns commercial buildings and the rest are included with Industry. The ETM also includes gas demand for district heating used for the built environment.

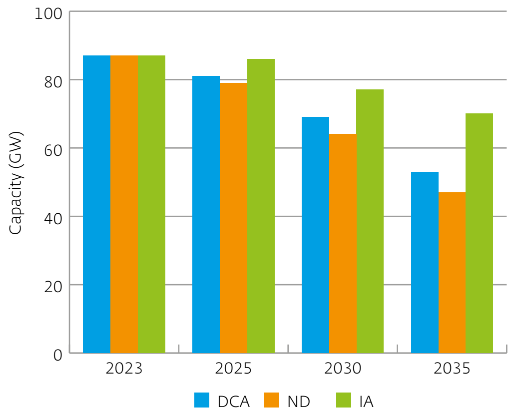
17 As a rule, 2019 is shown as a reference year for the current situation given that this is the reference year used in the Energy Transition Model (ETM). However, where in this IP the annual volume and the gas transmission capacity are shown side by side, 2023 has been used instead. This was done because the gas transmission capacity is determined under model-based climate conditions (effective outdoor temperature of minus 17°C). The situation experienced in 2019 does not provide a representative picture of this.

18 The relevant share of the market for households is calculated based on the number of installations. For buildings, the distribution is based on floor space (m²). The energy ratios will deviate from this given that different types of installations have different efficiency levels.

Figuur 2.5: Volume of methane in built environment



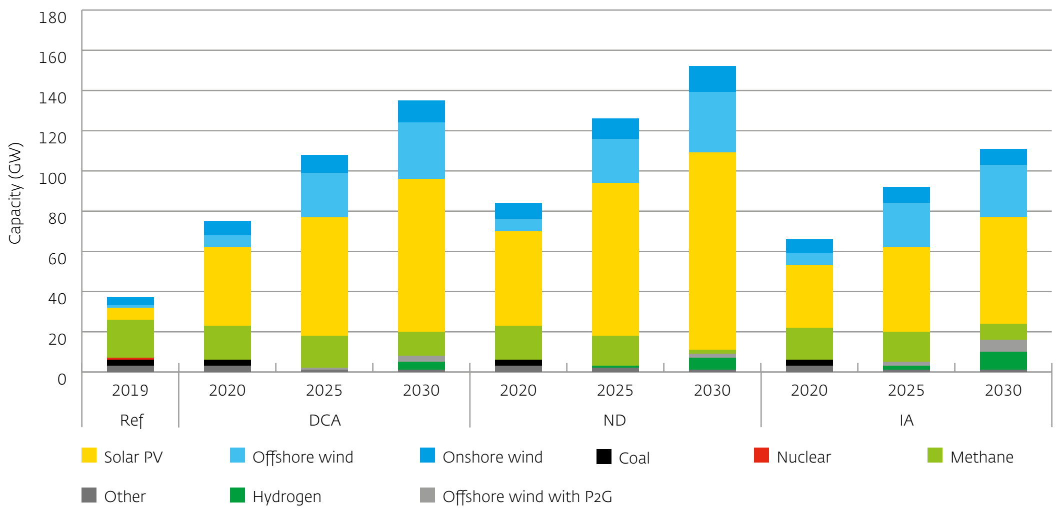
Figuur 2.6: Capacity of methane in built environment



Electricity generation

In the Netherlands, gas is also used to generate electricity, at power stations and in combined heat and power (CHP) plants, for example. In this regard, gas competes with other forms of electricity generation, such as coal, solar power and wind. The bar chart below illustrates the installed electrical capacity in the various scenarios. Some of this is gas-fired (methane and hydrogen) power. In all scenarios, we see an increase in the use of renewables and a decline in capacity from conventional sources. This is mainly due to the closure of coal-fired power stations. Capacity from gas-fired power stations will decline somewhat as well. From 2030, hydrogen will account for a portion of the gas capacity.

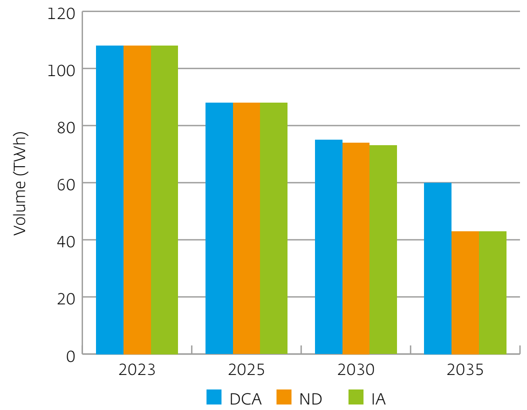
Figure 2.7: Installed electricity generation capacity



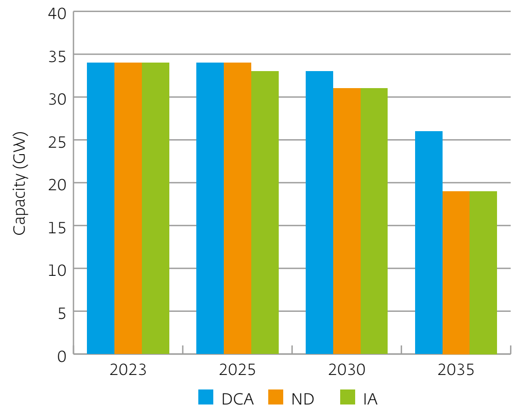
The use of gas-fired capacity depends entirely on the conditions on the electricity market. A large supply of solar and wind power will likely mean that little use will be made of the capacity of gas-fired power stations; they would, however, be in full operation during periods with little sun and little wind. Furthermore, use of gas-fired power stations still depends on developments in the electricity market in countries outside the Netherlands. It is conceivable that Dutch gas-fired power stations will also generate electricity for export. GTS has determined the installed capacity of gas-fired power stations (large, centralised ones and local stations) in the scenarios together with the other network operators. The parties also agreed on which power stations would switch from natural gas to hydrogen in the scenarios. For a good estimate of the use of gas-fired power stations and the annual gas consumption for electricity generation, as in previous editions of the investment plan, GTS uses TenneT's calculations in this draft IP.

The bar charts below show the levels of gas consumption for generating electricity, with one chart illustrating the annual volumes and the other peak capacity. The annual volume shows a sharp decline in the use of gas-fired power in all scenarios. This is related to the increase in electricity generated from solar, wind and other sources. Peak capacity will also decrease in the coming years, partly because certain power stations will use hydrogen instead of natural gas.

Figuur 2.8: Volume of methane for electricity generation



Figuur 2.9: Capacity of methane for electricity generation



Industry

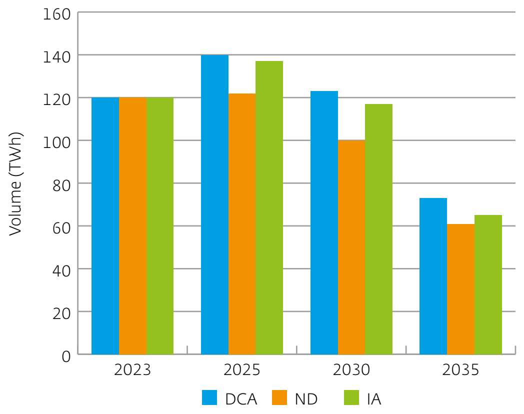
Within industry, the largest energy-intensive sectors are the chemical sector, refineries, the fertiliser industry and the metal industry. This is due to the use of high-temperature heat and/or natural gas as a feedstock in these sectors. The agricultural sector (including commercial greenhouses) is also included in this draft IP. The development of gas consumption is determined by various factors, such as the degree of efficiency improvements, technological changes, energy prices and the growth/shrinkage of the sector. The assumptions for industry are derived from the bottom-up process for the II3050 scenario trend developed by strategic consultant Kalavasta, focusing on the 14 largest industrial companies (G14)[19], the six industry clusters, local industry and waste processing operators. For this purpose, in the spring of 2022 Kalavasta conducted over 120 interviews, through which the industry assumptions were determined together with the market parties. The results, updated with information from public industry announcements, have been included in the scenarios for this 2024 IP. The ND and IA scenarios also take into account the EU's proposed Renewable Energy Directive III (REDIII) legislation for renewable hydrogen[20].

19 *Tata Steel IJmuiden, Shell (Pernis and Moerdijk), BP Rotterdam, ExxonMobil Rotterdam, Gunvor Rotterdam, OCI Geleen, Yara Sluiskil, DOW Terneuzen, SABIC Geleen, Air Products Rotterdam, Air Liquide Rotterdam, Nobian (three sites) and BioMCM. Due to the sanctions against Russia, Kalavasta made its own estimate for Zeeland Refinery.*

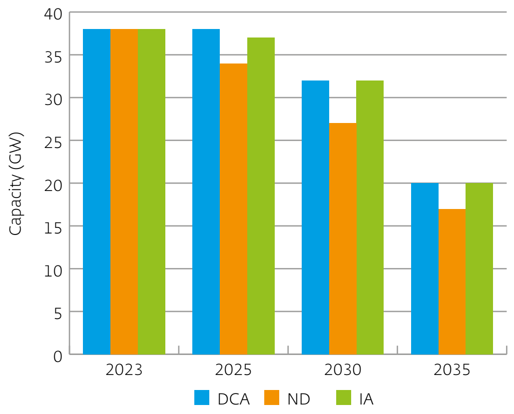
20 *The REDIII determines, among other things, the minimum share of renewable fuels of non-biological origin ('RFNBO': green hydrogen or energy carriers derived from hydrogen) to be used in industry. At the time the 2024 IP scenarios were paused, there was no agreement on the precise share. The ND scenario assumes 50% in 2030 and 70% in 2035 (at the upper limit) and IA assumes 35% and 50% respectively (at the lower limit). The EU institutions have now agreed targets of 42% in 2030 and 60% in 2035. See also: https://www.consilium.europa.eu/en/press/press-releases/2023/03/30/council-and-parliament-reach-provisional-deal-on-renewable-energy-directive/*

The bar charts below show the total gas demand from industry in the three scenarios. In the charts, we still see an effect of high gas prices in 2023, primarily causing lower volume than in recent years (the effect on peak capacity is slight). The DCA and IA scenarios foresee growth in industrial demand in the first years after 2024. Analogous to the C&EO, it is assumed that in the coming years production will return to the level seen in recent years. Over the longer term, all scenarios anticipate a decline in gas demand from industry, in part as a result of energy saving measures and switching to other energy carriers like hydrogen and electricity. The ND scenario envisions the fastest decline in gas demand, partly due to the strong focus on electrification in this scenario. Another factor in this decline would be the relatively large imports of ammonia for fertiliser instead of this being produced locally from natural gas.

Figuur 2.10: Volume of methane in industry



Figuur 2.11: Capacity of methane in industry



Transport & Mobility

At this time, the transport & mobility sector mainly uses petroleum-derived liquid fuels, such as diesel and petrol. In terms of gas demand, transport & mobility is currently a relatively small sector, consuming an annual volume of approximately 1TWh. All the 2024 IP scenarios assume growth in electricity and hydrogen in particular, as well as limited growth in methane-based propulsion in inland shipping. On balance, the use of methane/natural gas decreases in all scenarios.

2.3.2 Gas supply in the Netherlands

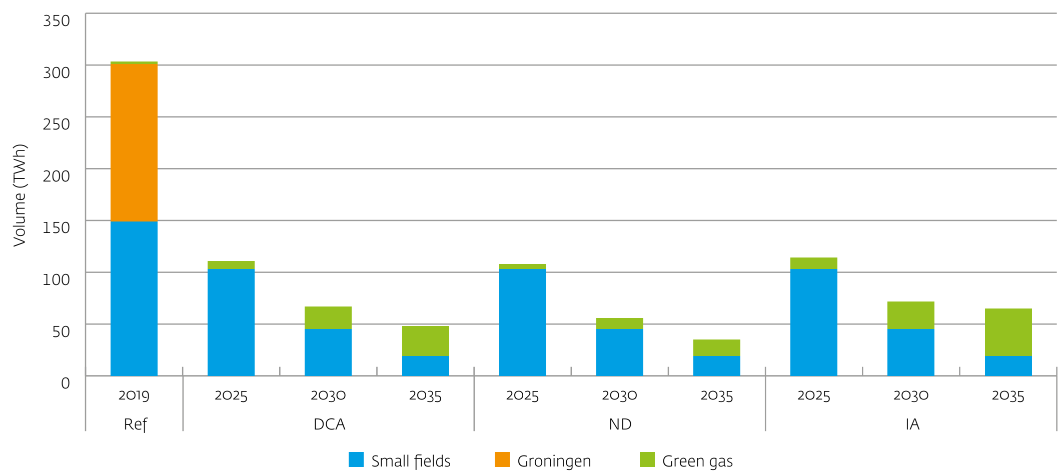
Section 2.4.1 shows that demand in the Netherlands decreases in all scenarios. However, the domestic supply of natural gas is decreasing even faster. The main cause is the accelerated phasing out and the planned permanent closure of production from the Groningen field. In the coming years, the production of natural gas in the Netherlands will decrease further, as can also be seen in the bar chart below. In reference year 2019, approximately 300TWh was still being produced, with about half of this coming from the Groningen field. Extraction of gas from the Groningen field ceased on 1 October 2023. It may still be necessary, only in very special situations, to temporarily extract a limited amount of natural gas; however, in principle there will be no natural gas extraction whatsoever. [21] As of that date, only the small fields remain open for production. With the depletion of the reserves from the small fields, it is expected that only 45TWh will be produced in 2030, and by 2035 natural gas production will have fallen further to 19TWh[22]. The assumptions for domestic natural gas production are the same for all scenarios.

21 *https://www.rijksoverheid.nl/onderwerpen/gaswinning-in-groningen/afbouw-gaswinning-groningen#:~:text=In%20het%20gasjaar%202021%2F2022,als%20de%20nood%20hoog%20is.*

22 *Figures for small fields come from the 2021 annual review on natural resources and geothermal energy in the Netherlands. Only current and conditional reserves were considered: https://www.nlog.nl/sites/default/files/2022-07/jaarverslag_2021_delfstoffen_en_aardwarmte_in_nederland.pdf*

On the other hand, the supply of green gas will increase in the coming years. Green gas is methane harvested from organic material via anaerobic digestion or gasification. Since the resulting gas is chemically identical to natural gas it can be injected directly into the gas grid. The Dutch Climate Ambition scenario aligns with the current government target of 22TWh in 2030[23]. The ND scenario assumes relatively little green gas production, with only organic growth (based on CE Delft's analysis).[24] In 2030, the total gas production is around 11TWh. The availability of gasification technology will still be limited at that time but will increase in the following years. The IA scenario considers an upper limit for green gas production, both from anaerobic digestion and gasification, with total production of around 27TWh in 2030. After 2030, the production of green gas, mainly from gasification, will increase further, reaching between 16 and 46TWh by 2035. Compared to gas demand, the domestic production volume will be limited, meaning that the Netherlands will later, as it is now, be a net importer of natural gas.

Figure 2.12: Natural gas and green gas production



2.3.3 Developments outside the Netherlands

Since the gas demand and gas supply trend abroad has an impact on gas flows through the Netherlands, the developments in surrounding countries are also considered in this draft IP. For this purpose, this draft IP uses data from the 2022 TYNDP joint scenario report of ENTSOG and ENTSO-E[25]. The National Grid's Future Energy Scenarios (FES)[26] were used for the UK. This section looks at the basic principles for gas demand and gas supply in the Netherlands and abroad, with specific attention paid to the supply and demand of methane.

23 *https://www.rijksoverheid.nl/documenten/kamerstukken/2022/07/01/bijmengverplichting-groen-gas*

24 *https://ce.nl/wp-content/uploads/2022/06/CE_Delft_210414_Bijmengverplichting_groen_gas_DEF.pdf*

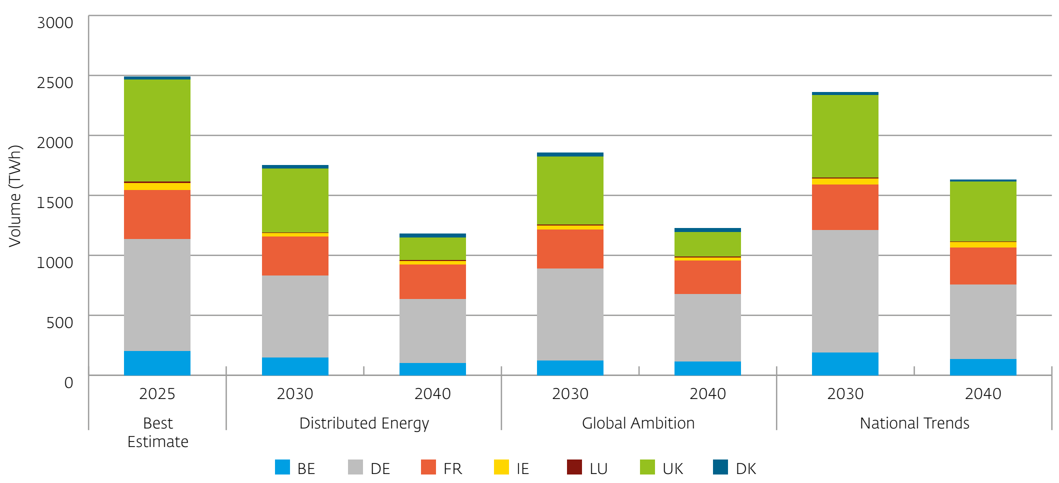
25 *https://2022.entsos-tyndp-scenarios.eu/*

26 *https://www.nationalgrideso.com/future-energy/future-energy-scenarios*

Gas demand

The 2022 TYNDP has one scenario for 2025 and three for 2030 and 2040. These scenarios are illustrated in the bar chart below. The scenario for 2025 is based on a best estimate of the TSOs. For 2030 and 2040, the 2022 TYNDP has three different scenarios[27]. The National Trends scenario is in line with the national energy and climate plans of the EU Member States. This scenario assumes that in this period there is still relatively high gas demand. In addition, ENTSO-E and ENTSOG have developed two flanking scenarios based on storylines. The Distributed Energy scenario focuses on electrification and on the EU Member States producing as much of the required energy as possible. The Global Ambition scenario focuses more on hydrogen, including from imports. Both flanking scenarios anticipate a sharper decline in gas demand[28].

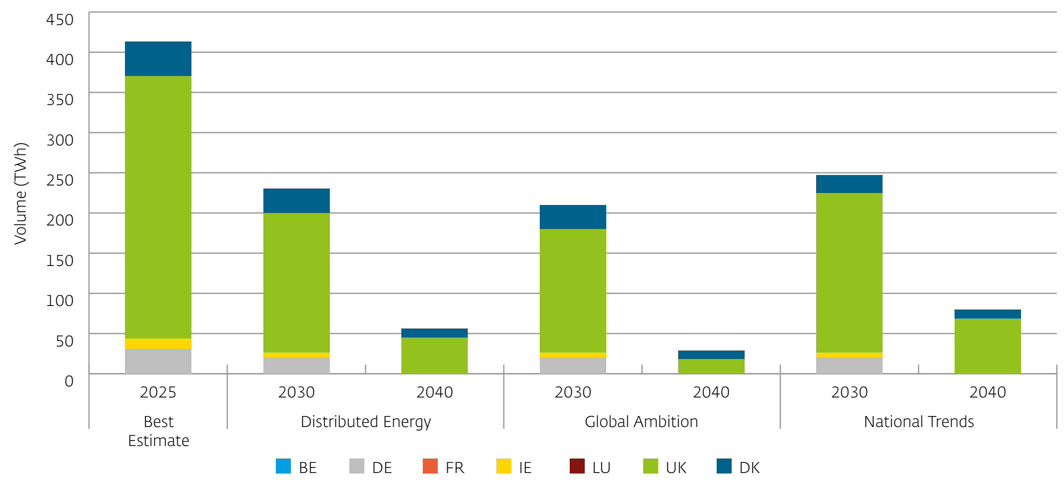
Figure 2.13: Gas demand in countries neighbouring the Netherlands



Gas supply

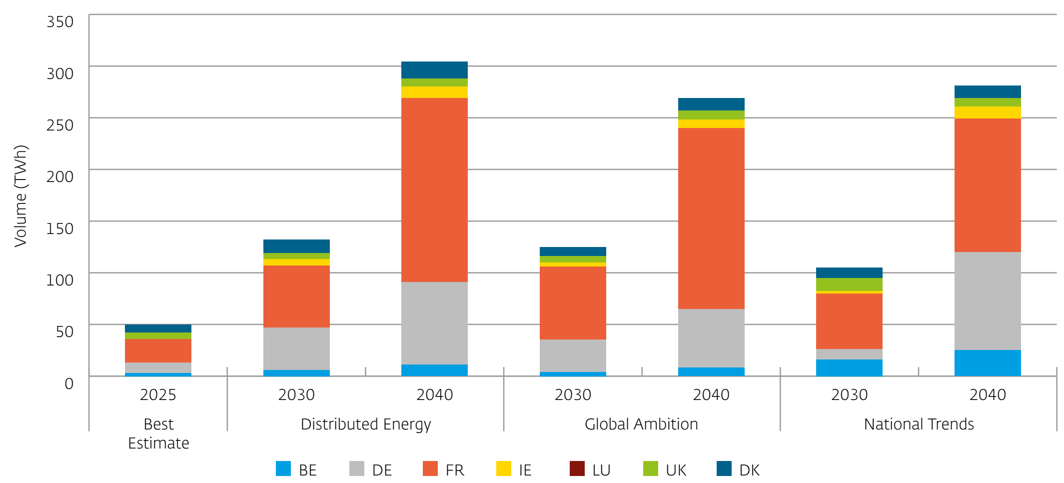
As in the Netherlands, natural gas production in the rest of north-western Europe is declining. Alongside the Netherlands, the United Kingdom and, to a lesser extent, Germany, Denmark and Ireland are the main gas producers at the moment. The bar chart below shows the development in gas production in these countries. Gas production declines in all scenarios, reaching between 210 and 255TWh in the Netherlands' closest neighbours by 2030. In 2040, in these countries only a fraction of the current natural gas production (between 28 and 80TWh) will remain.

Figure 2.14: Gas supply in countries neighbouring the Netherlands



In contrast to the dwindling natural gas production, renewable gas production will grow in the neighbouring countries too. The bar chart below illustrates the production of renewable methane in the countries around the Netherlands. Renewable methane mainly consists of green gas produced through anaerobic digestion or gasification. In addition, a limited amount of synthetic methane is produced through electrolysis (power to methane), including in France and Germany. In 2030, the production of renewable gas in the Netherlands' neighbouring countries will reach between 104 and 131TWh; by 2040 this will have grown to between 269 and 304TWh.

Figure 2.15: Renewable methane production in countries neighbouring the Netherlands

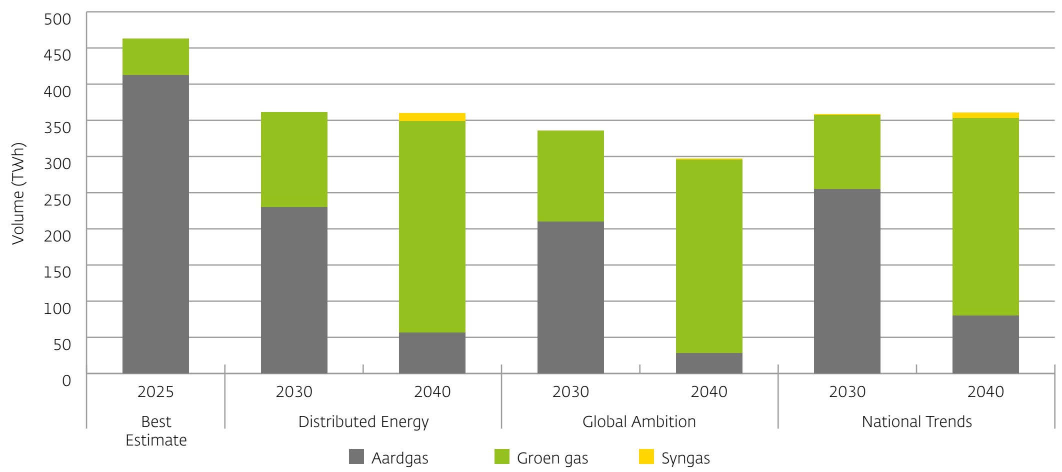


27 For the analysis in this draft IP, the scenarios from the FES are shown with the most similar scenario from ENTSO-E and ENTSOG: System Transformation with National Trends, Leading the Way with Distributed Energy, and Consumer Transformation with Global Ambition. The average of these three FES scenarios is shown for the best estimate. The Falling Short scenario from the FES is not used, given that in this scenario the climate targets are not achieved.

28 The figures from the TYNDP scenario, for which ENTSOG took into account the 20 Mt target for green hydrogen in 2030 from RepowerEU, were used.

The bar chart below shows the sum of natural gas, green gas and syngas production in countries surrounding the Netherlands. It is notable that methane production is expected to stabilise somewhat after 2025. The decline in natural gas production is more or less compensated by the growth in the production of renewable gas. In 2030, the share of renewable gas production will be between 29% and 37% and this will increase further after 2030, up to a maximum of 91% in 2040. After 2040, the production of renewable gas will increase further still.

Figure 2.16: Total methane production in countries surrounding the Netherlands



2.3.4 Utilisation of the GTS network

The previous sub-sections provide an overview of domestic and foreign developments in gas supply and demand. Naturally, domestic developments directly affect the gas flows through the GTS network, but GTS also transports gas abroad. Although the Netherlands has been a net importer of natural gas for several years, the country will still export low-calorific gas until 2030. In addition, the Netherlands also handles 'transit flows', like the flow of LNG to Germany via the Netherlands.

To gain insight into the natural gas flows crossing the border, ENTSOG simulations were used for the 2022 TYNDP scenario report[29]. The bar charts below show the total transport through the GTS network. What stands out in the chart is the sharp decline in the total annual volume between now and 2030. There are several reasons for this. Firstly, a large part of the decrease is caused by the phasing out of obligations regarding the export of low-calorific gas. Secondly, as mentioned previously, domestic demand in countries neighbouring the Netherlands will also be declining. Finally, we see a decrease in the transit of H-gas to the Netherlands' neighbouring countries. This has to do with the higher need for H-gas (for quality conversion) in the Netherlands as well as a lower demand for natural gas in north-western Europe.

All of this will result in a decline of between 52% and 59% up to 2030, compared to the 2019 levels. Over the five years after that, the decline will continue by another 12 to 14% (resulting in an expected decrease of 63% to 73% in 2035 compared to 2019).

29 The analysis is based on the various supply and demand scenarios presented in the TYNDP, assuming the PCI infrastructure level for methane and infrastructure level 2 for hydrogen. The ENTSOG simulations assume optimum gas transmission, without taking into account uncertainties in the market, optimisation of individual parties, or operational limitations and, as a result, provide a picture that corresponds to a minimum transmission requirement. For more information, see: https://www.entsog.eu/tyndp#entsog-ten-year-network-development-plan-2022.

Figure 2.17: Transport volume for domestic, export and transit

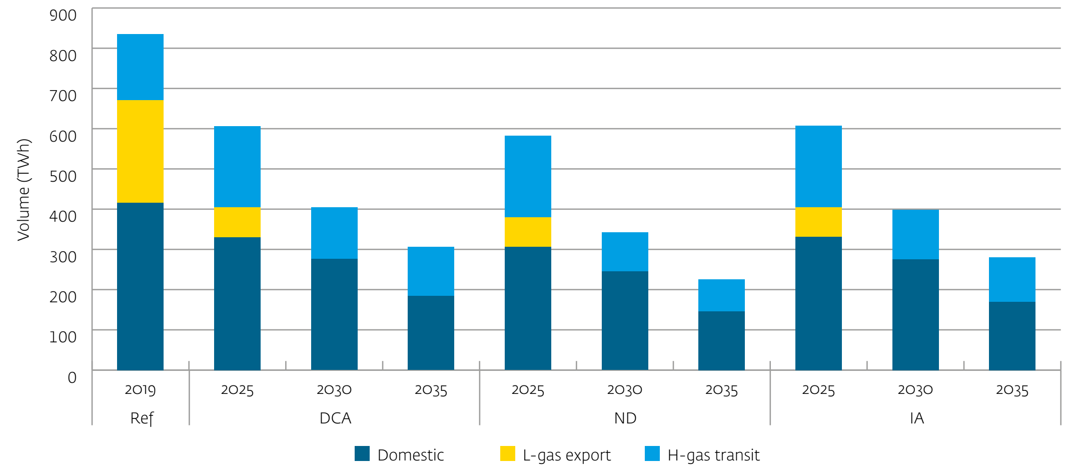
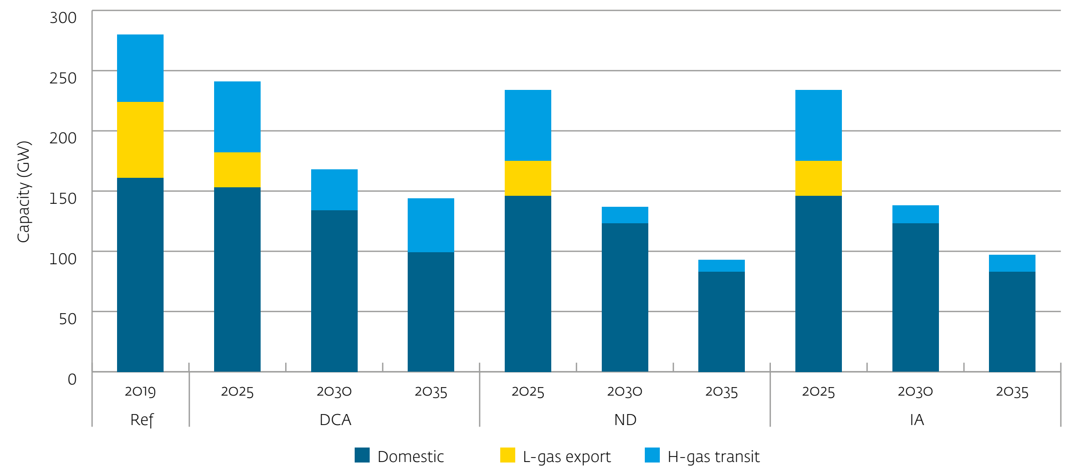


Figure 2.18: Transport capacity for domestic, export and transit



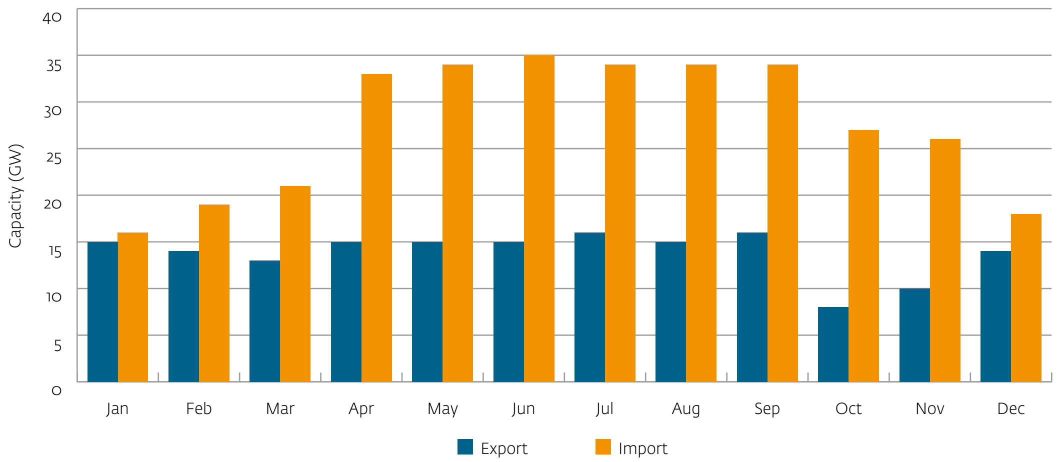
Transport capacity will also decrease in the coming years and will be between 40% and 51% lower in 2030 compared to 2019. In 2035, the decline will be between 49% and 67%[30]. However, this decline in transport capacity is slower than the decline in annual transport volume. This is because the Dutch gas network is an important source of flexibility in peak situations, for example through hybrid heating and gas-fired power stations. Not only does this apply within the Netherlands: the Netherlands is also an exporter of seasonal flexibility to surrounding countries. The bar chart below gives an example of the flexibility in exports for 2030 in the IA scenario (the profile is similar in the other scenarios)[31]. The chart shows imports and exports per month side by side. First of all, the chart shows that the Netherlands is a net importing country, given that imports are higher than exports. However, the ENTSOG scenarios also show a difference in profile between import and export. Where exports are almost constant every month, that is not the case for imports, which are considerably lower in winter (when demand is high) than in summer. This shows that the Netherlands enables the countries around it to import more when demand is higher in the winter and, accordingly, the Dutch gas network (indirectly) facilitates flexibility in neighbouring countries. The Netherlands is therefore a net importer of

30 The presentation of transport capacity differs slightly methodologically from the presentation in the 2022 IP. In this 2024 IP, only peak demand in a winter/cold winter has been included in the analysis. Because storage facilities are typically filled in the summer, the corresponding capacity is not shown in the chart.

31 Monthly average capacity based on ENTSOG model results, assuming a normal weather profile that year.

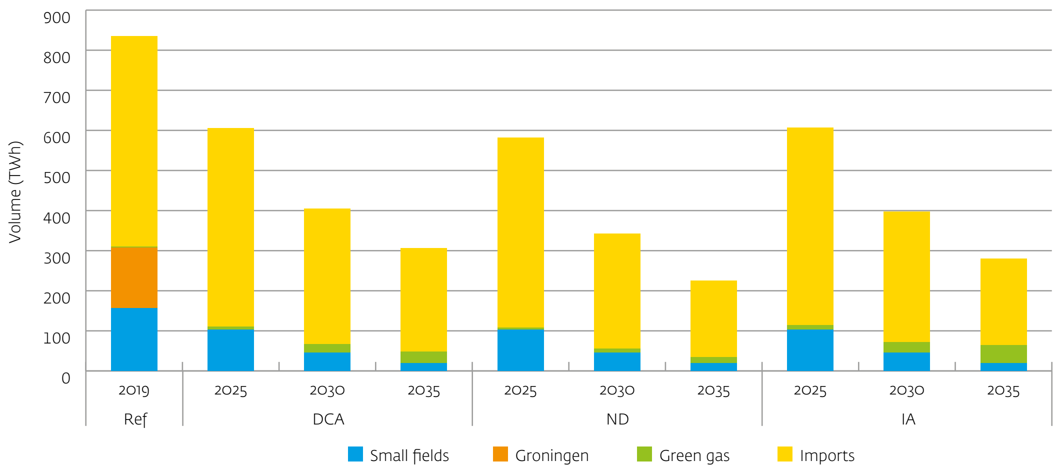
natural gas and yet a net exporter of seasonal flexibility. This seasonal flexibility comes from Dutch storage facilities. This example illustrates the importance of Dutch gas storage facilities for the north-western European gas market.

Figure 2.19: Import and export in IA scenario 2030



The chart below shows the supply of methane and the important role imports play in this. This concerns the supply including the transit flow of natural gas. The import of natural gas decreases in all scenarios. In 2019, the import of natural gas was still 525TWh. In the scenarios for 2030, this has fallen to between 286 and 338TWh, assuming a year with a normal weather profile[32]. Between then and 2035, the import demand is expected to decrease further, to between 190 and 258TWh.

Figure 2.20: Transport volume for local production and import



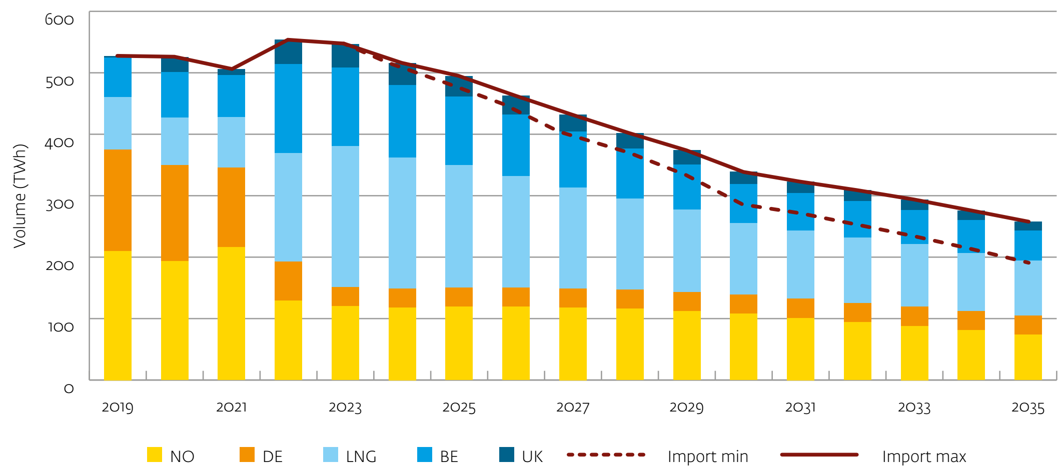
The Netherlands' import needs will largely be met by Norway and with LNG (possibly via the UK or Belgium). The precise ratio between the various sources is uncertain. In the chart below, the import demand (including transit) is broken down by the various import sources. The ratio between the various sources is based on the observed ratio in 2023[33] and, as such, is indicative.

32 In a cold year, gas demand is roughly 15% higher than in a normal year. After the closure of the Groningen field, the required extra volume will have to be provided entirely through additional imports.

33 Measured values up to the end of September; an estimate has been made for the remaining months.

The pipeline imports from Norway follow the trend in the production outlook of the Norwegian Petroleum Directorate[34]. For Germany, only the entry flow from the German storage facilities that are connected to the GTS network are taken into account. The other sources supply the remaining volume on a pro-rata basis. Imports from Belgium and the UK will mainly consist of Norwegian gas or LNG. Because the demand for imports will decrease in the long term, this will also allow more scope for different entry directions.

Figure 2.21: Import demand in the Netherlands



34 This takes into account currently active fields and discovered (but yet to be developed) reserves; see also https://www.norskpetroleum.no/en/production-and-exports/exports-of-oil-and-gas/

3 Developments in the gas market

In this section, GTS explains developments in the gas market in the Netherlands and in other countries.

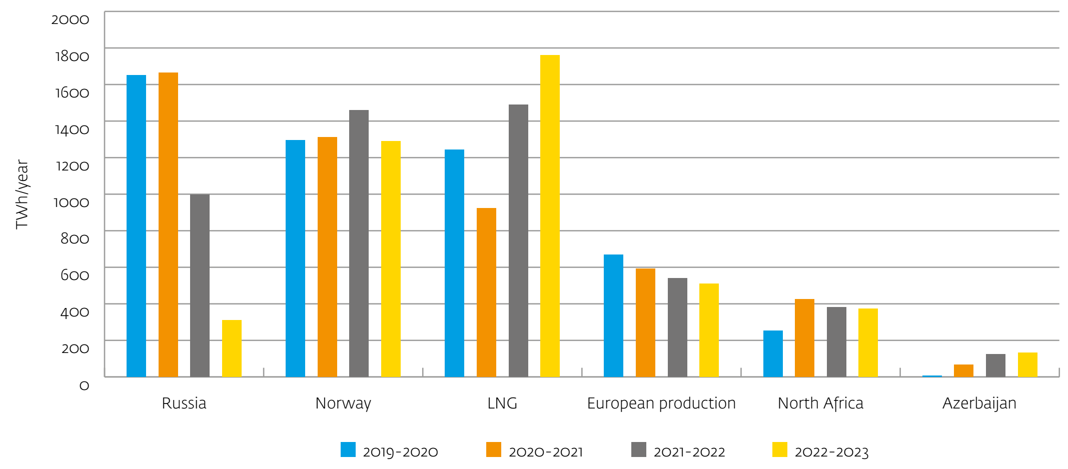
3.1 Changing gas market situation: no more Russian gas in north-western Europe

Russia's war against Ukraine and the sabotage of the Nord Stream pipelines have brought about drastic changes in the European gas market, changes that are also affecting the Netherlands. Previously, Russia supplied approximately 40% of the gas consumed in the EU. That is now less than 10% for the 27 EU Member States (EU 27), while north-western Europe receives no Russian gas at all. The year 2022 saw a major supply shortage, resulting in high gas prices. Though prices in 2023 have dropped considerably from those in effect during a large part of 2022, the average gas price in 2023 is still more than twice as high as before the war[35]. This situation is costly and otherwise to the detriment of consumers, businesses and industry. As a result of the high prices, gas demand has now fallen by around 15% in the Netherlands and the rest of the EU. The EU gas market has therefore found a new (but more expensive) way to balance supply and demand.

Figure 3.1 shows that before Russia's war against Ukraine, Russia supplied about 1,700TWh to the EU 27 per gas year, i.e. around 40% of the regular EU-27 gas demand of approximately 4,000TWh. In the 2021/2022 gas year, Russia supplied a lot less, but still around 1,000TWh. This supply was used during the spring of 2022 to fill the gas storage facilities. For the 2022/2023 gas year, Russia's supply has been limited to deliveries to Eastern European EU countries, accounting for an estimated volume of approximately 300TWh.

The Russian gas supply to the EU-27 dropped by around 1,400TWh between the 2020/2021 gas year (1,700TWh) and the 2022/2023 gas year (300TWh). Combined with a fall in demand of approximately 600TWh (or 15% of 4,000TWh), this results in a supply shortfall of approximately 800TWh. This shortfall has been covered by additional LNG supply, as can also be seen in Figure 3.1.

Figure 3.1: Gas imports by region - EU27

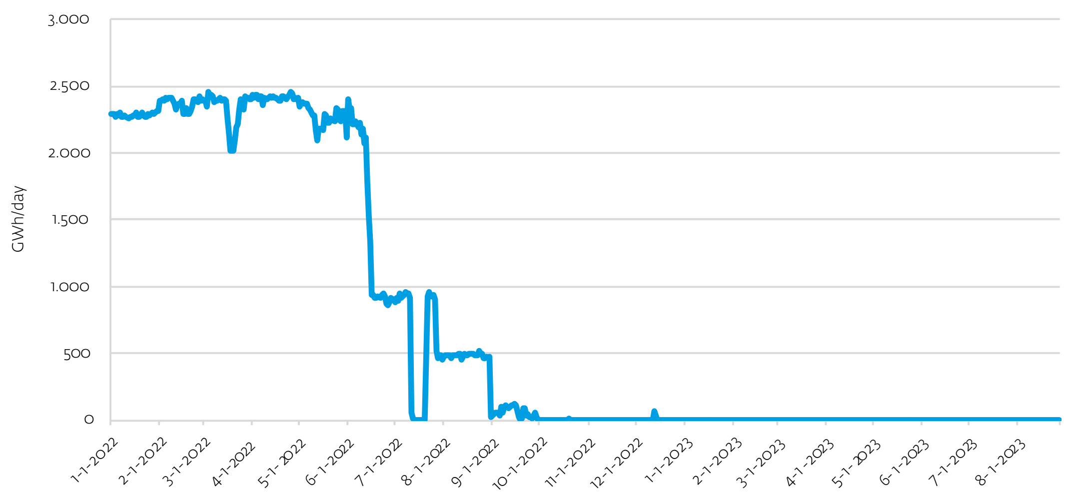


Source: ENTSOG

35 This concerns the situation on 1 September 2023.

Since September 2022, Russian gas has no longer been supplied to north-western Europe via Nord Stream 1, the Czech Republic or Poland. For Germany, a major consumer of Russian gas and an important transit country for this gas for north-western Europe, the effect of the absence of Russian gas is clearly visible in Figure 3.2.

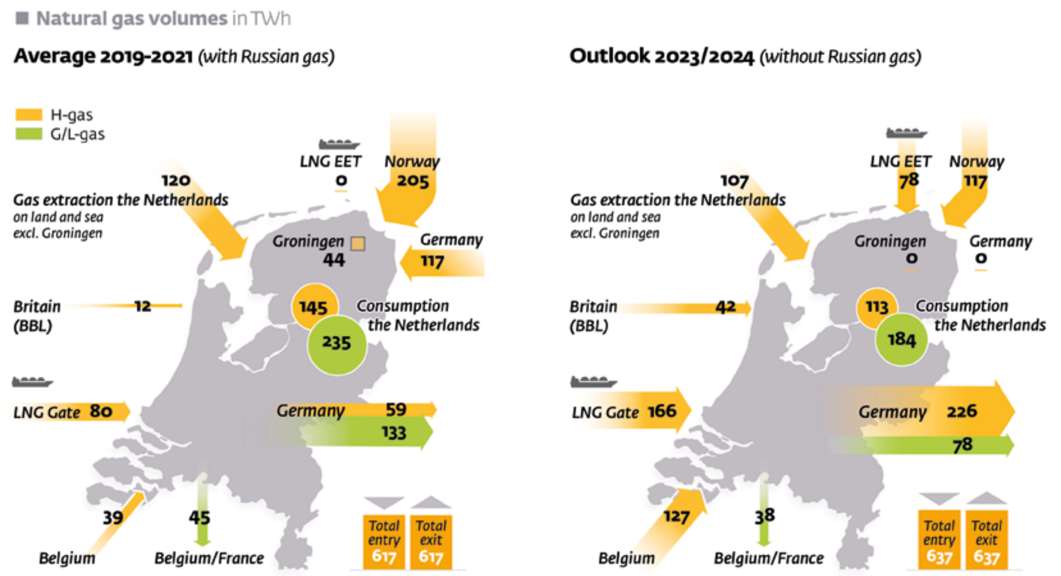
Figure 3.2: German import of Russian gas from 1/1/2022 to 1/9/2023



Source: ENTSOG

The Dutch gas market, too, has changed as a result of Russia's war against Ukraine. The graph in Figure 3.3 shows gas flows in the Netherlands before the start of Russian's war against Ukraine (average in 2019-2021) and gas flows in the Netherlands after the start of Russian's war against Ukraine (forecast for 2023/2024 gas year). Prior to the war, the gas flows in the Netherlands mainly went from east to west. However, as can be seen in the graph above, the expected gas flows are now mainly oriented from west to east. It is clear to see that, since the start of Russian's war against Ukraine, with the strong increase in export (transit flow) to Germany, the Netherlands has been becoming more and more a gas transit country, and this while domestic gas consumption in the Netherlands has fallen since the start of Russian's war against Ukraine. The forecast gas flows in the 2023/2024 gas year shown in Figure 3.3 are based on the actual gas flows from the previous gas year (2022/2023) given that this is the only representative gas year since the start of Russia's war against Ukraine.

Figure 3.3: Dutch gas flows before and after the start of Russia's war against Ukraine

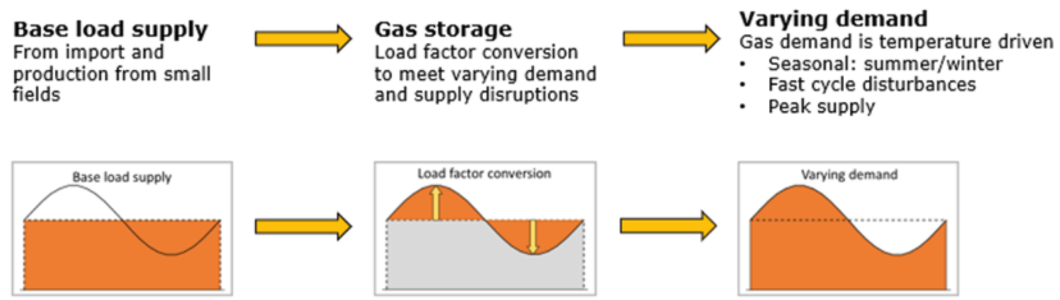


Source: GTS

3.1.1 Utilisation of gas storage facilities is crucial for security of supply

Dutch gas demand is highly seasonal: due to the use of natural gas for heating purposes, demand in winter far exceeds that in the summer. At the other end we see supply with a virtually flat profile; this supply comes from production from small fields or imports transported over long distances. It can thus be seen (as also made clear in the graphs in Figure 3.4) that gas storage facilities are an indispensable component in the supply chain to ensure that the unvarying gas supply (flat profile) is sufficient to meet the varying gas demand.

Figure 3.4: Gas storage facilities ensure a balance between supply and demand



Source: GTS

In addition to balancing seasonal variations in gas demand, gas stores are also essential for absorbing short-term imbalances or moments of peak demand. In addition, gas storage facilities can be called on in the event of interruptions on the supply side or disruptions in the transmission system.

Gas can be stored in empty gas fields and in salt caverns. The vast empty gas fields can be made suitable for storing gas for use for seasonal variations and to absorb interruptions in the supply. The Netherlands has a total of approximately 135TWh of storage volume available, consisting of converted gas fields. The smaller volume of the salt caverns makes them especially suitable for balancing short periods of cyclical peak demand and short-term disruptions. The volume in salt caverns for the Dutch gas market is around 10TWh.

Until recently, the Groningen field was one of the few production fields with sufficient flexibility to handle the variations in market demand and to absorb interruptions in supply. Together with the gas storage facilities, the Groningen field provided a significant part of the required seasonal flexibility in the north-western European gas market. With the accelerated closure of the Groningen field, the level of flexibility has decreased and the importance of gas storage facilities has increased even further. And this importance has been enhanced by the loss of supply from Russia, with a replacement supply with a less predictable profile, such as LNG.

3.1.2 The phase-out of production from the Groningen field

Gas extraction from the Groningen field leads to earthquakes, making the area unsafe. Among other adverse effects, the earthquakes cause damage to buildings and have a negative impact on the well-being of local residents. To make the region safer, since 2018 the government has been phasing out gas extraction as quickly as possible, while maintaining security of supply and the quality-neutral gas market. In recent years, parties have worked hard to implement measures that contribute to achieving this objective. A number of these measures have already been completed, for example: i) filling the Norg UGS facility with pseudo G-gas instead of Groningen gas; ii) enabling the export of pseudo G-gas via Oude Statenzijl to Germany; iii) converting the Grijpskerk UGS facility to handle G-gas; and iv) increasing pseudo G-gas production through the use of extra base-load nitrogen for nitrogen ballasting ('derichment'). In addition, a number of measures are currently being implemented. The phased delivery of the Zuidbroek II nitrogen installation will soon be fully completed. Other measures, such as switching households in Belgium, France and Germany from L-gas to H-gas and switching the Netherlands' nine largest industrial consumers from using only G-gas to using mainly H-gas, are expected to be completed in the coming years. Thanks in part to these measures, gas extraction from the Groningen field has entered the next phase, with the field only serving as backup from the 2022/2023 gas year and the Dutch government intending to permanently close the field by no later than 1 October 2024.

In the context of security of supply, GTS has a statutory duty to advise the Minister of Economic Affairs and Climate Policy (and/or the State Secretary for the Extractive Industries) each year on the required Groningen capacity and volumes. In the past, one of the principles underlying this annual advisory round was that there would be sufficient H-gas available in the Netherlands at all times. The significantly altered situation in supply and demand (as a result of the loss of the supply of Russian H-gas) has meant that this can no longer be a firm presumption. Based on analyses (including the changed H-gas situation as a starting point), GTS has concluded that

the capacity of several Groningen gas production sites will be needed to be able to guarantee security of supply in the 2023/2024 gas year. GTS has identified two scenarios here where production from the Groningen field may be necessary[36]. These are:

a) in a situation with extremely low temperatures and loss of capacity comparable to the largest resource, the use of production sites in the Groningen field would be necessary to cover peak demand; and

b) should a large volume be drawn from the UGS facilities during a cold winter, gas from the Groningen field would be needed to fill the UGS facilities again in the summer to a level sufficient to guarantee security of supply in the following year[37].

Through the adoption decision for the 2023/2024 gas year (made in September 2023), the State Secretary for the Extractive Industries finalised the full termination of gas production from the Groningen field. For the 2023/2024 gas year, there will still be the option of extracting a limited volume of gas from existing production sites in certain exceptional situations (as described in the adoption decision). The relevant production sites will only be brought to 'pilot-light level' if there is the imminent threat of an exceptional situation as described in the adoption decision occurring. In the summer of 2023, NAM successfully tested escalating to pilot-flame level with one of the production sites that was closed as of 1 April in accordance with the adoption decision for the 2022/2023 gas year[38].

3.1.3 Development of LNG feed-in capacity in the Netherlands and Germany

In 2022, the LNG feed-in capacity in the Netherlands expanded significantly. This section briefly discusses the completed LNG initiatives.

Gate terminal (Gate)

In September 2021, Gate had a send-out capacity of 17.5GW (approximately 130TWh per year). By September 2022, this capacity had increased, in several steps, to 21GW (approximately 160TWh per year).

EemsEnergyTerminal (EET)

On 6 September 2022, GTS published a final addendum to the 2022 investment plan[39]. This addendum described the measures required to ensure that EET's new FSRU (floating storage and regasification unit) could be connected to the GTS network. Through these measures, around 10GW (about 80TWh per year) of additional LNG feed-in capacity was created in just six months' time.

The completion of both these initiatives significantly expanded the Dutch LNG feed-in capacity during 2022, making it possible to nearly double the LNG volume that could potentially be imported (from 130TWh to 240TWh per year).

36 *Analysis of current gas market situation and security of supply for the next gas year, our reference L 23.0289, dated 26 May 2023*

37 *For more details see: Analysis of current gas market situation and security of supply for the next gas year, our reference L 23.0289, dated 26 May 2023*

38 *https://www.rijksoverheid.nl/documenten/kamerstukken/2023/03/31/besluit-over-voorgenomen-sluiting-van-productielocaties-van-het-groningenveld-per-1-april-2023*

39 *https://www.gasunietransportservices.nl/uploads/fckconnector/dea79379-7de5-5a51-b62a-b8b56e589a05/3375201555/Definitief%20addendum%20IP2022.pdf*

Further expansion of LNG feed-in capacity in the Netherlands

In 2023, GTS received several connection requests from parties wanting to feed LNG into the TSO's gas transmission network in the Maasvlakte and Midden-Zeeland regions. If the LNG projects behind these connection requests go ahead, GTS must, in compliance with its statutory duty, provide these parties with a connection to the national gas grid. GTS currently has insufficient transmission capacity available in its network to provide all these connections with the requested entry capacity. The measures needed for GTS to be able to accommodate these connection requests and the way in which GTS intends to realise these measures are described in the addendum to the 2022 IP. For all measures, GTS will only implement all the required measures and connections if and when there is sufficient certainty on the realisation of the relevant LNG project(s).

With regard to the Maasvlakte industrial area, it is now clear that one of the LNG parties has already formally withdrawn its initial request. In addition, it is clear that Gate terminal has made a positive investment decision[40] on the LNG project relating to the connection request and will be installing a fourth tank. GTS believes that it has sufficient certainty to implement the measures needed to accommodate Gate's fourth tank.

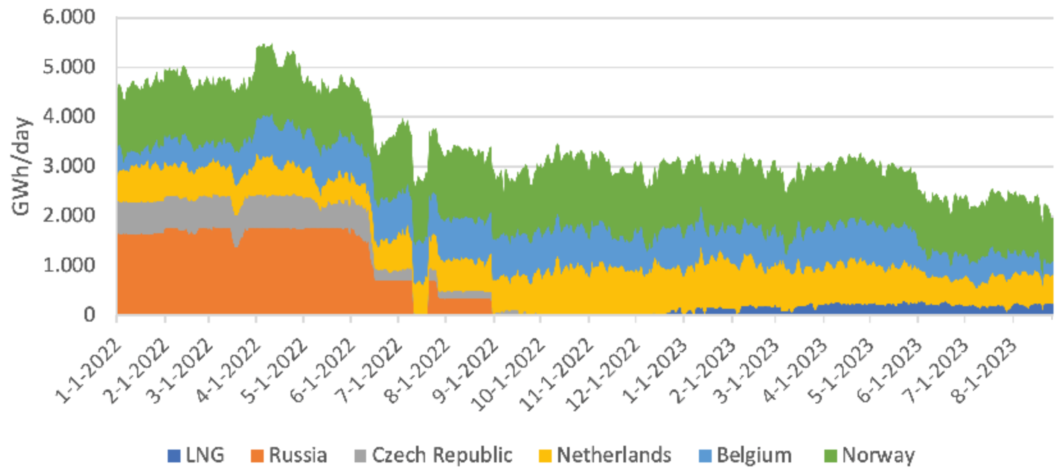
LNG feed-in capacity in Germany

A key variable in the supply and demand balance in the Dutch gas market is the development of H-gas transit to Germany via the Dutch network. The first LNG projects in Germany are now operational. In 2023, the supply running through the three operational LNG terminals is still limited, partly due to the limited capacity (for this extra gas) in the German gas transmission network, which still needs to be expanded.

As can be seen in Figure 3.5, annual market demand in Germany has decreased sharply (from approximately 5,000GW/day to 3,000GW/day) and the loss of Russian gas is being compensated (in part) by additional imports from Norway, the Netherlands and Belgium. At around 7%, the average share of LNG in the German import mix is still modest for now.

40 https://www.gateterminal.com/nieuwsberichten-archive/9682/

Figure 3.5: Main gas import flows from Germany



Source: ENTSOG

FSRUs will be delivered in the coming winter and the offtake capacity of the existing three FSRUs will be increased, meaning that LNG import capacity will increase significantly from mid-2024.

The gradual development of LNG import capacity in Germany may increasingly influence the currently relatively high export of H-gas from the Netherlands (and Belgium) to Germany as well as imports from Norway. With higher volumes going through the German LNG terminals, it is expected that part of the transit through Germany to its neighbouring countries will also increase again[41]. At this time it cannot be ruled out[42] that transit to Germany (via the Netherlands) will remain high in the coming years.

3.1.4 TTF in light of the changing gas market situation

The launch of TTF in 2003 as an administrative network point has led to a major growth in gas trading on one single marketplace, which has enormously increased the liquidity of gas trading. As a result, the TTF price has become the benchmark for natural gas trading in Europe.

Thanks to the solid infrastructure, the TTF price is used as a reference price, not only in the Netherlands, but also in the surrounding countries. About 75% of the volume of gas (in MWh) traded in Europe now bears a TTF label. TTF is also increasingly becoming a global gas marker, with an ever increasing number of LNG contracts with indexation to TTF.

41 *2022-2032 Gas Network Development Plan, Germany (Table 14: Data on the gas quantity balance of the security of supply variant LNGplus C)*

42 *https://www.bmwk.de/Redaktion/EN/Pressemitteilungen/2023/03/20230303the-federal-ministry-for-economic-affairs-and-climate-action-presents-a-report-on-the-plans-for-floating-and-fixed-lng-terminals-and-their-capacities.html*

Liquidity ensures that the market value is reflected in the prices, though this still does not guarantee (permanently) low gas prices. Factors such as supply and demand and the presence or absence of transmission/transport bottlenecks are much more decisive for the price level. This can also cause significant price fluctuations on liquid gas markets. A striking illustration of this is the gas price trend on TTF in the period January 2021 to August 2023, which can be seen in Figure 3.6.

Figure 3.6: Gas and electricity price movements January 2021 - August 2023

Source: Intercontinental Exchange

A changed balance in supply and demand has resulted in (sometimes drastic) gas price increases. Due to the increasing loss of pipeline gas supplied from Russia and LNG now being imported by sea to compensate (in part) for the loss of this gas supply, there has been a change in gas flows in Europe, from east-to-west to west-to-east. This flow reversal has created transmission bottlenecks in various locations in Europe, which, together with heightened uncertainty of gas supply, is pushing up gas prices. The storage capacity filling obligation imposed by the European Commission has also contributed to increased gas demand in a tight gas market.

Domestic reserves in Europe are dwindling, further increasing the need for imports (of LNG, etc.). TTF is an important facilitator in directing new sources of gas to Europe. However, liquidity is no guarantee that the gas will actually be delivered. There is also a need for actual gas in the rest of the world. Especially Southeast Asia has a growing natural gas market, and one that is already much larger than Europe's. Developments in China, in particular, could strongly influence the LNG volumes available for Europe (and the associated gas prices).

Platts European Gas Daily concludes that, despite the extreme conditions, the liquidity of European wholesale market gas held up well in 2022[43]. Again in 2022, TTF was '...by far the most liquid gas trading hub in the EU, with more than 10,000 derivatives' transactions per day, representing 95% of EU gas derivatives' trading'.[44]

43 *Platts European Gas Daily 7/10/2022 (FEATURE: European wholesale gas liquidity holding up in extreme circumstances)*
44 *ACER Market Correction Mechanism Effects, p33.*

3.2 Legislation and regulations

Draft Dutch Energy Act

In June 2023, the Minister of Economic Affairs and Climate Policy sent the draft Energy Act[45] to the Dutch House of Representatives. The proposed Energy Act would replace the Gas Act and the Electricity Act and merge these into one piece of legislation. The Energy Act serves to implement the new EU regulation on the internal market for electricity while also giving substance to national policy objectives, like those stated in the Dutch Climate Agreement.

Although the changes are less drastic for gas than for electricity, the Energy Act will nevertheless have noticeable consequences for stakeholders in the gas market. For example, the connection duty of gas TSOs and DSOs is formulated less broadly in the Energy Act than in the Gas Act. The Energy Act does offer GTS the option of taking in biogas, for example, provided that this can be blended to the correct delivery specifications for natural gas. Furthermore, under the new Energy Act a number of the current codes established by ACM will be fully or partially included in the primary and secondary legislation. The Energy Act will also contain the legal foundations for a new system of data governance for the sector. In addition, more so than in the Gas Act, the terminology used in EU regulations is being used in the Energy Act as well; for example the term 'programme-responsible party' is being replaced by 'balance-responsible party'. With regard to security of supply, the draft legislation expands GTS' duty to guarantee gas supply in certain situations. Further consultations between GTS and the Ministry of Economic Affairs and Climate Policy concerning the scope of this duty and its implementation are currently underway.

Secondary legislation, in which various matters will be defined and elaborated will be drafted in the remaining months of 2023 and in 2024. The Ministry of Economic Affairs and Climate Policy expects that the Energy Act, including the secondary legislation, will come into force in the course of 2025 or 2026.

Legislative amendment 'After zero, what then?'[46]

To provide clarity to the parties involved about the (remaining) obligations after the Groningen field has been closed, the current Dutch Gas Act (and Mining Act) will need to be amended. The Ministry has submitted a bill for this, the wetsvoorstel sluiting Groningenveld (Groningen field closure bill), which, if passed, would ban the extraction of Groningen gas from 1 October 2024. With the closure of the Groningen field, GTS' legal obligations regarding providing advice on the required Groningen capacities and volumes needed for security of supply also cease. Instead, GTS will be given the statutory duty of reporting annually on the security of gas supply in the Netherlands.

3.3 Green gas developments

Gasunie wants to make a significant contribution to the Dutch climate ambition in the field of green gas. The climate ambition is expressed as a target of 2 bcm (approximately 20TWh) of green gas production in the Netherlands in 2030.

45 *(Dutch Parliamentary documents 2022-2023, 36 378, no. 2)*
46 *This has now become the Wet beëindiging gaswinning Groningenveld (Law on the termination of gas extraction in the Groningen field).*

In recent years, there have been various developments, both in the Netherlands and on the international scene, that have made the importance of green gas in the energy mix of the future even clearer.

International developments regarding green gas

On an international level, Russia's war against Ukraine has resulted in accelerated independence from Russian gas. With an accelerated transition to renewable energy sources, the EU will be less dependent on external energy sources.
In addition, Europe is committed to accelerating the energy transition. The target for cutting carbon emissions has been increased to 55% in 2030 compared to the 1990 level. With regard to green gas, in 2022 the EU set the target to produce 35 bcm (approximately 342TWh) of green gas by 2030, partly to replace Russian gas.

Developments in the Netherlands regarding green gas

As regards the Netherlands, the letter to Dutch Parliament on the blending obligation for green gas has been published[47]. The commitment is for 1.6 bcm (approximately 16TWh) of green gas (as a blending obligation) in 2030. In the letter to Parliament, the government notes that a blending obligation can serve as an appropriate instrument to stimulate the rapid growth of green gas production. Stimulating accelerated growth – through the blending obligation – is needed to achieve the climate ambition of 2 bcm (approx. 20TWh). The blending obligation will come into effect in 2025, preceded by a phased increase starting at 150 million m3 (approximately 1.5TWh) in 2025. The bill was published for consultation purposes at the end of July 2023 and, if passed, the new legislation is expected to come into force on 1 January 2025.

In another development regarding green gas, in 2023 ACM carried out the Green Gas Market Scan[48]. In its report, ACM states that network operators facilitate the feed-in of green gas in line with the 1.6 bcm (approx. 16TWh) from the blending obligation. In addition, in the run-up to the next regulatory period, which starts in 2027, ACM wants to look into the overall costs arising from green gas producers on the grid, and how these costs can be compensated.

Lastly, in 2023 the Ministry of Economic Affairs and Climate Policy amended the Ministerial Regulation on Gas Quality, partly at the request of GTS. This amendment facilitates the feed-in of green gas via a GTS gathering pipeline and makes reverse flow of green gas from the RDN to the HPGG possible. In the future, it will have to be examined whether additional obstacles to reverse flow arising from the differences in gas quality standards between the various gas networks need to be removed.

Green gas developments at GTS

At GTS there have been several developments regarding green gas over the last two years and GTS expects that more developments will follow.

GTS is receiving ever more requests relating to facilitating the feed-in of green gas into the regional grids, meaning there is the risk of a high degree of congestion as a result of all these requests. These requests may come from regional network operators looking to eliminate congestion in their grid via reverse flow, or they may concern large parties wanting to feed in their green gas but who are unable to obtain sufficient feed-in capacity in the regional network and so who want a direct feed-in connection via GTS.

47 (Dutch Parliamentary documents 2021-2022, 32 813, no. 1230)
48 https://www.acm.nl/system/files/documents/marktscan-groen-gas.pdf

A second gas booster has also been installed in Garminge, ensuring that the additional green gas being fed into Enexis' regional network near Wijster can be transferred to GTS' regional distribution network. This both prevents congestion on the Enexis network and enables GTS to contribute to the national green gas ambition.

Lastly, in 2023 the GZI green gas gathering pipeline was included as an investment in the addendum to the 2022 IP, which, after adoption, GTS published on 8 August 2023. The growing volume of green gas is increasingly causing congestion in the networks of the regional gas DSOs into which the various regional producers feed in their green gas. With the GZI gathering pipeline, one dedicated central pipeline has been created for feeding in the green gas of producers in the region between Emmen and Ommen, thus preventing further congestion in the existing regional networks in this area. The first green gas is expected to be flowing through the pipeline by August 2025.

3.4 Hydrogen network

GTS foresees a growing role for hydrogen as a sustainable energy carrier and feedstock. Existing natural gas pipelines will eventually be repurposed for the transmission of hydrogen. This is attractive for the users of the hydrogen transmission network because it means that there will be less need for laying new pipelines (which is more expensive than reusing existing natural gas pipelines). It is also attractive for GTS customers because it will reduce the costs of the remaining natural gas network.

Recent developments

The Minister of Economic Affairs and Climate Policy announced in a letter to Parliament[49] in mid-2022 that Gasunie subsidiary Hynetwork Services (HNS) would be tasked with developing and managing a national hydrogen transmission network. This duty is designated a 'service of general economic interest' (SGEI), to be carried out by HNS. The Minister will decide on the rules and conditions associated with this SGEI.

At the request of the Ministry of Economic Affairs and Climate Policy, HNS has been preparing for the development of the hydrogen transmission network for some time already. The State Secretary for Economic Affairs and Climate Policy wrote to Parliament about this in June 2021[50]. These preparations include further identifying the need for transmission capacity and connections, and obtaining commitment from future grid users. In July 2023, HNS consulted with stakeholders on a draft proposal for setting out the further specifics of the original roll-out plan[51]. Based on the ensuing final proposal from HNS, the Ministry of Economic Affairs and Climate Policy will determine a (possibly adjusted) roll-out plan. The roll-out plan sets out which part of the hydrogen transmission network is expected to be ready when. In consultation with representative network user organisations, HNS is developing the general conditions for the use of the hydrogen transmission system and for connections to the network. The FID has now been made and, based on this, HNS will start constructing the first part of the hydrogen transmission network at the Port of Rotterdam.

49 (Dutch Parliamentary documents 2021-2022, 32 813, no. 1061).
50 (Dutch Parliamentary documents 2020-2021, 32 813 No. 756).
51 https://www.hynetwork.nl/en/about-hynetwork-services/roll-out-plan

Use of existing GTS natural gas pipelines

Reuse of existing natural gas pipelines is a key principle in developing the hydrogen transmission network[52]. Research has shown that the natural gas pipelines can be technically modified in such a way as to enable the safe transmission of hydrogen. Technical adjustments concern, for example, replacing valve set-ups and cleaning the pipelines.

For GTS, technical transmission-related and social-economic considerations are decisive in the decision-making process regarding the transfer of existing natural gas pipelines to HNS for reuse in the hydrogen transmission network.

The 'technical transmission-related' aspects concern GTS being able to continue to fulfil its statutory duty with regard to natural gas transmission, i.e. it must be able to continue to guarantee the security of transmission of natural gas.

The 'socio-economic' aspects relate to GTS' duty to develop the gas transmission network in a way that guarantees the efficiency of that network and the supply of gas. In light of an expected decrease in demand for natural gas transmission, transferring natural gas pipelines to HNS could have a positive effect on the development of GTS' tariffs, for example because the sales proceeds would be deducted from GTS' transport tariffs. Existing natural gas pipelines are transferred using a valuation methodology based on the value of GTS' regulated asset base ('RAW'), in accordance with ACM's (amended) official advice on this matter[53].

52 *(Dutch Parliamentary documents 2021-2022, 32 813, no. 1061).*

53 *ACM's amended official advice states that GTS pipelines should be transferred to HNS at an acquisition price based on a standard price per kilometre, based on the average HPGG RAW of GTS t-1. In a previous recommendation (September 2022), ACM advised basing the acquisition price on the 'specific RAW'.*

4 Bottlenecks

In this section, GTS explains about the capacity bottlenecks and quality bottlenecks.

- GTS determines the capacity bottlenecks annually in its capacity bottleneck analysis. The results of this analysis are described in section 4.1.
- Identified quality bottlenecks are recorded and continuously monitored in a bottleneck register. Quality bottlenecks can either be resolved through investments or operational measures, or they can be accepted (see section 4.2).

4.1 Capacity bottleneck analysis findings

The bottleneck analysis was performed both for GTS' HPGG and its RDN. The transmission capacity of both networks has been assessed for all three scenarios (DCA, ND and IA) for the 2024/2025, 2029/2030 and 2034/2035 gas years. A gas year runs from 1 October to 30 September. For the HPGG, the bottleneck analysis is based on the complete set of high transmission load situations that can occur in a scenario based on the method for capacity assessment as described in section 1.3.2.

The capacity bottleneck analysis carried out did not reveal any new capacity bottlenecks: the three bottlenecks identified concern already known bottlenecks at the compressor stations (at Scheemda, Ravenstein and Wijngaarden)[54] caused by the change in gas flows. GTS described the measures to resolve these bottlenecks in the addendum to the 2022 IP, which it published on 8 August 2023, and will implement these measures to resolve these bottlenecks.

The transmission calculations have also shown that, after resolving these bottlenecks, all transmission situations can be accommodated in all scenarios. In all scenarios, the available capacities at the entry and exit points are at or above the required values as currently envisaged for the period concerned. Investments to create more capacity are therefore not necessary.

Only final decisions up to 1 October 2023 regarding the closure of the Groningen gas field have been included in this bottleneck analysis.

GTS has not included any envisioned LNG feed-in (or additional feed-in) from market parties, as described in the addendum to the 2022 IP, in this capacity bottleneck analysis. Once there is more certainty about the underlying LNG projects actually coming to fruition (or in the event of a positive investment decision by the relevant LNG party), the feed-in will be included in future capacity bottleneck analyses.

RDN

The RDN capacity analysis has not revealed any bottlenecks under any of the three scenarios.

54 *https://www.gasunietransportservices.nl/uploads/fckconnector/e675f0aa-b4a2-5893-930e-85196a59b141/3388490386/Definitief%20addendum%20IP2022%20%28augustus%202023%29.pdf The bottlenecks and proposed measures are described on pages 7 & 8. Additionally, the alternative analyses for the measures at CS Wijngaarden and CS Scheemda are described in appendices 1 and 2 respectively.*

4.2 Quality bottlenecks analysis findings

Various bottlenecks have been identified using the methods described in the QAS. These quality bottlenecks and the resulting investments are shown in Appendix III.1. Two quality bottlenecks have been identified that would require an investment of € 5 million or more (major investments) for which no FID has yet been made. See Appendix III.2 for detailed information on these investments.

In addition to these two major investments along with the annual standard replacement investments to resolve quality bottlenecks, GTS anticipates a growing number of quality bottlenecks in relation to cutting carbon emissions in the coming years, including as a result of impending EU regulations in the form of the planned Methane Emissions Regulation[55]. Study programmes have been started to further identify these bottlenecks and to determine and develop possible solutions. It is expected that many of these quality bottlenecks can be resolved through operational measures, but in a number of cases investments will be required. One of the most extensive investments concerns the replacement of the heating systems at a large number of gas receiving stations. The study programme for these replacements is covered in more detail in section 5.2.4.

No quality bottlenecks that would result in investments that fall under the National Coordination Scheme (NCS) have been identified. These are investments of national importance, for which the national government coordinates decision-making (including permits and exemptions).

Appendix IV provides an overview of the bottlenecks that cannot be resolved with investments. These bottlenecks must be addressed through operational measures (OPEX) or accepted for the time being on the basis of an assessment of the risk and costs of resolving the relevant bottleneck.

55 *https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2021%3A805%3AFIN&qid=1639665806476*

5 Investments proposed for 2024-2033

This section provides insight into the scope and structure of GTS' portfolio of proposed investments over the next 10 years.

5.1 General

The following categories are used in the Kader Informatiebehoefte Investeringsplannen 2024 GTS [Information Requirement Framework for GTS' 2024 Investment Plans] that ACM has sent to GTS for the purpose of assessing the 2024 Investment Plan (2024 IP):

- Regular investments: replacement and expansion investments of less than € 5 million, with the exception of connections, diversions and investments to meet a need identified in another process.
- Major investments: investments under the National Coordination Scheme or replacement and expansion investments greater than or equal to € 5 million, excluding connections, diversions and investments to meet a need identified in another process.
- Connections and diversions: investments in existing and new connections initiated by third parties, including green gas connections, and changes to the national gas transmission network at the request of third parties.
- Grid-related investments (IT investments): rather than being investments in the physical parts of the grid, these are grid-related investments in aspects of the business that pose a significant risk to fulfilling the statutory duty.

GTS uses these categories when presenting investments in this draft IP. The last category does not apply to GTS given that GTS uses IT assets owned by Gasunie. This means that GTS does not make IT CAPEX investments, but pays an annual fee (OPEX) to Gasunie for the use of these assets. Accordingly, no IT investments are presented in this draft 2024 IP.

Replacement investments

The assets in the national gas grid originate from different periods, the oldest being over 60 years old. Given this fact, regular and major replacement investments are made to keep the transmission system operating safely, reliably and in a risk-efficient manner.

The replacement investments mainly consist of corrective measures (bringing the performance of assets back up to the set quality standard), replacements in line with policy concerning, for example, obsolete parts (e.g. electronics), regularly scheduled activities (e.g. civil engineering maintenance), and CSR (e.g. reducing the carbon footprint).

In the context of risk-based asset management, replacement investments at GTS are considered based on established risks.

Expansion investments

An expansion investment is defined as an investment a) that leads to an increase in the length, capacity or functionality of the gas transmission network; and b) is based on an external need.

Available data

In this IP, GTS provides a complete overview of investments for 2024 and 2025, i.e. investments that have already been approved or are already in the preparatory phase. Additionally, data with respect to ongoing investments for 2026 onwards is included in the following categories:

- regular expansion investments
- major investments
- connections and diversions.

For new investments (both major and regular) and investments for connections and diversions in 2026 and later years, the investment levels as determined for the Investment Outlook are assumed. The Investment Outlook is an analysis by GTS that estimates investment levels over the next 15 years, partly based on historical investments. Among other things, these investment levels are used to determine GTS' financing needs.

Major investments for which an FID is yet to be made are accounted for on the basis of Alternative Considerations included in Appendix VI. The reference date for the investment portfolio is 1 September 2023, meaning that information provided with respect to aspects such as the status of an investment or a financial forecast is valid as at 1 September 2023.

Notes to the tables

The following sections include tables showing expected costs (forecasts) per year. This concerns both ongoing investments that were previously included in an investment plan or an addendum, as well as new investments that GTS is including in this draft 2024 IP. The forecast costs are aggregated at asset category level. In many cases, an investment can be allocated to a single asset category. Where an investment relates to several categories of assets, this is listed under the designation 'multiple asset categories'.

5.2 Regular and major investments

This section provides an explanation of various replacement and expansion investments that will determine the size and structure of the investment portfolio in the coming years.

Conversion projects

Following the decision of the Minister of Economic Affairs and Climate Policy that gas extraction from the Groningen field will be terminated, GTS has been assigned statutory duties requiring the TSO to help ensure this phase-out through quality conversion and switching. The projects being carried out at this time were already included in previous investment plans or in the related addenda:

- PG-I.012900: Zuidbroek nitrogen plant
- PG- (various): G-to-H conversion of large industrial consumers
- PG-I.014764: acquisition of gas transmission pipeline for maximum capacity of Grijpskerk UGS facility.

Renovation of valve set-ups

After a period during which a significant portion of the valve set-ups were replaced using a programme-based approach, in 2017 GTS switched to a condition-based maintenance strategy for the remaining part of the system. As part of this, an average of around 50 valve set-ups will be replaced per year at an expected average investment of approximately € 35 million per year.

Acquisition of assets

As described in the addendum to the 2020 IP, GTS is taking over the connection from a number of connected parties. The reason is that, as of January 2020, GTS is once more responsible for implementing the full connection (including the connection pipeline).

- PG-I.014516 Acquisition of connection pipelines

These expansion investments are described in the addendum to the 2020 IP that GTS published on 1 July 2021. In addition, other asset acquisitions that could possibly lead to investments are being studied.

Reversal of gas flows

Developments in the gas market have resulted in a reversal in the direction of the dominant gas flows, from east-to-west to west-to-east. This reversal has a significant impact on the way in which GTS' gas transmission network is deployed and has led to bottlenecks at the Wijngaarden, Ravenstein and Scheemda compressor stations (CS). To fix these bottlenecks, GTS must invest in the following compressor stations:

- PG-I.014782 CS Wijngaarden: modification and expansion of switching facilities
- PG-I.014783 CS Ravenstein: limited modification to functionality
- PG-I.014788 CS Scheemda: modification and expansion with reduction facility

These expansion investments are described in the addendum to the 2022 IP that GTS published on 8 August 2023.

Connection requests for LNG feed-in

In 2022, the LNG feed-in capacity in the Netherlands was vastly expanded by increasing the send-out capacity of Gate terminal at the Maasvlakte industrial area (Port of Rotterdam) and by EemsEnergyTerminal (EET) commissioning an FSRU (floating storage and regasification unit) at the port of Eemshaven. The measures needed to connect EET's FSRU to the GTS network were described in an addendum to the 2022 IP that GTS published on 6 September 2022.

GTS has received connection requests from various parties wanting to feed LNG into GTS' gas transmission network.
If the LNG projects behind these connection requests go ahead, GTS must, in compliance with its statutory duty, provide these parties with a connection to the national gas grid. The addendum to the 2022 IP that GTS published on 8 August 2023 lists investments needed for the expansion of the GTS network, i.e.:

- PG-I.014795 Expanding the Maasvlakte HPGG
- PG-I.014744 Measures to feed in LNG in the Midden-Zeeland region

For all of these investments, GTS will only implement the required measures and connections if and when there is sufficient certainty on the realisation of the relevant LNG projects, which is now the case for expansion of the HPGG in the Maasvlakte industrial area as a result of the positive investment decision by Gate terminal on the installation of a fourth LNG tank.

Other ongoing major investments

The following four major investments are ongoing projects that were included as a study in the 2022 IP and have now been finalised:

- PG-I.013799 and PG-I.014572 GZI Green gas gathering pipeline
- PG-I.014513 Replacement programme for making metering and regulating stations (M&R stations) emission-free
- PG-I.014442 Replacement programme for Capacity Registration Systems (CARS) and Telemetry Systems (TMX)
- PG-I.014510 Replacement programme for Electronic Volume Correctors (EVCs)

These expansion investments are described in the addendum to the 2022 IP that GTS published on 8 August 2023.

PG-I.014727 - Replacement of gas chromatographs

The GTS gas chromatographs (GC) and data acquisition systems (DAS) used at GTS are obsolete and will eventually need to be replaced. An adequately functioning GC is a legally required component of the gas metering installations that ensures accurate determination of the energy content of the gas flow.

Prior to the start of the replacement programme, GTS will conduct laboratory testing and a pilot at a site in preparation for the replacements that will be carried out over a period of several years.

This new major investment was included as a study in the 2022 IP and is being officially presented in this draft 2024 IP. The alternatives analysis for this proposed investment is included in Appendix VI.1.

PG-I.014852 Zuidwal green gas gathering pipeline (A-601 west)

To address congestion in the feed-in of green gas into the RDNs that is developing in the Noord Friesland region, GTS has explored the possibilities of making the western part of pipeline A-601 suitable as a green gas gathering pipeline (as a low-pressure gas pipeline).

This new major investment for repurposing this pipeline as a green gas gathering pipeline is being officially presented in this draft 2024 IP. The alternatives analysis for this proposed investment is included in Appendix VI.2.

5.2.1 Regular investments for 2024-2025

The regular investments concern all investments in the national gas grid amounting to less than € 5 million, with the exception of connections and diversions. The new regular investments for 2024 and 2025, together with the previously approved regular investments, are shown in Table 5.1. For comparison's sake, the table also includes forecasts for 2023 (status as per 1 September 2023).

Table 5.1: Regular investments per asset category from 2024 onwards

Regular (€ millions)	Forecast for 2023[56]	Forecast for 2024	Forecast for 2025
Valve set-ups	28.9	33.1	49.1
Compressor stations	12.7	19.0	17.5
Export stations	0.0	1.5	0.0
Gas receiving stations	8.2	8.9	3.0
Pipelines	7.7	12.4	16.7
LNG	4.3	1.4	1.7
M&R	0.4	1.7	0.0
Multiple asset categories	5.9	1.7	0.5
Blending stations	1.5	0.8	0.3
Other	0.0	0.0	0.0
Reducing stations	0.4	1.9	0.8
Nitrogen installations	2.7	1.3	0.2
Total	72.8	83.7	89.8

Appendix III details the underlying regular investments for the period 2024-2025.

56 *Forecast as per 1 September 2023*

5.2.2 Major investments for 2024-2025

Major investments comprise all investments amounting to € 5 million or more and investments that fall under the National Coordination Scheme (RCS) for the maintenance and development of the national gas grid, with the exception of connections and diversions. The new major investments for 2024 and 2025, together with the previously approved major investments, are shown in Table 5.2. For comparison's sake, the table also includes forecasts for 2023 (status as per 1 September 2023).

Table 5.2: Major investments per asset category from 2024 onwards

Major (€ millions)	Forecast for 2023[57]	Forecast for 2024	Forecast for 2025
Valve set-ups	8.4	0.2	0.0
Compressor stations	2.1	10.4	20.0
Gas receiving stations	1.7	5.4	44.4
Pipelines	48.7	41.7	33.6
LNG	0.1	0.0	0.0
M&R	0.4	1.0	13.8
Multiple asset categories	1.0	11.6	34.5
Other	0.0	0.0	0.0
Nitrogen installations	61.2	15.9	0.0
Total	123.5	86.1	146.3

5.2.3 Regular and major long-term investments

The Investment Outlook shows an annual investment level of approximately € 85 million for the regular and major replacement investments. The replacement investments include multi-year investment programmes for the replacement of obsolete equipment (EVCs, CARS/TMX, gas chromatographs). Compared to the previous IP (2022 IP), the effect of increased material costs and higher hourly rates can be seen in the market. In addition, the dismantling of G-gas compressor stations, among other things, will have a lowering effect on replacement investments from 2027.

On balance, these effects lead to a (slightly) higher expected level of investments compared to the previous IP.

To reduce GTS' carbon footprint, study programmes to reduce electricity and gas consumption and GHG emissions are underway. It is expected that this will lead to substantial replacement investments on top of the standard annual replacement investments.

With the completion of conversion projects as described in section 5.2, the share of investments for Groningen measures (Zuidbroek nitrogen plant, G-to-H gas conversion) within the total investment level will decrease sharply in the coming years.

57 *Forecast as per 1 September 2023*

GTS also takes into account regular and major investments for green gas boosters and green gas gathering pipelines to enable feeding green gas into the grid. For the longer term, an estimate has been made of the annual investment level for these specific green gas investments, assuming € 10 million per year from 2026.

The regular and major investments up to and including 2033 are shown in Table 5.3. For comparison's sake, the table also includes forecasts for 2023 (status as per 1 September 2023).

Table 5.3: Regular and major long-term investments

Regular and major long-term investments per project											
Forecast (€ millions)	2023[58]	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Replacement investments											
Replacement investments, standard	80.9	84.5	86.7	85	85	85	85	85	85	85	85
Replacement investments for CSR and cutting emissions	4.5	16.6	84.1	53.6	63.9	64.4	60	5	5	5	5
Subtotal, RI	85	101	171	139	149	149	145	90	90	90	90
Expansion investments											
Zuidbroek N_2 plant	59.5	14.9	0.0	-	-	-	-	-	-	-	-
Conversion G-gas to H-gas	36.4	32.7	13.0	-	-	-	-	-	-	-	-
Green gas boosters + gathering pipelines	3.2	14.3	15.6	11	10	10	10	10	10	10	10
Various expansions and acquisitions	0.9	-	-	-	-	-	-	-	-	-	-
Acq. of connection pipelines (NC-TAR)	10.1	0.2	2.7	2.0	-	-	-	-	-	-	-
Reversal of gas flows	0.5	6.6	14.0	1.9	0	-	-	-	-	-	-
LNG measures	0.2	0.3	20.0	14.6	0.1	-	-	-	-	-	-
Subtotal, EI	111	69	65	30	10	10	10	10	10	10	10
Total Regular + Major	196	170	236	169	159	159	155	100	100	100	100

58 *Forecast as per 1 September 2023*

Table 5.4 below shows the breakdown by asset category of the expected replacement investments (regular + major), totalling approx. € 85 million per year for the 2024-2028 period.

For comparison's sake, the table also includes forecasts for 2023 (status as per 1 September 2023).

Table 5.4: Replacement investments (regular + major) per asset category

Replacement investments (regular + major) per asset category						
Forecast (€ millions)	2023[59]	2024	2025	2026	2027	2028
Valve set-ups	37.3	33.2	48.3	44	44	44
Compressor stations	12.4	17.3	10.4	6	6	6
Export stations	0.0	1.5	0.0	0.5	0.5	0.5
Gas receiving stations	9.8	14.1	44.7	55	60	62
Pipelines	7.5	12.3	15.7	15	17	17
LNG	4.2	1.4	1.7	0	0	0
M&R	0.8	2.7	13.8	7	7	7
Multiple asset categories	7.0	13.3	34.9	2	2	2
Blending stations	1.5	0.8	0.3	0.5	0.5	0.5
Other	0.0	0.0	0.0	2	2	2
Reducing stations	0.4	1.9	0.8	1	2	2
Nitrogen installations	4.3	2.3	0.2	5	7	7
Total	85	100	171	138	148	150

5.2.4 Studies into possible major investments

GTS is currently carrying out a number of studies from which investments may possibly follow. These studies are still in the preparatory phase. Because these investments may come within the scope of the 2024 IP, GTS feels it should include these studies for information purposes. Should the studies described below actually reach the realisation phase and come within the scope of the 2024 IP, GTS can add an addendum if the required investment would result in a significant variance. The expected investment costs stated below are a rough estimate.

PG-I.014604 Large-scale replacement of GRS heating systems

For the 2025-2030 period, GTS anticipates that the heating boilers at 779 gas receiving stations will need to be replaced. The boilers are 15 to 18 years old and are reaching the end of their service life. This may involve high investment costs. The replacement strategy must be carefully considered. Key considerations include: energy efficiency, emission reduction, optimisation and further sustainability of the design, and preventive/corrective intervention. Depending on the solution chosen, around 30 kilotonnes of CO_2 equivalent could be avoided per year.

GTS will first carry out a pilot in 2024, after which a multi-year programme for the replacement of the heating systems at the gas receiving stations will get underway in 2025. An initial indicative estimate of the potential size of the investment for this multi-year project is around € 250 million.

59 *Forecast as per 1 September 2023*

Measures for GHG emission reduction

As a prudent TSO, GTS must prevent and repair methane leaks in order to reduce GHG emissions into the atmosphere. In line with the Dutch Climate Agreement, methane emissions must be cut nearly in half by 2030 compared to 2020 and CO_2 emissions must also be reduced substantially. In this context, a number of study programmes are running within GTS, with regard to:

- emission control measures and solutions to substantially reduce methane emissions, with a focus on repairing gas leaks through:
  - corrective maintenance
  - project-based approach
  - standardised approach
  - special approach (complex leaks);
- completion of an emissions registration system;
- an update on EU's methane emissions regulations, which will come into force in early 2024;
- emission control measures and solutions to substantially reduce CO2 emissions.

Within the programmes, studies are being conducted that could result in the initiation of investment projects with an estimated cost of around € 50 million.

5.3 Connections and diversions

This concerns investments in existing and new connections, including green gas connections. Diversions concern investments required due to developments relating to spatial planning by third parties (e.g. municipalities, Rijkswaterstaat) that result in GTS assets having to be relocated. This mainly concerns pipelines and, once every two to three years on average, a gas receiving station. The party requesting the diversion pays GTS compensation of, on average, two-thirds of the costs; the actual amount depends on the legal position.

The new investments for connections and conversions for the 2024IP, together with the previously approved investments for these, are shown in Table 5.5. The amounts shown in Table 5.5 and the confidential Appendix III do not include contributions from third parties, where applicable.

The 2024-2025 diversion portfolio is expected to amount to € 5.2 million and € 5.6 million respectively, excluding contributions from third parties.

Table 5.5: Investments in connections and diversions per asset category from 2023 onwards

Investments in connections and diversions (€ millions)	Forecast for 2023[60]	Forecast for 2024	Forecast for 2025
Connections			
Valve set-ups	0.0	0.0	0.0
Gas receiving stations	0.2	1.6	0.1
Pipelines	3.2	2.6	11.8
Multiple asset categories	0.0	0.0	0.0
Subtotal, connections	3.4	4.2	11.8
Diversions[61]			
Pipelines	5.7	4.6	5.6
Multiple asset categories	0.1	0.0	0.0
Subtotal, diversions	5.8	4.6	5.6
Total, connections and diversions	9.2	8.8	17.4

Due to increasing demand for connections we see a slightly increasing trend in this category compared to the previous investment plan (2022 IP), especially with regard to feeding in green gas or connecting the biofuel industry. Increased material costs and higher hourly rates also play a role in connections and diversions.

On the other hand, we anticipate lower investments for diversions. This is thanks to recently completed diversions and, as a result, an expected smaller number of pipelines to be rerouted annually. In the long term, an annual average investment level of € 9 million is expected for new connections and € 7 million for diversions, excluding third-party contributions (see Table 5.6). The level of investment in these categories obviously depends on the future economic development (among other factors).

Table 5.6: Investments in connections and diversions over the long term

Connections and diversions over the long term											
Forecast (€ millions)	2023[62]	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Connections	3.4	4.2	11.8	9	9	9	9	9	9	9	9
Diversions[63]	5.8	4.6	5.6	7	7	7	7	7	7	7	7
Total, connections and diversions	9.2	8.8	17.4	16	16	16	16	16	16	16	16

Appendix III details the underlying investments in connections and diversions for the period 2024-2025.

60 Forecast as per 1 September 2023
61 Excl. third-party contributions
62 Forecast as per 1 September 2023
63 Excl. third-party contributions

5.4 'Need identified in another process' investments

There are investments for which the need has already been identified in relation to a different process, being required under national or European legislation, for example. This concerns connecting small fields and facilitating cross-border transport (incremental capacity).

Small fields

In accordance with Article 54a of the Dutch Gas Act, GTS must take in gas from small fields. Production from small fields (onshore) has been declining for years and there is little likelihood that new feed-in points for small fields will be arranged even in the short and medium term. An exception to this is the request for connection of the Papekop production site (close to Woerden), which is planned to be connected to the GTS network.

The approval of these investments is subject to a separate process and does not fall within the scope of the IP.

Any further investments relating to small fields are expected to mainly involve modifications to existing connections.

Incremental capacity

In line with EU Regulation 2017/459 (Network Code on Capacity Allocation Mechanisms; NC CAM), the incremental capacity process has been introduced. This is an EU-wide harmonised process to identify the market demand for incremental capacity by TSOs.

In the course of its market interest assessment for the 2021-2023 incremental capacity process, GTS has not received any non-binding demand indications. The 2021-2023 incremental capacity process has accordingly been completed.

The 2023-2025 incremental capacity process started on 6 July 2023. The market interest assessment process has now been completed. Market parties have not informed us of any capacity needs and it has accordingly been determined, in consultation with the bordering TSOs, that there is no reason to offer incremental capacity or to start a next phase. This means that the 2023-2025 incremental capacity process has also been completed.

5.5 Total investments (2024-2033)

Up to the end of 2026, GTS' investment portfolio will be largely determined by measures for the change in gas flows in the Netherlands (adaptation of compressor stations) and the multi-year investment programmes for the replacement of obsolete equipment (EVCs, CARS/TMX, gas chromatographs).

Additionally, there are initiatives in the market for feeding both green gas and LNG into the GTS network. GTS will in any case have to invest in the GZI gathering pipeline (green gas) and in expanding the grid in the Maasvlakte industrial area (to handle additional LNG feed-in).

GTS is also anticipating further investments aimed at reducing its carbon footprint, mainly concerning programmes for increasing energy efficiency, cutting emissions, making optimisations and increasing the sustainability of GTS' business operations.

An effect due to increased material costs and higher hourly rates can also be seen in the market. As a result of these developments, it is expected that the level of investments will increase, while the share within this for investments for the Groningen measures will decrease.

On balance, to maintain the transmission network GTS expects a normal investment level of approximately € 85 million per year for the longer term, up to the end of 2033.

Table 5.7 presents an overview of GTS' investments over the long term. For comparison's sake, the table also includes forecasts for 2023 (status as per 1 September 2023).

Table 5.7: Total investments over the long term

Total investments over the long term											
Forecast (€ millions)	2023[64]	2024	2025	2026	2027	2028	2029	2030	2031	2032	2033
Regular + Major											
Replacement investments	80.8	83.7	86.7	85	85	85	85	85	85	85	85
Replacement investments, CSR and cutting emissions	4.5	16.6	84.1	53.6	63.9	64.4	60	5	5	5	5
Zuidbroek N2 plant	59.5	14.9	0.0	-	-	-	-	-	-	-	-
Conversion G-gas to H-gas	36.4	32.7	13.0	0	-	-	-	-	-	-	-
Green gas boosters + gathering pipelines	3.2	14.3	15.6	11	10	10	10	10	10	10	10
Various expansions and acquisitions	0.9	-	-	-	-	-	-	-	-	-	-
Acq. of connection pipelines (NC-TAR)	10.1	0.2	2.7	2	0	-	-	-	-	-	-
Reversal of gas flows	0.5	6.6	14.0	1.9	-	-	-	-	-	-	-
LNG measures	0.2	0.3	20.0	14.6	0.1	-	-	-	-	-	-
Connections	3.4	4.2	11.8	9	9	9	9	9	9	9	9
Diversions	5.8	4.6	5.6	7	7	7	7	7	7	7	7
Total	206	179	253	184	175	175	171	116	116	116	116

64 Forecast as per 1 September 2023

6 Review of the 2022 Investment Plan (2022 IP)

In the previous investment plans (2020 IP and 2022 IP), GTS offered an overall view of the investments required for expansion of and replacements in the national gas grid.

This section provides an overview of the investment projects planned in previous years that were completed in 2021 and 2022 and shows the actual costs compared to the estimated costs.

6.1 List of completed investment projects

Appendix V provides an overview of the investment projects completed in 2021 and 2022, per category.

As this overview shows, most of GTS' investment projects are being completed within the estimated lead time and within the on-target budget range. Accordingly, it can be seen that GTS pays a lot of attention to managing project risks in advance of and during the implementation of investment projects. The phasing used in the project process contributes to this, and the Gasunie project governance process ensures quality assurance as well as correct decision-making at each phase gate in a project. These processes are described and explained in the GTS QAS.

A deviation from the estimated lead time or the budget range can be seen in a limited number of investment projects. In these cases, as well as in cases where the investment project has been completed on schedule and on budget, GTS attaches importance to a thorough evaluation and recording the lessons learned. This evaluation is part of the Gasunie project governance process. The lessons learned are recorded in a database so that they can be applied to new investment projects.

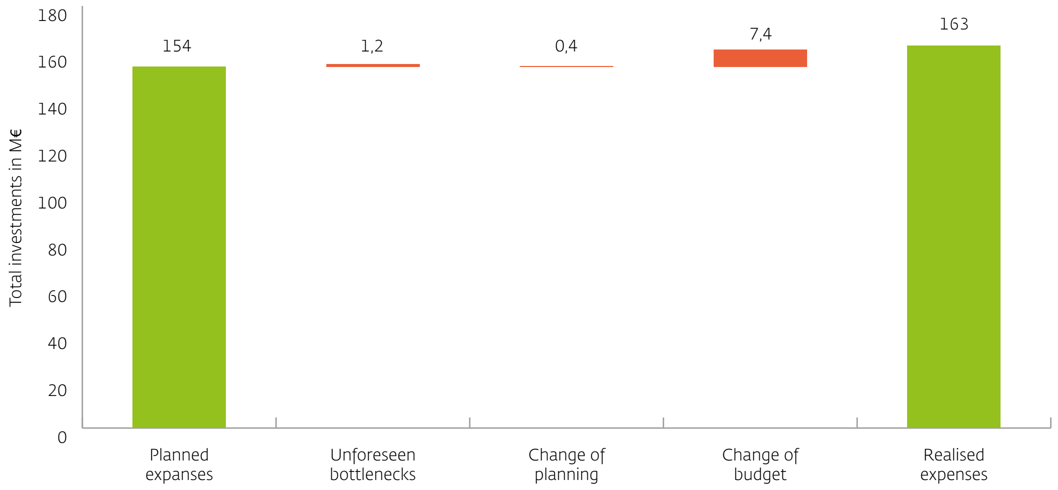
GTS has made an analysis of the investment projects completed in 2021 and 2022 (regular, major, connections and diversions). These planned investments were included in an earlier investment plan or addendum.

For these completed projects, the variances (from the forecast/advance estimate) can be broadly divided as follows:

- Budget adjustment: to ensure that the project is delivered with the intended functionality and quality level, the investment budget is adjusted upwards or downwards to reflect the actual project costs.
- Unanticipated bottlenecks: this concerns an emergency situation or serious disruptions. Investments to resolve these bottlenecks could not be anticipated in the annual plan process.
- Adjustments to schedule: changing when the project is carried out.

Figure 6.1 provides an overview of the various factors that contributed to the difference between the estimated costs and the actual costs of the investment projects. The average budget overrun (of the estimated basic budget) for the investment projects completed in 2021 and 2022 was approximately 6%.

FIGURE 6.1: OVERVIEW OF THE VARIANCES BETWEEN THE FORECASTS AND ACTUAL INVESTMENTS FOR COMPLETED PROJECTS IN 2021 AND 2022



6.2 Variances in actual investments for completed projects

This section explains the variances between the forecast and actual investments for completed projects.

There are a number of factors, both external and internal, that resulted in variances, which brought about differences between planning and completion of the projects that were commissioned in 2021 and 2022. In this period there were virtually no recent price effects caused by high inflation.

For budget overruns of more than 25%, the cause of the variance and the impact on GTS' statutory duties are described in Appendix V. An explanation of the causes and consequences is provided in sections 6.2.1 and 6.2.2. Finally, section 6.2.3 describes the measures taken by GTS to minimise such variances.

6.2.1 Causes of project variances

A variance may arise due to changes in project implementation or adjustments to the project portfolio.

Deviations during project implementation

The main reasons for deviations from the project timetable are described below:

- Gas transmission restrictions: there are limited time windows during which gas flows can be interrupted or diverted.
- Permit procedures: long procedures or additional requirements of the competent authority, i.e. the municipal, provincial or national authorities.
- Unavailability of technical and other staff: GTS has limited resources available.
- Delivery time for materials: longer lead times for ordering and delivering required materials.
- External circumstances: encountering unexpected situations such as soil contamination, a change to a scheduled shutdown at a connected party, weather conditions, etc.

Adjustments to the project portfolio

Adjustments to the project portfolio may result in changes to the scheduling or scope of the investments, which may in turn result in variances between the estimated timeframe and/or costs stated for an investment project in the 2020 and 2022 investment plans and the actual timeframe/costs.

- Budget adjustments: the costs of a project may come out higher or lower than anticipated due to aspects like market price developments for materials and contractors or the required deployment of resources.
- Unforeseen bottlenecks, including those classified as emergency situations: serious disruptions (urgent situations) that have a major impact on external/internal safety and/or transmission security. Action to resolve these bottlenecks is taken immediately; these corrective action projects fall outside the annual plan process.
- Economies of scope: a situation can arise where a cost advantage can be achieved by combining projects and implementing them simultaneously, for example by bringing forward a project from a later annual plan so that it can be carried out jointly with a project from the current annual plan.

Appendix V gives the reasons for the variances for projects where the actual costs deviate by more than 25% from the estimated costs.

6.2.2 Consequences of the variances

Despite the disruptions mentioned, most of the completed projects from the 2020 IP and 2022 IP were completed on schedule and with the envisioned level of functionality and quality, meaning the variance had no consequences.

For several projects, due to disruptions during implementation, the timetable or the budget for the project concerned has been adjusted.

- Due to changes to the schedule, a number of investment projects have shifted in part to the following implementation year or been postponed to the extent that these will fall under a following annual plan. An investment project may therefore not be completed within the allotted timescale. External agreements have been taken into account for the prioritisation of projects and for risk ranking. Furthermore, there may be cases where a project is completed in an earlier year than planned due to an earlier start or shorter lead time.
- In a number of cases the budget has been adjusted so that the project can be delivered with the intended level of functionality and quality.

6.2.3 Measures to minimise project variances

GTS uses a professional project management system and has largely delivered the projects described in the 2020 IP and 2022 IP on budget and on schedule.

In the following, we describe the main measures to prevent and/or mitigate variances.

Gas transport restrictions

When working on the gas grid, it is often necessary to purge the gas from the system and/or to interrupt the gas flow. Given that, due to seasonal factors, there are limited time windows when gas flows can be interrupted or diverted, a delay in the project timeline can mean that the project can no longer continue uninterrupted and that further works must be postponed to a time window in the following season or year.

This means that a relatively modest delay (of a few days) during the works can ultimately lead to a major delay (from a few months to up to a year) in the timeline for the project as a whole. This is good reason for GTS to be extra alert when carrying out projects, in order to mitigate the risks that can accompany such delays.

To effectively include these dependencies in the project timeline, GTS consults on the technical gas transmission options and time windows early on in the project. Nevertheless, there are also factors – such as permit procedures, availability of personnel, delivery times of materials, and other external circumstances – that cannot always be controlled or prevented.

Permit procedures

Whenever we decide to expand or replace parts of the gas transmission network, we need permits before the work can go ahead. These can be temporary permits for the work involved, such as a permit for excavation work, or permanent permits for high-pressure gas transmission. In some cases, the permit procedures can be lengthy as a result of required soil surveys and/or other procedures or requirements set by the competent authority to take additional measures relating to air, soil or water quality for example.

To prevent project delays, GTS starts permit procedures at an early stage and maintains close contact with the competent authorities and local communities. If obtaining a permit takes more time than anticipated, we investigate whether it is possible to reschedule the works such that certain activities will be carried out earlier and the remaining works completed once the permit has been granted.

Shortage of technical and other staff

GTS and Gasunie, the energy infrastructure company of which GTS is a part, have limited in-house staff available. To compound this situation, the Netherlands is still faced with persistent labour shortages, especially when it comes to technical staff. That is why a liquid workforce (or 'flex layer') comprising external employees and contractors is used in many investment projects.

Material delivery time

Certain materials, such as custom materials, are subject to long delivery times. To make sure projects can stay on schedule, GTS tries to use standardised materials as much as possible. Whenever customisation is inevitable, the non-standardised materials are ordered well ahead of the construction phase.

The delivery time for materials can be longer than planned due to unforeseen circumstances at suppliers. Where, despite our best efforts, delays occur, we take appropriate control measures, such as relocating standardised materials from one project to another, provided that the former project can then still be executed as planned, or by scaling up by switching from on-site manufacturing alone to both on-site and off-site manufacturing or prefabrication.

External circumstances

When working on the gas transmission network, unanticipated situations may be encountered, such as detection of soil contamination or the presence of harmful dust or aerosols containing chromium-6 originating from coated surfaces, a change to the planned production shutdown of a connected party, weather conditions, required soil surveys and/or other procedures, or an obligation to take additional measures to prevent nitrogen deposition. To account for delays should such circumstances arise and keep projects on schedule, GTS always tries to include some leeway in its project timelines.

GTS also had to deal with external circumstances relating to the Covid-19 pandemic and Russia's invasion of Ukraine. The impact of the pandemic on the progress of projects has been limited as far as possible through the implementation of additional measures. Supplies of critical materials from abroad have in several cases been delayed due to the restrictions and limitations production companies have encountered.

Appendix

Appendix I: Sources

Netherlands Authority for Consumers and Markets: Marktscan groen gas [Green gas market scan], 2023

European Network of Transmission System Operators for Gas: Ten-Year Network Development Plan 2022, 2023

European Union Agency for the Cooperation of Energy Regulators: Market Correction Mechanism - Effects assessment report, 2023

FNB GAS: Network Development Plan 2022, 2022

Gasunie Transport Services: Analysis of current gas market situation and security of supply for the next gas year, 2023

Gasunie Transport Services: Description of GTS' quality assurance system, 2023

Hynetwork Services: Conceptvoorstel aanpassing uitrolplan landelijke waterstofnetwerk [draft proposal for changes to the roll-out plan for the national hydrogen network], 2023

Ministry of Economic Affairs and Climate Policy: Letter to Parliament on the green gas blending obligation, 2022

Ministry of Economic Affairs and Climate Policy: Letter to Parliament on the proposed closure of production sites in the Groningen field as of 1 April 2023, 2023

Ministry of Economic Affairs and Climate Policy: Letter to Parliament on the Dutch government's approach to climate policy, 2022

Netbeheer Nederland: 2030-2050 Integral Infrastructure Survey scenario report, second edition – The Energy System of the Future, 2023

Netbeheer Nederland: Investment plan scenarios of the Dutch electricity and gas TSOs and DSOs, version 1.01, 20 February 2023

PBL Netherlands Environmental Assessment Agency: 2022 Climate & Energy Outlook

Appendix II: Glossary and initialisms/acronyms

ACM	Netherlands Authority for Consumers and Markets
ALARA	As low as reasonably achievable
BCM	Billion cubic metres
CAPEX	Capital expenditure
CARS	Capacity registration systems
CCS	Carbon Capture and Storage
CES	Cluster Energy Strategy
CID	Commercial Investment Decision
CS	Compressor station
SGEI	Service of general economic interest
DAS	Data Acquisition Systems
EET	EemsEnergyTerminal, floating LNG terminal in the port of Eemshaven
ENTSO-E	European Network of Transmission System Operators for Electricity
ENTSOG	European Network of Transmission System Operators for Gas
ETM	Energy transition model
EU27	27 Member States of the European Union
EVC	Electronic volume corrector
EZK	Dutch Ministry of Economic Affairs and Climate Policy
FES	Future Energy Scenarios
FID	Final investment decision
RAW	Regulated asset value
GC	Gas chromatograph
GRS	Gas receiving station
GTS	Gasunie Transport Services, national TSO for gas
GW	Gigawatt (capacity)
H-gas	High-calorific gas
HNS	Hynetwork Services, envisioned national hydrogen infrastructure
HPGG	High-pressure gas grid
IA	International Ambition (scenario)
II3050	2030-2050 Integral Infrastructure Survey
IP	Investment Plan
DCA	Dutch Climate Ambition (scenario)
QAS	Quality assurance system
C&EO	Climate & Energy Outlook
Small fields	Natural gas production sites in the Netherlands
L-gas	Low-calorific gas
LNG	Liquid natural gas
MCA	Multi-case approach: GTS simulation software for network planning based on the pressure drop calculation for the gas grid.

MR	Ministerial Regulation on Gas Quality
M&R	Metering and regulating station
CSR	Corporate Social Responsibility
National Grid	National TSO for gas and electricity in the UK
NCIA	National Charging Infrastructure Agenda
NC TAR	Network code on harmonised transmission tariff structures for gas
ND	National Driver (scenario)
Netbeheer Nederland	Industry organisation for all network and grid operators
OPEX	Operational expenditure
P50	Budget estimate with a 50% probability of budget overrun (see footnote 11 for explanation)
P90	Budget estimate with a 10% probability of budget overrun (see footnote 11 for explanation)
PBL	PBL Netherlands Environmental Assessment Agency
RBAM	Risk-based asset management
NCS	National Coordination Scheme
RES	Regional Energy Strategy
RFO	Ready for Operation
RNO	Regional network operator
RDN	Regional distribution network
SMR	Steam methane reforming
TenneT	Dutch national grid operator for electricity
TMX	Telemetry system
TSO	Transmission System Operator
TTF	Title Transfer Facility
TWh	Terawatt hour (volume)
TYNDP	Ten Year Network Development Plan
EI	Expansion investment
UGS	Underground gas storage (facility)
RI	Replacement investment
WoZ	Wind op Zee (offshore wind energy)

Appendix III: List of investment projects

III.1 Investment classification and available information

For the assessment of GTS' draft 2024 IP, ACM has drawn up the document Kader Informatiebehoefte Investeringsplannen 2024 [2024 Information Requirement Framework for Investment Plans]. In this document, investments are grouped under the following classifications:

Table III.1a: Investment classification

Investment classification	Period
Regular maintenance investments	2024 – 2028
Connections and diversions	2024 – 2028

GTS notes that a complete overview can only be provided for the projects already approved or in preparation for the years 2024 and 2025 and their related bottlenecks. For 2026 and later, the investment levels assumed are those used for the '15-year investment outlook'. This is because the portfolio for those years is largely determined by corrective measures and/or external factors, the necessity of which is determined only after the IP has been presented. Where possible, details are given for the years 2026 and beyond.[65]

Table III.1b: Available information

Years	2024 and 2025	2026 to 2033
Basis of information	Portfolio overview	15-year investment outlook

Due to the way in which GTS records project information in its data systems, the information available for the period 2024-2025 does not always line up perfectly with ACM's information requirements. Often only limited information is available in the early stages of a project, with the amount of information increasing as a project progresses. GTS therefore feels it necessary to specify the information for certain projects in a more general or, in some cases, more detailed way.

65 *The 15-year investment outlook is an estimate of the investment level over the next 15 years for GTS' financing needs, among other things.*

III.2: Notes to the tables

In the table below, GTS explains both the choices made when collecting the data and the terminology.

Table III.2a: Notes to the investment tables

Information	Notes
Bottleneck code	Code identifying the project/aggregate projects
Investment	Name of the investment/project
Bottleneck	Designation as a quality or capacity bottleneck
Asset/ network component category	Certain projects include more than one asset category. The dominant category is shown, or the description 'multiple asset categories' is stated.
Network pressure (RDN/HPGG)	Certain projects include more than one pressure level. Either the dominant pressure level or multiple pressure levels are stated.
Classification by expansion project or replacement project	Expansion investment is indicated as EI and replacement investment as RI.
Physical location of bottleneck	Location of the bottleneck in the GTS network.
Asset	Type of asset in that part of the network.
Numbers of individual assets or kilometres per year	Certain projects include several individual assets. The actual number is specified where possible; otherwise the designation 'multiple' or 'km TBD' is used.
Bottleneck starting year	The starting year for a bottleneck is the year that a potential bottleneck is identified. Following identification, it can take some time before the bottleneck is sufficiently concrete and has sufficient information to be submitted formally. The list of bottlenecks contains bottlenecks that were formally submitted before 1/9/2023 and have a unique number.
Year of CM	For the commissioning (CM) date the technically complete (TECO) date or the AM3 date – the agreed milestone (date) when the measure will be put into technical use – is shown.
On schedule	If the project is on schedule: Yes, otherwise No
Complete or partial replacement	Replacement investments: classification as partial or complete replacement. Certain projects include partial and full replacement of assets. This is indicated where applicable.
Statutory duty	GTS' statutory duty affected by the bottleneck.
Key aspect	Most important aspect arising from the risk assessment.
Investment amounts per year (2024/2025)	The amounts are approved budgets (or approved budgets for preparations) and forecast amounts, excluding risk premiums; see explanation of budget methodology.
Investment amounts after 2025 (2026 and beyond)	The amounts are forecast amounts based on '15-year investment outlook'.

Table III.3: Regular and major investments

Type	Bottleneck code	Investment (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	EI or RI	Physical location of bottleneck	Remediation starting year	Year of CM	On schedule (yes/no)	Statutory duty	Key aspect	Investment amounts 2024	Investment amounts 2025	Investment amounts 2026 and later
major	014727	Repl. gas chromatographs phase 2 (2024 and later)	QUA	multiple	Other	RI	multiple	2022	2028	yes	transmission	transport security			
major	014852	Zuidwal green gas gathering pipeline (A-601 west)	CAP	Pipeline	Other	EI	A-621	2023	2026	yes	transmission	sustainability			
regular	014069	Repl. Olst N-556-60 dyke crossing	QUA	Pipeline	Other	RI	N-556-60	2021	2024	yes	transmission	transport security			
regular	014428	Prep. repl. Gas chromatographs + pilot	QUA	multiple	Other	RI	multiple	2021	2024	yes	transmission	transport security			
regular	014499	Adjust ventilation cap. in office and field	QUA	multiple	Other	RI	multiple	2021	2023	yes	transmission	safety			
regular	014537	CDM Veeningen N-526-10-KR-015/016	QUA	Pipeline	Other	RI	N-526-10	2022	2024	yes	transmission	transport security			
regular	014542	Repl. 't Harde S-1212 GRS 't Harde	QUA	Valve	RDN	RI	S-1212	2021	2024	yes	transmission	transport security			
regular	014543	Repl. valves S-107 and S-161 IJsselmonde	QUA	Valve	HPGG	RI	S-107; S161	2022	2024	yes	transmission	transport security			
regular	014544	A-115 M&R Zoeterwoude subsidence metering line	QUA	M&R	Other	RI	A-115	2021	2024	yes	transmission	transport security			
regular	014545	Repl. Workum S-4128 De Goede Verwachting	QUA	Valve	RDN	RI	S-4128	2021	2025	yes	transmission	transport security			
regular	014555	S-408 Alphen Enex. and S-197 Chaamse Baan	QUA	Valve	HPGG	RI	S-408; S-197	2020	2025	yes	transmission	transport security			
regular	014557	Repl. overpass pipeline W-570-01	QUA	Pipeline	Other	RI	W-570-01	2021	2025	yes	transmission	transport security			
regular	014564	Scheduled maint. HVAC OIW 2024	QUA	CS	Other	RI	CS Wieringermeer	2021	2024	yes	transmission	transport security			
regular	014569	Repl. v. set-up S-184 Tata Steel Noord	QUA	Valve	HPGG	RI	S-184	2021	2025	yes	transmission	transport security			
regular	014580	Repl. v. set-up S-2228 Bovenkerk	QUA	Valve	RDN	RI	S-2228	2022	2025	yes	transmission	transport security			
regular	014581	Repl. v. set-up S-2331 Moordrecht	QUA	Valve	RDN	RI	S-2331	2020	2024	yes	transmission	transport security			
regular	014587	Repl. Schaesberg S-8715 branch	QUA	Valve	RDN	RI	S-8715	2022	2024	yes	transmission	transport security			
regular	014590	Repl. valve 024/025 s-263 Noordbroek	QUA	Valve	HPGG	RI	S-263	2022	2024	yes	transmission	transport security			
regular	014592	Repl. heating system Spijk	QUA	CS	Other	RI	CS Spijk	2021	2023	yes	transmission	transport security			
regular	014593	Repl. v. set-up S-3180 Vlijmen	QUA	Valve	RDN	RI	S-3180	2022	2024	yes	transmission	transport security			
regular	014594	Repl. S-3192 Veghel 1 Evertsen	QUA	Valve	RDN	RI	S-3192	2022	2024	yes	transmission	transport security			
regular	014595	Repl. S-3184 Waalwijk	QUA	Valve	RDN	RI	S-3184	2022	2024	yes	transmission	transport security			
regular	014596	Replacement S-3217 St. Oedenrode	QUA	Valve	RDN	RI	S-3217	2022	2024	yes	transmission	transport security			
regular	014599	CSR measures N2 displacement solar units WMR	QUA	CS	Other	RI	CS Wieringermeer	2022	2024	yes	transmission	sustainability			
regular	014600	Reduce CH4 emissions in venting stack	QUA	CS	Other	RI	CS Ommen	2021	2024	yes	transmission	sustainability			
regular	014601	Repl. obsolete alarm panels OI	QUA	CS	Other	RI	multiple	2021	2024	yes	transmission	transport security			
regular	014602	Repl. Born S-8552 and Sittard S-8555 branch	QUA	Valve	RDN	RI	S-8552; S-8555	2021	2024	yes	transmission	transport security			
regular	014603	Repl. Zevenaar S-9709 Babberich	QUA	Valve	RDN	RI	S-7909	2022	2024	yes	transmission	transport security			
regular	014605	Repl. Huissen S-1148 Liander	QUA	Valve	RDN	RI	S-1148	2022	2025	yes	transmission	transport security			
regular	014606	Repl. The Hague v. set-up S-5989 't Woudt	QUA	Valve	RDN	RI	S-5989	2022	2026	yes	transmission	transport security			
regular	014607	Repl. Echteld S-1494 Korevaar	QUA	Valve	RDN	RI	S-1494	2022	2024	yes	transmission	transport security			

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Type	Bottleneck code	Investment (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	EI or RI	Physical location of bottleneck	Remediation starting year	Year of CM	On schedule (yes/no)	Statutory duty	Key aspect	Investment amounts 2024	Investment amounts 2025	Investment amounts 2026 and later
regular	014608	TO-OP small flow odorisation Phase 2	QUA	GRS	Other	RI	multiple	2022	2024	yes	transmission	transport security			
regular	014609	Repl. GVs line 1 and 2 W-244 Cabot	QUA	GRS	Other	RI	W-244	2021	2023	yes	transmission	transport security			
regular	014610	Repl. Zwolle S-9830 Kamperweg	QUA	Valve	RDN	RI	S-9830	2022	2024	yes	transmission	transport security			
regular	014611	Repl. valve set-up Midwoud S-5080 Broerdijk	QUA	Valve	RDN	RI	S-5080	2022	2025	yes	transmission	transport security			
regular	014613	Repl. v. set-up S-2003 GRS Voorschoten	QUA	Valve	RDN	RI	S-2003	2022	2024	yes	transmission	transport security			
regular	014614	Repl. Amsterdam S-2429 Ookmeerweg	QUA	Valve	RDN	RI	S-2429	2022	2025	yes	transmission	transport security			
regular	014615	CSR measure Hofdijk S-756 prevent gas emissions	QUA	RS	HPGG	RI	S-756	2022	2024	yes	transmission	sustainability			
regular	014616	Green gas booster Tilburg	CAP	CS	Other	EI	Noord-Brabant	2022	2024	yes	transmission	sustainability			
regular	014617	Repl. regulators GRS Zeist W-333	QUA	GRS	Other	RI	W-333	2022	2023	yes	transmission	transport security			
regular	014618	Mod. OAZ S-060 and S-062 for pigging A-52	QUA	pipeline	HPGG	RI	S-060; S062	2022	2024	yes	transmission	transport security			
regular	014623	Repl. S-2369 and S-5479 Lekkerkerk	QUA	Valve	RDN	RI	S-2369; S-5479	2022	2024	yes	transmission	transport security			
regular	014625	Repl. S-5481 Reeweg/Dordrecht	QUA	Valve	RDN	RI	S-5481	2022	2024	yes	transmission	transport security			
regular	014626	Repl. S-5477 Ouderkerk a/d IJssel	QUA	Valve	RDN	RI	S-5477	2021	2024	yes	transmission	transport security			
regular	014627	Repl. S-5627 Rijksweg 15 Papendrecht	QUA	Valve	RDN	RI	S-5627	2022	2024	yes	transmission	transport security			
regular	014631	Mod. OAZ A-520-02 and A-520-15 for pig.	QUA	Pipeline	Other	RI	A-520-02; A-520-15	2022	2025	yes	transmission	transport security			
regular	014632	Modifications for pigging A-538-06	QUA	Pipeline	Other	RI	A-538-06	2022	2025	yes	transmission	transport security			
regular	014633	Modifications for pigging A-525-05	QUA	Pipeline	Other	RI	A-525-05	2022	2025	yes	transmission	transport security			
regular	014643	Repl. obsolete intercom systems	QUA	CS	Other	RI	multiple	2022	2024	yes	transmission	transport security			
regular	014651	Repl. heating system GRS W-299	QUA	GRS	Other	RI	W-299	2022	2024	yes	transmission	transport security			
regular	014653	Refurb. AP security system (GTS' part!)	QUA	MS	Other	RI	MS Anna Paulowna	2020	2024	yes	transmission	safety			
regular	014654	Repl. Born S-3271, shortcomings Z-271 Nedcar	QUA	Valve	RDN	RI	S-3271; Z-271	2022	2026	yes	transmission	transport security			
regular	014656	Dummy cathodic protection upgrade prog. OL 2024	QUA	Pipeline	Other	RI	multiple	2022	2024	yes	transmission	transport security			
regular	014662	Repl. Autronica BA-45 fire extng control panels	QUA	CS	Other	RI	multiple	2022	2024	yes	transmission	transport security			
regular	014667	Repl. Mokveld regulating valves OIW	QUA	CS	Other	RI	multiple	2022	2025	yes	transmission	transport security			
regular	014669	Repl. turbine gas meters > 30 years 2024	QUA	GRS	Other	RI	multiple	2022	2024	yes	transmission	transport security			
regular	014680	Green gas booster Almere	CAP	CS	Other	EI	Flevoland	2022	2025	yes	transmission	sustainability			
regular	014691	Mod. purge air system Scheemda CS	QUA	CS	Other	RI	CS Scheemda	2022	2023	yes	transmission	transport security			
regular	014698	Repl. valves W-003 Voorschoten	QUA	GRS	Other	RI	W-003	2022	2024	yes	transmission	transport security			
regular	014710	Scheduled maint. HVAC OAN 2025	QUA	CS	Other	RI	multiple	2022	2025	yes	transmission	transport security			
regular	014711	Repl. DNB with SNB system OIW	QUA	CS	Other	RI	CS Wieringermeer	2022	2024	yes	transmission	transport security			
regular	014713	Repl. Geleen S-596 DSM AFA 3	QUA	Pipeline	HPGG	RI	S-596	2022	2024	yes	transmission	transport security			
regular	014714	Repl. monitoring W-139 Uithoorn	QUA	GRS	Other	RI	W-139	2022	2023	yes	transmission	transport security			

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Type	Bottleneck code	Investment (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	EI or RI	Physical location of bottleneck	Remediation starting year	Year of CM	On schedule (yes/no)	Statutory duty	Key aspect	Investment amounts 2024	Investment amounts 2025	Investment amounts 2026 and later
regular	014720	Repl. S-2395 S-5805 S-2041 Gouda/Reewijk	QUA	Valve	RDN	RI	S-2395; S-5805; S-2041	2022	2025	yes	transmission	transport security			
regular	014723	Repl. S-3329 IFF Tilburg	QUA	Valve	RDN	RI	S-3329	2022	2025	yes	transmission	transport security			
regular	014724	CSR, prevent gas emissions Rhoon and Tusschenkl	QUA	RS	Other	RI	multiple	2022	2025	yes	transmission	sustainability			
regular	014725	Repl. S-3072 Bergeijk + Z-511 various	QUA	Valve	RDN	RI	S-3072; Z-511	2021	2025	yes	transmission	transport security			
regular	014726	Repl. ODS clamp-on flow metering	QUA	M&R	Other	RI	multiple	2022	2024	yes	transmission	transport security			
regular	014729	MOD2 Repl. v. set-up S-741 Yara Sluiskil	QUA	Valve	HPGG	EI	S-741	2022	2025	yes	transmission	transport security			
regular	014731	Repl. Angerlo S-032 HV 26 scraper trap valve	QUA	Valve	HPGG	RI	S-032	2022	2024	yes	transmission	transport security			
regular	014734	Green gas booster Mill	CAP	CS	Other	EI	Noord-Brabant	2022	2025	yes	transmission	sustainability			
regular	014736	Green gas booster Giethoorn	CAP	CS	Other	EI	Overijssel	2022	2025	yes	transmission	sustainability			
regular	014737	Repl. HPGG valves Wiermr A-403	QUA	CS	Other	RI	CS Wieringermeer	2022	2025	yes	transmission	transport security			
regular	014741	Instal. GC Wieringermeer fuel gas	QUA	CS	Other	RI	CS Wieringermeer	2022	2024	yes	transmission	transport security			
regular	014743	Repl. downstr. valves Z-159 Den Bosch	QUA	GRS	Other	RI	Z-159	2023	2023	yes	transmission	transport security			
regular	014746	Repl. leaking PWD valves	QUA	CS	Other	RI	multiple	2023	2023	yes	transmission	transport security			
regular	014755	Repl. v. set-up S-2046 Koudekerk GRS	QUA	Valve	RDN	RI	S-2046	2020	2025	yes	transmission	transport security			
regular	014757	Instal. 4" flange venting pipes HPGG v. set-ups	QUA	Valve	Other	RI	Valve set-up cluster	2023	2025	yes	transmission	transport security			
regular	014760	Repl. S-1189 Attica Oude Pekela	QUA	Valve	RDN	RI	S-1189	2023	2025	yes	transmission	transport security			
regular	014761	Repl. v. set-up Bolsward S-4114 Zaard	QUA	Valve	RDN	RI	S-4114	2023	2025	yes	transmission	transport security			
regular	014762	Repl. Noordsleen S-1262	QUA	Valve	RDN	RI	S-1262	2023	2025	yes	transmission	transport security			
regular	014765	Repl. Haalderen S-1372 ASV Bemmel	QUA	Valve	RDN	RI	S-1372	2023	2026	yes	transmission	transport security			
regular	014766	Repl. Spaubeek S-3054 GOS Spaubeek	QUA	Valve	RDN	RI	S-3054	2023	2025	yes	transmission	transport security			
regular	014767	Repl. v. set-up S-5997 Kruisweg Hoofddorp	QUA	Valve	RDN	RI	S-5997	2023	2025	yes	transmission	transport security			
regular	014768	Repl. Geleen S-3270 DSM Maurits branch	QUA	Valve	RDN	RI	S-3270	2023	2025	yes	transmission	transport security			
regular	014769	Repl. Landgraaf S-3457 Durox Abdissenbos	QUA	Valve	RDN	RI	S-3457	2023	2025	yes	transmission	transport security			
regular	014770	Repl. Born S-3096 GRS Born	QUA	Valve	RDN	RI	S-3096	2023	2025	yes	transmission	transport security			
regular	014771	Repl. S-3319 Hunter Douglas Ouden	QUA	Valve	RDN	RI	S-3319	2023	2026	yes	transmission	transport security			
regular	014772	Repl. v. set-up S-7267 branch Roosendaal	QUA	Valve	RDN	RI	S-7267	2023	2026	yes	transmission	transport security			
regular	014773	Repl. Sint-Oedenrode S-7863 Vossenbergweg	QUA	Valve	RDN	RI	S-7863	2023	2025	yes	transmission	transport security			
regular	014775	Replacement S-6428 S.P. Tiel	QUA	Valve	RDN	RI	S-6428	2023	2026	yes	transmission	transport security			
regular	014776	Repl. S-6276 Nieuwegein Kromme IJssel	QUA	Valve	RDN	RI	S6276	2023	2026	yes	transmission	transport security			
regular	014777	Replacement S-2080 Waardenburg	QUA	Valve	RDN	RI	S-2080	2023	2025	yes	transmission	transport security			
regular	014778	Repl. v. set-up S-5942 Zevenhuizen	QUA	Valve	RDN	RI	S-5942	2023	2025	yes	transmission	transport security			

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Type	Bottleneck code	Investment (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	EI or RI	Physical location of bottleneck	Remediation starting year	Year of CM	On schedule (yes/no)	Statutory duty	Key aspect	Investment amounts 2024	Investment amounts 2025	Investment amounts 2026 and later
regular	014779	Repl. S-2045 Botlek Robur Cement GRS	QUA	Valve	RDN	RI	S-2045	2023	2025	yes	transmission	transport security			
regular	014780	Repl. S-5611 Europoort Moezelweg	QUA	Valve	RDN	RI	S-5611	2023	2025	yes	transmission	transport security			
regular	014781	Repl. Vondelingenplaat S-5635 Petroleumweg	QUA	Valve	RDN	RI	S5635	2023	2025	yes	transmission	transport security			
regular	014786	Repl. GV 3-1 GRS Moordrecht W-331	QUA	GRS	Other	RI	W-331	2023	2024	yes	transmission	transport security			
regular	014787	Repl. v. set-up S-2381 Middelharnis	QUA	Valve	RDN	RI	S-2381	2023	2025	yes	transmission	transport security			
regular	014792	Repair W389 Rijnmond Power HVAC	QUA	GRS	Other	RI	W-389	2023	2024	yes	transmission	transport security			
regular	014793	Repl. gas detection CH4 LNG PS	QUA	LNG	Other	RI	LNG peak shaver	2023	2025	yes	transmission	transport security			
regular	014794	Ommen recompression Hall 02C	QUA	CS	Other	RI	CS Ommen	2023	2024	yes	transmission	transport security			
regular	014796	Repl. Sint-Oedenrode S-7707 De Horst	QUA	Valve	RDN	RI	S-77-7	2023	2025	yes	transmission	transport security			
regular	014797	Repl. v. set-up S-7516 Dongen	QUA	Valve	RDN	RI	S-7516	2023	2025	yes	transmission	transport security			
regular	014798	Repl. v. set-up S-3461 RED Helmond	QUA	Valve	RDN	RI	S-3461	2023	2025	yes	transmission	transport security			
regular	014799	Repl. v. set-up S-7804 Gulbergen	QUA	Valve	RDN	RI	S-7084	2023	2025	yes	transmission	transport security			
regular	014800	Repl. Enschede S-9790 M&R Hengelo	QUA	Valve	RDN	RI	S-9790	2023	2025	yes	transmission	transport security			
regular	014801	Repl. v. set-up S-2083 Nieuwveen GRS	QUA	Valve	RDN	RI	S-2083	2023	2025	yes	transmission	transport security			
regular	014807	Repl. Geleen S-404 DSM AFA 2	QUA	Valve	HPGG	RI	S-404	2023	2026	yes	transmission	transport security			
regular	014808	Repl. Eibergen S-9795 Vaarwerkweg	QUA	Valve	RDN	RI	S-9795	2023	2025	yes	transmission	transport security			
regular	014809	Repl. components N-486 GRS Akkrum	QUA	GRS	Other	RI	N-486	2023	2024	yes	transmission	transport security			
regular	014810	Repl. components N-170 Beetgumermolen	QUA	GRS	Other	RI	N-170	2023	2024	yes	transmission	transport security			
regular	014811	Repl. Hardenberg S-1448	QUA	Valve	RDN	RI	S-1448	2023	2025	yes	transmission	transport security			
regular	014816	Repl. compressed air system ZB 1	QUA	MS	Other	RI	MS Zuidbroek 1	2023	2025	yes	quality conversion	transport security			
regular	014817	Green gas RDN connection Axel–Ossendrecht	CAP	Pipeline	Other	EI	Noord-Brabant; Zeeland	2023	2025	yes	transmission	sustainability			
regular	014818	CSR resolve emissions gas oper. actuators	QUA	multiple	Other	RI	multiple	2023	2024	yes	transmission	sustainability			
regular	014822	Repl. Flow metering source valve MS A-401	QUA	MS	Other	RI	CS Ommen	2023	2024	yes	quality conversion	transport security			
regular	014823	Repl. above-ground diesel storage 04R A-401	QUA	CS	Other	RI	CS Ommen	2023	2024	yes	transmission	transport security			
regular	014824	Repl. servers and software GTS OA	QUA	CS	Other	RI	multiple	2023	2024	yes	transmission	transport security			
regular	014825	Modifications for pigging A-570-12	QUA	Pipeline	Other	RI	A-570-12	2023	2025	yes	transmission	transport security			
regular	014826	Modifications for pigging A-671-01	QUA	Pipeline	Other	RI	A-671-01	2023	2025	yes	transmission	transport security			
regular	014827	Modifications for pigging A-529-04	QUA	Pipeline	Other	RI	A-529-04	2023	2025	yes	transmission	transport security			
regular	014828	Repl. S-2006 GRS and S-6041 Pijnacker	QUA	Valve	RDN	RI	S-2006; S6041	2023	2025	yes	transmission	transport security			
regular	014829	Repl. interface panels OI 2025-2029	QUA	CS	Other	RI	multiple	2020	2025	yes	transmission	transport security			

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Type	Bottleneck code	Investment (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	EI or RI	Physical location of bottleneck	Remediation starting year	Year of CM	On schedule (yes/no)	Statutory duty	Key aspect	Investment amounts 2024	Investment amounts 2025	Investment amounts 2026 and later
regular	014830	Modifications for pigging A-541-13	QUA	Pipeline	Other	RI	A-541-13	2023	2025	yes	transmission	transport security			
regular	014832	BERK Repl. valve GV-106 of S-344 WORKUM	QUA	Valve	HPGG	RI	S-344	2023	2025	yes	transmission	sustainability			
regular	014838	Repl. Hirschmann routers Ommen A-401	QUA	CS	Other	RI	CS Ommen	2023	2024	yes	transmission	transport security			
regular	014840	BERK Repl. Angerlo S-032 HV-31 valve	QUA	RS	HPGG	RI	S-032	2023	2025	yes	transmission	sustainability			
regular	014844	Repl. emitting valve A-409 CS Spijk	QUA	CS	Other	RI	CS Spijk	2023	2024	yes	transmission	transport security			
regular	014846	Repl. heat exchanger W194 Cargill Botlek	QUA	GRS	Other	RI	W-194	2023	2024	yes	transmission	transport security			
regular	014859	Safety measures B-package Zelzate	QUA	ES	HPGG	RI	ES Zelzate	2024	2024	yes	transmission	safety			

Table III.4: Connections and diversions

type	Bottleneck code	Investment (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	EI or RI	Physical location of bottleneck	Remediation starting year	Year of CM	On schedule (yes/no)	Statutory duty	Key aspect	Investment amounts 2024	Investment amounts 2025	Investment amounts 2026 and later
connections	014598	New connection Air Products	CAP	Pipeline	Other	connection	Botlek	2022	2025	yes	connection	transport security			
connections	014658	Connection Nature Energy Coevorden	CAP	Pipeline	Other	connection	Drenthe	2022	2024	yes	connection	transport security			
connections	014671	New connection SFP Delfzijl	CAP	Pipeline	Other	connection	Delfzijl	2022	2024	yes	connection	transport security			
connections	014672	New connection BEN Delfzijl	CAP	Pipeline	Other	connection	Delfzijl	2022	2026	yes	connection	transport security			
connections	014681	New connection Corre Energy Storage	CAP	Pipeline	Other	connection	Groningen	2022	2026	yes	connection	transport security			
connections	014683	New connect. Titan LNG Supply BV Adam	CAP	Pipeline	Other	connection	Amsterdam	2022	2025	yes	connection	transport security			
connections	014684	New connection UPM Maasvlakte	CAP	Pipeline	Other	connection	Maasvlakte	2022	2026	yes	connection	transport security			
connections	014738	New green gas connection Delfzijl D4	CAP	Pipeline	Other	connection	Delfzijl	2022	2025	yes	connection	transport security			
connections	014790	Coteq connection GVL-GZI Hardenberg	CAP	Pipeline	Other	connection	Drenthe	2023	2025	yes	connection	transport security			
connections	014791	Rendo connection GVL-GZI Elim	CAP	Pipeline	Other	connection	Drenthe	2023	2025	yes	connection	transport security			
connections	014841	New connection Ennatuurlijk Geertruidenberg	CAP	Pipeline	Other	connection	Geertruiden-berg	2023	2026	yes	connection	transport security			
diversions	014497	Repl. bridge pipeline Helmond Z-540-01	QUA	Pipeline	Other	DIVERS	Z-540-01	2021	2024	yes	transmission	transport security			
diversions	014685	Diversion Z-523-01 new-build Orthen 53A	QUA	Pipeline	Other	DIVERS	Z-523-01	2022	2024	yes	transmission	transport security			
diversions	014733	Div. Zuidwending N-524-20 Corre Energy	QUA	Pipeline	Other	DIVERS	N-524-20	2022	2025	yes	transmission	transport security			
diversions	014740	Diversion W-533-03 Crailo Hilversum	QUA	Pipeline	Other	DIVERS	W-533-03	2023	2025	yes	transmission	transport security			
diversions	014745	Div. Born A-520 for VDL NedCar phase 2	QUA	Pipeline	Other	DIVERS	A-520	2023	2025	yes	transmission	transport security			
diversions	014839	Div. at stor. basin dewatering Overwaard W-528-01	QUA	Pipeline	Other	DIVERS	Zuid-Holland	2021	2026	yes	transmission	transport security			
diversions	014845	Div. Cuijk Z-542-17 Dommelsvoort	QUA	Pipeline	Other	DIVERS	Z-542-17	2023	2025	yes	transmission	transport security			

Appendix IV: Overview of bottlenecks

For the assessment of GTS' draft 2024 IP, ACM has drawn up the document Kader Informatiebehoefte Investeringsplannen 2024 [2024 Information Requirement Framework for Investment Plans]. Under section 3.2 of the document stated above, which covers ACM's information needs regarding bottlenecks, the following bottleneck overviews are requested:

- bottlenecks resolved with OPEX
- accepted bottlenecks.

Table IV.1: Overview of OPEX bottlenecks

Bottleneck code	Measure (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	Physical location of bottleneck	Remediation starting year	Year of solution	On schedule (yes/no)	Statutory duty	Key aspect
014735	PIG-24 Construction costs Pigging 2024	QUA	Pipeline	Other	multiple	2022	2024	yes	transmission	transport security
022621	Hoevelaken Terschuur RW A1 eliminate emissions N-571-81	QUA	Pipeline	Other	N-571-81	2022	2025	yes	transmission	transport security
023164	I.013399 Removal S-9875 + inst. con. adapt.	QUA	Valve	RDN	S-9875	2022	2025	yes	transmission	dismantling
023262	Repair/coating 17 bridge pipelines	QUA	Pipeline	Other	multiple	2022	2023	yes	transmission	transport security
023304	Eemszinker pipeline protection plan A-542	QUA	Pipeline	Other	A-542	2021	2023	yes	transmission	safety
023327	Resolve CDM Noordzeekanaal A-550, A-661	QUA	Pipeline	Other	A-550; A-661	2023	2025	yes	transmission	transport security
023377	Dismt. Groningen S4489 Nieuwe Gat	QUA	Valve	RDN	S-4489	2020	2024	yes	transmission	dismantling
023379	Dismt. Hoogeveen S-4898	QUA	Valve	RDN	S-4898	2020	2024	yes	transmission	dismantling
023381	LNG PS put in reserve	QUA	LNG	Other	LNG peak shaver	2020	2024	yes	transmission	dismantling
023382	Dismt. Ried S-4250 Kloosterpolder	QUA	Valve	RDN	S-4250	2020	2025	yes	transmission	dismantling
023385	Dismantling v. set-up Oude Pekela S-4854	QUA	Valve	RDN	S-4854	2020	2024	yes	transmission	dismantling
023448	Repl. venting system GOSs OLN	QUA	GRS	Other	multiple	2020	2023	yes	transmission	transport security
023466	Removal Harculo S-091 Hattem S-092 thrust block	QUA	Valve	HPGG	S-091; S-092	2020	2025	yes	transmission	dismantling
023481	Resolve various v. set-up issues OLWB	QUA	Valve	Other	multiple	2020	2023	yes	transmission	transport security
023500	Converting FWS firefighting systems	QUA	Other	Other	multiple	2020	2023	yes	transmission	safety
023534	Dism. protection pipe W-570-01	QUA	Pipeline	Other	W-570-01	2021	2025	yes	transmission	dismantling
023570	Dismantling S-7109 Doorndijk	QUA	Valve	RDN	S-7109	2021	2023	yes	transmission	dismantling
023583	Cathodic protection improv. programme RDN OPEX phase 2	QUA	Pipeline	Other	multiple	2021	2023	yes	transmission	transport security
023615	CSR 2024 Heating curve control for 100 GRSs	QUA	GRS	Other	multiple	2021	2024	yes	transmission	sustainability
023616	Dismt. Bathmen S-005 Brondsvoorderdijk	QUA	Valve	HPGG	S-005	2021	2025	yes	transmission	dismantling
023651	Dismt. 't Harde S-9893 Industrieweg	QUA	Valve	RDN	S-9893	2021	2024	yes	transmission	dismantling
023681	Dismt. Akkrum S-4453 Niewe Dijk	QUA	Valve	RDN	S-4453	2021	2024	yes	transmission	dismantling
023716	Dismantling v. set-up S-5077 Enkhuizen	QUA	Valve	RDN	S-5077	2022	2024	yes	transmission	dismantling
023720	Dismantling HP supply W-045-52 Enci	QUA	Pipeline	Other	W-045-52	2022	2024	yes	transmission	dismantling
023725	I.014602 Dism. jacketed piping Born Z-540-xx	QUA	Pipeline	Other	Z-540-xx	2022	2024	yes	transmission	dismantling
023729	Dism. v. set-up S-5914 Voorburg	QUA	Valve	RDN	S-5914	2022	2025	yes	transmission	dismantling
023734	Dismt. Maastricht S-8908 Biesenweg	QUA	Valve	RDN	S-8908	2022	2024	yes	transmission	dismantling
023736	Instal. connect. adapt. Deest S-9930 Uiversnest	QUA	Valve	RDN	S-9930	2022	2024	yes	transmission	transport security
023737	Dismt. v. set-up S-4454 Deelswei	QUA	Valve	RDN	S-4454	2022	2024	yes	transmission	dismantling
023746	Dismt. Zwolle S-9828 Ceintuurbaan	QUA	Valve	RDN	S-9828	2022	2024	yes	transmission	dismantling
023747	Dismt. S-5994 Aalsmeer pumping st.	QUA	Valve	RDN	S-5994	2022	2024	yes	transmission	dismantling
023750	Dism. v. set-up Akkrum S-4445 De Boorne	QUA	Valve	RDN	S-4445	2022	2024	yes	transmission	dismantling

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IV.1: Overview of OPEX bottlenecks continued previous page

Bottleneck code	Measure (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	Physical location of bottleneck	Remediation starting year	Year of solution	On schedule (yes/no)	Statutory duty	Key aspect
023759	Dismt. S-5478 Prov. road 30 Ouderk ad IJssel	QUA	Valve	RDN	S-5478	2022	2024	yes	transmission	dismantling
023762	Resolve issue S300 - S817 A-611-01	QUA	Pipeline	HPGG	S-300; S-817; A-611-01	2022	2024	yes	transmission	transport security
023785	Dismantling v. set-up S-5042 Koog ad Zaan	QUA	Valve	RDN	S-5042	2022	2024	yes	transmission	dismantling
023788	Remediation Midwoud site S-5080	QUA	Valve	RDN	S-5080	2022	2025	yes	transmission	sustainability
023795	Resolve jacketed piping shut-off valve W-572-01 Oostzaan	QUA	Pipeline	Other	W-572-01	2022	2025	yes	transmission	transport security
023799	Fix leaks RS R-054 and R-055	QUA	RS	Other	R-054; R-055	2022	2025	yes	transmission	transport security
023803	Dismantling pipeline W-515-03-KR-005_007	QUA	Pipeline	Other	W-515-03	2022	2026	yes	transmission	dismantling
023810	Overhaul HV switches Ommen A401	QUA	N2	Other	CS Ommen	2022	2024	yes	transmission	transport security
023828	Change to underwater pipeline at It Deel canal Akkrum	QUA	Pipeline	Other	Akkrum	2023	2024	yes	transmission	transport security
023831	Dismt. remaining pipeline DN200	QUA	Pipeline	Other	multiple	2022	2024	yes	transmission	dismantling
023832	Dismantling W-314 Voorhout line 3	QUA	GRS	Other	W-314	2022	2024	yes	connection	dismantling
023834	Resolving bottlenecks cowhorn assmb. M&Rs	QUA	M&R	Other	multiple	2022	2025	yes	transmission	transport security
023842	Dismt. v. set-up S-7567	QUA	Valve	RDN	S-7567	2022	2024	yes	transmission	dismantling
023844	Repl. software SRP UCP for emission registr.	QUA	Other	Other	multiple	2022	2025	yes	transmission	sustainability
023875	CH4 emission study (overarching)	QUA	multiple	Other	multiple	2022	2023	yes	transmission	sustainability
023879	Reparation 602 unit CS Grijpskerk	QUA	CS	HPGG	CS Grijpskerk	2022	2023	yes	transmission	transport security
023892	Minor exposure issues 2024	QUA	Pipeline	Other	multiple	2022	2024	yes	transmission	safety
023912	Study: vent stacks emission reduction	QUA	CS	Other	multiple	2023	2023	yes	transmission	sustainability
023922	Dismt. S-7814 Hulsterbrug Geldrop	QUA	Valve	RDN	S-7814	2021	2025	yes	transmission	dismantling
023923	Dismt. Eexterzandvoort S-4850	QUA	Valve	RDN	S-4850	2023	2025	yes	transmission	dismantling
023924	Removal Kessel S-050 Belfeld S-051 thrust block	QUA	Valve	HPGG	S-050; S-051	2023	2024	yes	transmission	dismantling
023926	Removal jacketed piping Z-554-01-XS-001-1	QUA	pipeline	HPGG	Z-554-01	2023	2025	yes	transmission	dismantling
023927	Dismt. Bathmen S-026	QUA	Valve	HPGG	S-026	2021	2025	yes	transmission	dismantling
023928	Minor exposure issues 2025	QUA	Pipeline	Other	multiple	2023	2025	yes	transmission	safety
023938	Provisional figures studies diversions 2024	QUA	Pipeline	Other	multiple	2023	2024	yes	transmission	transport security
023939	OPEX provisional figures studies GTS 2024	QUA	multiple	Other	multiple	2023	2024	yes	transmission	transport security
023940	Resolve exposure issue W-517-01-KR-010	QUA	Pipeline	Other	W-517-01	2023	2025	yes	transmission	safety
023943	Resolve jacketed piping shut-off Hilvarenbeek A-526	QUA	Pipeline	Other	A-526	2023	2025	yes	transmission	transport security
023945	Dismt. S-6358 Noorderwaaldijk	QUA	Valve	RDN	S-6358	2022	2025	yes	transmission	dismantling
023952	Dismt. mod. for pigging A-538-06	QUA	Pipeline	Other	A-538-06	2022	2025	yes	transmission	dismantling
023957	Dismt. Emmen S-4729 S-4722 incl. pipeline	QUA	Valve	RDN	S-4729; S-4722	2023	2026	yes	transmission	dismantling
023963	Dismt. Tegelen ES A-191 and A-520-04	QUA	ES	Other	A-191; S-520-04	2023	2025	yes	transmission	dismantling
023965	Sched. 10-year maint. VSDS units Wijngaarden	QUA	CS	Other	CS Wijngaarden	2023	2024	yes	transmission	transport security
023967	Wadden Sea pipelines issue mgmt. 2024	QUA	Pipeline	Other	multiple	2023	2024	yes	transmission	transport security
023971	BERK resolve leak emerg. relief valve PS tank	QUA	LNG	Other	LNG peak shaver	2023	2024	yes	transmission	sustainability
023972	BERK Fix LNG flange leaks PS D-302/30	QUA	LNG	Other	LNG peak shaver	2023	2024	yes	transmission	sustainability
023984	Making gas extinguishing systems airtight CS	QUA	CS	Other	multiple	2023	2024	yes	transmission	transport security
023985	BERK dummy workflow 4 specials OPEX	QUA	multiple	Other	multiple	2023	2024	yes	transmission	sustainability
023986	BERK dummy workflow 3 specials OPEX	QUA	multiple	Other	multiple	2023	2025	yes	transmission	sustainability
023987	BERK dummy workflow 2 specials OPEX	QUA	multiple	Other	multiple	2023	2025	yes	transmission	sustainability
023989	Study: integrity spec. construct. pipelines	QUA	Pipeline	Other	multiple	2023	2024	yes	transmission	transport security
023996	Dismantling S-5012-S-5011 Amsterdam	QUA	Valve	RDN	S-5012; S-5011	2022	2025	yes	transmission	dismantling

Table IV.2: Overview of accepted bottlenecks

Bottleneck code	Measure (NAME)	Bottleneck (CAP or QUA)	Asset/network component category	Network pressure (RDN or HPGG)	Physical location of bottleneck	Bottleneck starting year	Statutory duty	Key aspect
934	Flanged plug valves	Quality	RDN valve locations	RDN	S-599	2021	Gas transmission	Loss tolerance
1033	Flanged plug valves	Quality	RDN valve locations	HPGG	General	2021	Gas transmission	Loss tolerance
1064	Corrosion inlet pipeline	Quality	RDN pipeline	RDN/ HPGG	W-540, W-529-01	2021	Gas transmission	Loss tolerance
1212	Rooftop pipeline	Quality	RDN pipeline	RDN	Z-540-26	2022	Gas transmission	Loss tolerance
1134	Corrosion inflow pipeline	Quality	Gas receiving stations	RDN	General	2022	Gas transmission	Loss tolerance
1285	Pipeline under railway line	Quality	HPGG pipelines	HPGG	A-536-06	2023	Gas transmission	Loss tolerance
1341	Pressure reduction M&R	Quality	Metering and regulating stations	RDN	multiple	2023	Gas transmission	Sustainability

Appendix V: Investment projects completed in 2021 and 2022

Table V.1: List of completed investment projects – Regular investments

Investment	bottleneck code	EI/RI classification	network component category	network pressure (RDN/ HPGG)	no. of components or km	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.012215 - GNIPG1510 Z-381 Terneuzen (Dow Benelux)	N/A - IP20	RI	GRS	RDN	1	€ 1.888.243	€ 2.234.449	€ 346.206	18%	-	-	-
I.012332 - Repl. v. set-up S-2127 Desco Dordrecht	N/A - IP20	RI	Valve set-up	RDN	1	€ 861.599	€ 1.166.293	€ 304.694	35%	Budget adjustment	Higher material costs and costs for installing an extra stopple fitting	None
I.012336 - GNIPG1510 AS Z-381 Terneuzen (Dow)	N/A - IP20	RI	Valve set-up	RDN	1	€ 994.624	€ 1.021.902	€ 27.278	3%	-	-	-
I.012414 - GNIPA1644 AS N-150 Workum	N/A - IP20	RI	Valve set-up	RDN	1	€ 675.000	€ 696.444	€ 21.444	3%	-	-	-
I.012425 - GNIPA S-1396 Arnhem Elden	N/A - IP20	RI	Valve set-up	RDN	1	€ 610.100	€ 616.372	€ 6.272	1%	-	-	-
I.012519 - GNIPA-1703 Paterswolde-Leek	N/A - IP20	RI	Valve set-up	RDN	multiple	€ 2.712.863	€ 2.707.899	€ -4.964	0%	-	-	-
I.012576 - GNIPA-1715 Woerden-Redland connection	N/A - IP20	RI	Valve set-up	RDN	multiple	€ 2.165.082	€ 4.691.235	€ 2.526.153	117%	Budget adjustment	More work than anticipated due to complex in situ situation and additional risk measures	None
I.012578 - GNIPA-1718 Zaltbommel-Rossum	N/A - IP20	RI	Valve set-up	RDN	multiple	€ 2.723.318	€ 2.492.814	€ -230.504	-8%	-	-	-
I.012628 - GNIPA S-2160 Loosduinen-N Westland	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.079.610	€ 1.076.462	€ -3.148	0%	-	-	-
I.012722 - GNIPA S-2042 Zaltbommel RS	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.097.264	€ 1.095.778	€ -1.486	0%	-	-	-
I.012748 - Adjustment of scraper traps A-510,A-514,A-549 OIO	N/A - IP20	RI	CS	HPGG	1	€ 507.357	€ 286.500	€ -220.857	-44%	Budget adjustment	Construction costs lower than anticipated	None
I.012825 - Repl. v. set-up S-2323 incl. liquid catcher GRS Oostzaan	N/A - IP20	RI	Valve set-up	RDN	1	€ 987.850	€ 669.808	€ -318.042	-32%	Budget adjustment	Construction costs lower than anticipated	None
I.012903 - Repl. turbine gas meters > 30 years in 2020	N/A - IP20	RI	GRS	RDN	multiple	€ 1.010.326	€ 856.857	€ -153.469	-15%	-	-	-
I.012904 - Repl. turbine gas meters > 30 years in 2021	N/A - IP20	RI	GRS	RDN	multiple	€ 604.550	€ 536.726	€ -67.824	-11%	-	-	-
I.012912 - Renov. A-130 M&R V´plate using R-105	N/A - IP20	RI	M&R	HPGG	1	€ 4.370.000	€ 4.037.792	€ -332.209	-8%	-	-	-
I.012980 - Repl. E-actuators cluster OIW	N/A - IP20	RI	CS	HPGG	multiple	€ 321.940	€ 75.133	€ -246.807	-77%	Budget adjustment	Construction costs lower than anticipated	None
I.013045 - GTS: Repl. W7 with W10 for P.C.S.	N/A - IP20	RI	Other	N/A	1	€ 2.631.800	€ 2.939.568	€ 307.767	12%	-	-	-
I.013143 - GNIPA-1801 MR Angerlo-Westerv.dijk phase2	N/A - IP20	RI	Valve set-up	RDN	2	€ 1.730.215	€ 2.033.465	€ 303.250	18%	-	-	-
I.013180 - LNG PS Peripheral equip. low-pressure boil-off comp rev	N/A - IP20	RI	LNG	HPGG	1	€ 3.475.816	€ 3.369.243	€ -106.573	-3%	-	-	-
I.013224 - Repl. OI video management system	N/A - IP20	RI	CS	HPGG	multiple	€ 535.000	€ 620.948	€ 85.948	16%	-	-	-
I.013258 - GNIPA-S-6249 SP Waarder, nearby netconf.	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.009.005	€ 1.243.844	€ 234.839	23%	-	-	-
I.013273 - Repl. of Beek S-8700 and Landgraaf S-8561	N/A - IP20	RI	Valve set-up	RDN	2	€ 1.529.660	€ 1.353.513	€ -176.148	-12%	-	-	-
I.013283 - CDM W-574-03 Anna Paulowna	N/A - IP20	RI	Pipelines	RDN	0	€ 590.453	€ 551.367	€ -39.086	-7%	-	-	-
I.013304 - Adjustment of natural gas condensate storage system OIR	N/A - IP20	RI	CS	HPGG	1	€ 2.838.429	€ 3.233.579	€ 395.150	14%	-	-	-
I.013305 - Adjustment of natural gas condensate storage system Spijk	N/A - IP20	RI	CS	HPGG	1	€ 750.000	€ 1.352.959	€ 602.959	80%	Budget adjustment	Wider scope of works than anticipated	None
I.013309 - Repl. S-2038 and disassembly S-5982 Maassluis	N/A - IP20	RI	Valve set-up	RDN	1	€ 912.806	€ 859.650	€ -53.156	-6%	-	-	-
I.013328 - Repl. (personal) gas detection	N/A - IP20	RI	Other	N/A	1	€ 1.735.830	€ 1.017.560	€ -718.270	-41%	Budget adjustment	Replaced less gas detection equipment than budgeted	None
I.013329 - Repl. Cathodic protection measuring device / DAS-2006	N/A - IP20	RI	Other	N/A	1	€ 189.868	€ 154.346	€ -35.522	-19%	-	-	-
I.013340 - CDM Nederasselt N-576-75-KR-006/007	N/A - IP20	RI	Pipelines	RDN	0	€ 1.198.291	€ 1.526.968	€ 328.677	27%	Budget adjustment	More work due to additional measures, required test trenches and other activities	None
I.013345 - Repl. oil coolers Solar CS Spijk	N/A - IP20	RI	CS	HPGG	multiple	€ 575.991	€ 690.065	€ 114.074	20%	-	-	-
I.013397 - Repl. S-536 Bio MCN I	N/A - IP20	RI	Valve set-up	HPGG	1	€ 816.512	€ 1.033.334	€ 216.822	27%	Budget adjustment	Construction costs higher than anticipated.	None
I.013462 - Repl. S-2134 and S-5911 Voorburg GRS	N/A - IP20	RI	Valve set-up	RDN	1	€ 752.649	€ 733.983	€ -18.666	-2%	-	-	-
I.013468 - GNIPA-S-5103 S.P. Nieuwsluizerbrug	N/A - IP20	RI	Valve set-up	RDN	1	€ 900.000	€ 509.473	€ -390.527	-43%	Budget adjustment	Construction costs lower than anticipated	None
I.013470 - GNIPA-S-5075 Hoorn	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.360.619	€ 860.767	€ -499.852	-37%	Budget adjustment	Construction costs lower than anticipated	None
I.013471 - GNIPA-S-5076 Hoogkarspel	N/A - IP20	RI	Valve set-up	RDN	1	€ 857.480	€ 513.066	€ -344.414	-40%	Budget adjustment	Construction costs lower than anticipated	None

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V.1: List of completed investment projects – Regular investments continued previous page

Investment	bottleneck code	EI/RI classification	network component category	network pressure (RDN/ HPGG)	no. of components or km	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.013473 - GNIPA-S-2014 GRS Hoorn	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.050.805	€ 945.328	€ -105.477	-10%	-	-	-
I.013496 - GNIPA-S-5991 Nieuwe Weg	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.238.556	€ 883.016	€ -355.540	-29%	Budget adjustment	Construction costs lower than anticipated	None
I.013504 - Repl. monitors Leusden GRS W-128	N/A - IP20	RI	GRS	RDN	1	€ 118.000	€ 57.604	€ -60.396	-51%	Budget adjustment	Construction costs lower than anticipated	None
I.013515 - GNIPA S-1270 Wijchen GRS	N/A - IP20	RI	Valve set-up	RDN	1	€ 507.500	€ 431.725	€ -75.775	-15%	-	-	-
I.013516 - GNIPA S-1284 Nijmegen De Colck GRS	N/A - IP20	RI	Valve set-up	RDN	1	€ 713.100	€ 599.729	€ -113.371	-16%	-	-	-
I.013538 - GNIPA-S-4848 MR Eext	N/A - IP20	RI	Valve set-up	RDN	1	€ 769.647	€ 665.018	€ -104.628	-14%	-	-	-
I.013540 - GNIPA-S-4684 Balinger Weiden	N/A - IP20	RI	Valve set-up	RDN	1	€ 475.700	€ 395.301	€ -80.398	-17%	-	-	-
I.013542 - GNIPA-S-4657 Anreep	N/A - IP20	RI	Valve set-up	RDN	1	€ 422.044	€ 380.386	€ -41.657	-10%	-	-	-
I.013580 - GNIPA-S-5536 Venkelweg Sp	N/A - IP20	RI	Valve set-up	RDN	1	€ 1.700.000	€ 2.298.159	€ 598.159	35%	Budget adjustment	Larger scope of work due to complex location	None
I.013631 - Repl. valve 22 S-379 Geertruidenberg	N/A - IP20	RI	Valve set-up	HPGG	1	€ 281.000	€ 277.223	€ -3.777	-1%	-	-	-
I.013634 - Adjustment of natural gas condensate storage system Grijpskerk	N/A - IP20	RI	CS	HPGG	1	€ 872.000	€ 826.645	€ -45.355	-5%	-	-	-
I.013635 - Adjustment of natural gas condensate storage system CS WM	N/A - IP20	RI	CS	HPGG	1	€ 700.000	€ 1.308.045	€ 608.044	87%	Budget adjustment	Wider scope of works than anticipated	None
I.013636 - Adjustment of natural gas condensate storage system MS AP	N/A - IP20	RI	CS	HPGG	1	€ 750.000	€ 885.152	€ 135.152	18%	-	-	-
I.013637 - Adjustment of natural gas condensate storage system Wijngrdn	N/A - IP20	RI	CS	HPGG	1	€ 1.104.500	€ 898.898	€ -205.602	-19%	-	-	-
I.013656 - Repl. v. set-up S-2271 GRS Valkenheide	N/A - IP20	RI	Valve set-up	RDN	1	€ 500.000	€ 774.925	€ 274.925	55%	Budget adjustment	Construction costs higher than anticipated.	None
I.013681 - Installation of rectifier Eijsden G3520	N/A - IP20	RI	Pipelines	HPGG	1	€ 67.422	€ 53.059	€ -14.363	-21%	-	-	-
I.013682 - Repl. S-537 Bio MCN II	N/A - IP20	RI	Valve set-up	HPGG	1	€ 447.542	€ 458.837	€ 11.295	3%	-	-	-
I.013722 - Repl. Vaals S-3059	N/A - IP20	RI	Valve set-up	RDN	1	€ 670.600	€ 788.513	€ 117.913	18%	-	-	-
I.013726 - Repl. Hal ESD valve 2-EV-90121 OIO	N/A - IP20	RI	CS	HPGG	1	€ 713.200	€ 1.699.235	€ 986.035	138%	Budget adjustment	Construction costs higher than anticipated due to wider scope of work than anticipated	None
I.013729 - Procurement of cutting tools OLS	N/A - IP20	RI	Other	N/A	1	€ 516.853	€ 473.708	€ -43.145	-8%	-	-	-
I.013747 - Installation of AC drainages - nationwide	N/A - IP20	RI	Pipelines	RDN	1	€ 502.218	€ 666.295	€ 164.077	33%	Budget adjustment	Construction costs higher than anticipated.	None
I.013751 - FP unspecifiable CAPEX-activ. 2020	N/A - IP20	RI	multiple	N/A	N/A	€ 739.940	€ 476.927	€ -263.013	-36%	Budget adjustment	Construction costs lower than anticipated	None
I.013756 - Repl. large-diameter valves OLS	N/A - IP20	RI	Other	N/A	1	€ 350.000	€ 189.644	€ -160.356	-46%	Budget adjustment	Construction costs lower than anticipated	None
I.013758 - Setting to 'Reserv.' CS Oldeboorn Loods Grijps.	N/A - IP20	RI	Other	N/A	1	€ 261.400	€ 267.732	€ 6.332	2%	-	-	-
I.013759 - Adjustment of S-3335 Z-335 Shell Moerdijk	N/A - IP20	RI	Valve set-up	RDN	1	€ 433.800	€ 453.829	€ 20.030	5%	-	-	-
I.013764 - Renovation Ressen N-493 GRS OLZM	N/A - IP20	RI	GRS	RDN	1	€ 90.000	€ 81.666	€ -8.334	-9%	-	-	-
I.013766 - Addressing A110 M&R Boxtel insufficiencies	N/A - IP20	RI	M&R	HPGG	1	€ 1.100.119	€ 799.573	€ -300.546	-27%	Budget adjustment	Lower investment costs by partially resolving the operational bottleneck	None
I.013771 - Procurement of flow-stop sets (bellows) OLS	N/A - IP20	RI	Other	N/A	1	€ 265.000	€ 264.084	€ -916	0%	-	-	-
I.013772 - Repl. v. set-up S-5537 Oude Maas	N/A - IP20	RI	Valve set-up	RDN	1	€ 750.000	€ 1.042.111	€ 292.111	39%	Budget adjustment	Construction costs higher than anticipated.	None
I.013784 - Repl. GV & reg. line 1, 2 Sonac W459	N/A - IP20	RI	GRS	RDN	1	€ 127.000	€ 106.463	€ -20.537	-16%	-	-	-
I.013789 - Repl. Zwolle S-9829 Hoogstraat	N/A - IP20	RI	Valve set-up	RDN	1	€ 464.200	€ 356.211	€ -107.989	-23%	-	-	-
I.013790 - Repl. Delden S-1244 GRS OLZD	N/A - IP20	RI	Valve set-up	RDN	1	€ 819.360	€ 593.616	€ -225.744	-28%	Budget adjustment	Construction costs lower than anticipated due to economies of scope	None
I.013791 - Repl. Beckum S-1109 gem. Hengelo OLZD	N/A - IP20	RI	Valve set-up	RDN	1	€ 709.700	€ 597.936	€ -111.764	-16%	-	-	-
I.013792 - Repl. Borculo S-9806 incl. VV Overbiel O	N/A - IP20	RI	Valve set-up	RDN	1	€ 539.400	€ 438.066	€ -101.334	-19%	-	-	-
I.013793 - Repl. Wamel S-1272 GRS OLZM	N/A - IP20	RI	Valve set-up	RDN	1	€ 579.700	€ 516.801	€ -62.899	-11%	-	-	-
I.013795 - Repl. Budel S-3232 GRS Budelco OLZ	N/A - IP20	RI	Valve set-up	RDN	1	€ 799.488	€ 591.496	€ -207.992	-26%	Budget adjustment	Less work required than anticipated	None
I.013804 - Repl. Denekamp N-335 GRS GV & reg line 3	N/A - IP20	RI	GRS	RDN	1	€ 56.000	€ 27.931	€ -28.069	-50%	Budget adjustment	Construction costs lower than anticipated	None
I.013806 - Repl. S-5963 Rijksweg A-20	N/A - IP20	RI	Valve set-up	RDN	1	€ 854.194	€ 698.140	€ -156.054	-18%	-	-	-
I.013809 - Repl. O2 gas detection Ommen OIO	N/A - IP20	RI	CS	HPGG	1	€ 382.000	€ 536.000	€ 154.000	40%	Budget adjustment	Construction costs higher due to higher cost prices than anticipated	None
I.013816 - Installation of 2 rectifiers Born RDN OLZB	N/A - IP20	RI	Pipelines	RDN	1	€ 85.182	€ 93.324	€ 8.143	10%	-	-	-

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Investment	bottleneck code	EI/RI classification	network component category	network pressure (RDN/ HPGG)	no. of components or km	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.013824 - GRS Repl. inlet valve line 2/3 Z180 Vlijmen	N/A - IP20	RI	GRS	RDN	1	€ 198.990	€ 161.016	€ -37.974	-19%	-	-	-
I.013826 - Repl. v. set-up S-1199 Kollum	N/A - IP20	RI	Valve set-up	RDN	1	€ 650.000	€ 520.293	€ -129.707	-20%	-	-	-
I.013827 - Expand monitoring rot. eqmt N2 Ommen	N/A - IP20	RI	Nitrogen installation	HPGG	1	€ 892.000	€ 894.645	€ 2.645	0%	-	-	-
I.013828 - FP unspecifiable CAPEX-activ. 2021	N/A - IP20	RI	multiple	N/A	N/A	€ 600.000	€ 600.000	€ -	0%	-	-	-
I.013829 - FP unspecifiable CAPEX-activ. 2022	N/A - IP20	RI	multiple	N/A	N/A	€ 600.000	€ 600.000	€ -	0%	-	-	-
I.013830 - Repl. S-3262 and resolving bottleneck Z-262 Cmpn Vghl	N/A - IP20	RI	Valve set-up	RDN	1	€ 690.000	€ 762.917	€ 72.917	11%	-	-	-
I.013832 - Green gas feed-in Wijster CS	N/A - IP20	RI	multiple	RDN	1	€ 2.830.000	€ 3.757.228	€ 927.228	33%	Budget adjustment	Construction costs higher than anticipated.	None
I.013833 - Repl. reg. & safety GRS N431 Geeuwenbrug	N/A - IP20	RI	GRS	RDN	1	€ 84.090	€ 90.436	€ 6.346	8%	-	-	-
I.013834 - Rectifier N-521-40 and IK N-520-21	N/A - IP20	RI	Pipelines	RDN	1	€ 118.354	€ 155.099	€ 36.745	31%	Budget adjustment	Construction costs higher than anticipated.	None
I.013836 - Repl. of S-3213 and addressing bttlnck Z-213 Boekel	N/A - IP20	RI	GRS	RDN	1	€ 692.219	€ 1.198.321	€ 506.102	73%	Budget adjustment	Higher construction costs anticipated due to price effects	None
I.013839 - Repl. Heerde N-499 heat exchanger line.1	N/A - IP20	RI	GRS	RDN	1	€ 66.000	€ 43.004	€ -22.996	-35%	Budget adjustment	Construction costs lower than anticipated	None
I.013840 - Repl. v. set-up S-7314 Nieuw Gastelsedijk	N/A - IP20	RI	Valve set-up	RDN	1	€ 700.000	€ 596.337	€ -103.663	-15%	-	-	-
I.013841 - Repl. v. set-up S-7264 branch Bruynzeel	N/A - IP20	RI	Valve set-up	RDN	1	€ 387.000	€ 432.454	€ 45.454	12%	-	-	-
I.013842 - Repl. regulator line 1 GRS N-414 Hengelo	N/A - IP20	RI	GRS	RDN	1	€ 47.000	€ 30.623	€ -16.377	-35%	Budget adjustment	Construction costs lower than anticipated	None
I.013844 - Installation of rectifier Z-567-01-KR-011 Ritthem	N/A - IP20	RI	Pipelines	RDN	1	€ 50.000	€ 45.111	€ -4.889	-10%	-	-	-
I.013847 - Repl. leaking regulator GRS N-700 Grouw	N/A - IP20	RI	GRS	RDN	1	€ 57.000	€ 117.530	€ 60.530	106%	Budget adjustment	Construction costs higher due to more work than anticipated	None
I.013850 - Adjustment of metering capacity Amercen Z-300	N/A - IP20	RI	GRS	HPGG	1	€ 65.000	€ 389.890	€ 324.890	500%	Budget adjustment	More work due to additional safety and insulation measures than anticipated	None
I.013854 - Repl. Rijssen S-1391	N/A - IP20	RI	Valve set-up	RDN	1	€ 531.000	€ 494.799	€ -36.201	-7%	-	-	-
I.013858 - Repl. Raalte N-356 3 valves	N/A - IP20	RI	GRS	RDN	1	€ 131.000	€ 89.153	€ -41.847	-32%	Budget adjustment	Construction costs lower than anticipated	None
I.013859 - Repl. of set-up S-1407 Hindeloopen GRS	N/A - IP20	RI	Valve set-up	RDN	1	€ 500.000	€ 760.330	€ 260.330	52%	Budget adjustment	Construction costs higher than anticipated.	None
I.013862 - Repl. of set-up S-5992 Kruisweg	N/A - IP20	RI	Valve set-up	RDN	1	€ 827.000	€ 833.252	€ 6.252	1%	-	-	-
I.013867 – Repl. boilers GRS Oeffelt Z-135	N/A - IP20	RI	GRS	RDN	1	€ 73.000	€ 101.011	€ 28.011	38%	Budget adjustment	Construction costs higher than anticipated.	None
I.013869 - Repl. S-9862 Globe v. set-up Harderwijk	013869	RI	Valve set-up	RDN	1	€ 698.365	€ 562.203	€ -136.162	-19%	-	-	-
I.013872 - Repl. S-2053 and S-5669 Haarlem Parkweg	AGREGATIE 013872	RI	Valve set-up	RDN	multiple	€ 808.964	€ 1.078.497	€ 269.533	33%	Budget adjustment	Construction costs higher than anticipated.	None
I.013873 - Repl. Renkum S-1096 Parenco	013873	RI	Valve set-up	RDN	1	€ 524.200	€ 627.862	€ 103.662	20%	-	-	-
I.013880 - Repl. Oss MR A-109 incl. valve	N/A - IP20	RI	M&R	HPGG	1	€ 160.000	€ 202.685	€ 42.685	27%	Budget adjustment	Construction costs higher than anticipated.	None
I.013885 - Repl. actuators A-196 OSZ	N/A - IP20	RI	Export stations	HPGG	1	€ 109.500	€ 111.637	€ 2.137	2%	-	-	-
I.013888 - GRS Remove/repl. boilers W-325 Krimpen	N/A-new	RI	GRS	RDN	1	€ -	€ 99.828	€ 99.828	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.013900 - Repl. actuators 3 RK Windeweer A-447	N/A - IP20	RI	Reducing station	HPGG	1	€ 120.000	€ 185.398	€ 65.398	54%	Budget adjustment	Construction costs higher due to more work than anticipated	None
I.013906 - Repl. S-5877 Kortelandse Dreef	013906	RI	Valve set-up	RDN	1	€ 560.369	€ 560.277	€ -92	0%	-	-	-
I.013908 - Repl. Zuidwolde S-1271	N/A - IP20	RI	Valve set-up	RDN	1	€ 525.000	€ 598.746	€ 73.746	14%	-	-	-
I.013920 - Repl. Emmen S-1378	013920	RI	Valve set-up	RDN	1	€ 585.669	€ 518.395	€ -67.274	-11%	-	-	-
I.013922 - CSR Repl. Angerlo A-147-A RS actuators	N/A - IP20	RI	Reducing station	HPGG	1	€ 250.000	€ 393.969	€ 143.969	58%	Budget adjustment	Construction costs higher than anticipated.	None
I.013923 - Repl. Neede S-9783 De Matterhaar	N/A - IP20	RI	Valve set-up	RDN	1	€ 750.000	€ 457.177	€ -292.823	-39%	Budget adjustment	Construction costs lower than anticipated	None
I.013934 - rectifier Rheden T22523 N-559-20	N/A - IP20	RI	Pipelines	RDN	1	€ 42.000	€ 56.816	€ 14.816	35%	Budget adjustment	Construction costs higher than anticipated.	None
I.013935 - Repl. valves Marknesse N-136 GOS	N/A - IP20	RI	GRS	RDN	1	€ 75.000	€ 118.867	€ 43.867	58%	Budget adjustment	Construction costs higher than anticipated.	None
I.013936 - Repl. Oostrum S-3119 connect. Oostrum	N/A - IP20	RI	Valve set-up	RDN	1	€ 725.000	€ 552.476	€ -172.524	-24%	-	-	-
I.013937 - Repl. Workum S-1482 Goede Verwachting	013937	RI	Valve set-up	RDN	1	€ 486.700	€ 559.681	€ 72.981	15%	-	-	-
I.013940 - GRS repl. boilers W-113 Zwijndrecht	N/A - IP20	RI	GRS	RDN	1	€ 89.000	€ 104.798	€ 15.798	18%	-	-	-
I.013943 - Repl. SNB A-181 ES Zevenaar	N/A - IP20	RI	Export stations	HPGG	1	€ 40.000	€ 45.890	€ 5.890	15%	-	-	-

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Investment	bottleneck code	EI/RI classification	network component category	network pressure (RDN/ HPGG)	no. of components or km	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.013944 - Repl. Weert S-3370 Hoechst GRS	N/A - IP20	RI	Valve set-up	RDN	1	€ 950.000	€ 436.306	€ -513.694	-54%	Budget adjustment	Lower investment costs by partially resolving the operational bottleneck	None
I.013945 - rectifier Ubbena T22118 N-507-30	N/A - IP20	RI	Pipelines	RDN	1	€ 42.000	€ 31.966	€ -10.034	-24%	-	-	-
I.013946 - SOLAR phase 2 - Adjust. to Cathodic protection	N/A - IP20	RI	Pipelines	HPGG	multiple	€ 150.000	€ 543.804	€ 393.804	263%	Budget adjustment	Construction costs higher than estimated due to longer permit procedures and more hours and materials than anticipated	None
I.013947 - Repl. v. set-up Rijsenhout S-2029 Rijsenh	N/A - IP20	RI	Valve set-up	RDN	1	€ 550.000	€ 564.388	€ 14.388	3%	-	-	-
I.013948 - Repl. Dreumel S-1290 Aansl. Dreumel	013948	RI	Valve set-up	RDN	1	€ 495.800	€ 603.899	€ 108.099	22%	-	-	-
I.013949 - Procur. 4 sandwich valves DN 600 & 900	N/A - IP20	RI	Other	N/A	1	€ 710.000	€ 684.389	€ -25.611	-4%	-	-	-
I.013953 - Repl. inl. valve GRS N-287 Nijkerkerveen	N/A - IP20	RI	GRS	RDN	1	€ 106.000	€ 54.210	€ -51.790	-49%	Budget adjustment	Construction costs lower than anticipated	None
I.013954 - Repl. Echt S-3296 Echt Havenweg	013954	RI	Valve set-up	RDN	1	€ 667.500	€ 728.724	€ 61.224	9%	-	-	-
I.013957 - rectifier Park Wanroij T22516 Z-518-08	N/A - IP20	RI	Pipelines	RDN	1	€ 42.000	€ 38.449	€ -3.551	-8%	-	-	-
I.013964 - Repl. v. set-up S-3157 Berlicum	013964	RI	Valve set-up	RDN	1	€ 681.406	€ 772.967	€ 91.561	13%	-	-	-
I.013969 - Repl. v. set-up S-1461 Godlinze	013969	RI	Valve set-up	RDN	1	€ 450.151	€ 493.561	€ 43.410	10%	-	-	-
I.013972 - Repl. hall lighting CS Ravenstein	N/A - IP20	RI	CS	HPGG	1	€ 122.000	€ 137.927	€ 15.927	13%	-	-	-
I.013980 - GRS Repl. GV-3-1 W-240 Alblasserdam	N/A - IP20	RI	GRS	RDN	1	€ 238.000	€ 218.574	€ -19.426	-8%	-	-	-
I.013981 - GRS Repl. control v. PCV-3-3 W220 Wieldrecht	N/A - IP20	RI	GRS	RDN	1	€ 54.000	€ 42.957	€ -11.043	-20%	-	-	-
I.013984 - GRS resolve bottlenecks W-185 Exxon	N/A - IP20	RI	GRS	RDN	1	€ 320.000	€ 1.350.857	€ 1.030.857	322%	Budget adjustment	More serious bottleneck than anticipated Complete replacement of valve set-up required instead of planned partial replacement	None
I.013986 - Repl. check valve MS1 Wieringermeer	N/A - IP20	RI	Blending station	HPGG	1	€ 500.000	€ 281.037	€ -218.963	-44%	Budget adjustment	Construction costs lower than anticipated	None
I.013990 - Inst. Levelling CS Grijpskerk	013990	RI	CS	HPGG	1	€ 1.206.000	€ 1.635.356	€ 429.356	36%	Budget adjustment	Construction costs higher than anticipated due to additional measures required and price effects	None
I.013995 - Repl. actuator valve 21 S-094 Putten	013995	RI	Valve set-up	HPGG	1	€ 120.000	€ 13.169	€ -106.831	-89%	Budget adjustment	Construction costs lower than anticipated	None
I.013997 - Purchase pressure plugs OLS	013997	RI	Other	N/A	1	€ 135.000	€ 123.863	€ -11.137	-8%	-	-	-
I.013998 - Repl. reg. line 2 Z-144 Sleeuwijk	013998	RI	GRS	RDN	1	€ 50.000	€ 30.958	€ -19.042	-38%	Budget adjustment	Work carried out in house Construction costs lower than anticipated	None
I.013999 - Repl. reg. line 3 Z177 Oosterhout	013999	RI	GRS	RDN	1	€ 96.000	€ 37.251	€ -58.749	-61%	Budget adjustment	Work carried out in house Construction costs lower than anticipated	None
I.014064 - Repl. reg. line 1 N-078 Harderwijk	014064	RI	GRS	RDN	1	€ 79.000	€ 27.193	€ -51.806	-66%	Budget adjustment	Construction costs lower than anticipated	None
I.014065 - GRS Repl. heat exchanger Katwijk W-111	014065	RI	GRS	RDN	1	€ 59.560	€ 61.186	€ 1.626	3%	-	-	-
I.014348 - V unspecifiable CAPEX for O 2021	N/A - IP20	RI	multiple	N/A	N/A	€ 700.000	€ 765.709	€ 65.709	9%	-	-	-
I.014349 - V unspecifiable CAPEX for O 2022	N/A - IP20	RI	multiple	N/A	N/A	€ 650.000	€ 650.000	€ -	0%	-	-	-
I.014350 - Repl. monitor line 3 + reg line 1 Z-308	014350	RI	GRS	RDN	multiple	€ 80.821	€ 82.964	€ 2.143	3%	-	-	-
I.014355 - Repl. valves 2, 3 GRS Z107 Sliff.weg	014355	RI	GRS	RDN	multiple	€ 186.000	€ 174.681	€ -11.319	-6%	-	-	-
I.014376 - Repl. Oldenzaal S-9099 incl. pipeline rearrangement	014376	RI	Valve set-up	RDN	1	€ 636.370	€ 689.581	€ 53.211	8%	-	-	-
I.014398 - Repl. Zweekhorst A-406 air handling units	014398	RI	CS	HPGG	1	€ 782.800	€ 660.670	€ -122.130	-16%	-	-	-
I.014399 - Install. Hengelo N-566-08 2 drainage boxes	N/A-new	RI	Pipelines	RDN	1	€ -	€ 23.807	€ 23.807	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014405 - Repl. reg en gasmtr line 1 Z214 Schijndel	014405	RI	GRS	RDN	multiple	€ 92.903	€ 43.541	€ -49.362	-53%	Budget adjustment	Work carried out in house Construction costs lower than anticipated	None
I.014417 - Repl. boilers GRS W-100 Briele	014417	RI	GRS	RDN	1	€ 215.000	€ 236.247	€ 21.247	10%	-	-	-
I.014423 - Increase LNG PS capacity H-gas conv.	014423	RI	LNG	HPGG	1	€ 1.234.000	€ 2.648.981	€ 1.414.981	115%	Budget adjustment	Wider scope and higher construction costs than anticipated	None
I.014430 - Repl. pressure shutdown valve GRS Bergen W-241	014430	RI	GRS	RDN	1	€ 95.900	€ 25.151	€ -70.748	-74%	Budget adjustment	Construction costs lower than anticipated	None
I.014432 - Repl. reg. monitor line 3 Slootdorp W-407	014432	RI	GRS	RDN	multiple	€ 94.000	€ 36.657	€ -57.343	-61%	Budget adjustment	Construction costs lower than anticipated	None
I.014433 - Repl. GV 1-1 for HS Zandvoort W-145	014433	RI	GRS	RDN	1	€ 111.192	€ 47.625	€ -63.567	-57%	Budget adjustment	Construction costs lower than anticipated	None

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Investment	bottleneck code	EI/RI classification	network component category	network pressure (RDN/ HPGG)	no. of components or km	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.014443 - Repl./remove boilers GRS Z-072 Bergeyk	014443	RI	GRS	RDN	1	€ 101.000	€ 165.086	€ 64.086	63%	Budget adjustment	Additional costs due to unforeseen work and materials required	None
I.014444 - Repl. reg valves GRS Westergas W-110	014444	RI	GRS	RDN	multiple	€ 148.000	€ 67.141	€ -80.859	-55%	Budget adjustment	Construction costs lower than anticipated	None
I.014453 - Repl. GV 2-1 GRS W-057 Schiphol West	014453	RI	GRS	RDN	1	€ 79.285	€ 87.847	€ 8.562	11%	-	-	-
I.014459 - Repl. reg. line 1 & 2 N-275 Hoogkerk	014459	RI	GRS	RDN	multiple	€ 41.000	€ 60.082	€ 19.082	47%	Budget adjustment	Construction costs higher than anticipated.	None
I.014478 - PIG-22 Construction costs Pigging 2022	AGREGATIE 014478	RI	Pipeline systems cluster	HPGG	multiple	€ 40.000	€ 18.740	€ -21.260	-53%	Budget adjustment	Lower investment costs by partially resolving the operational bottleneck	None
I.014523 - Increase capacity W-158 Air Liquide	N/A-new	RI	GRS	RDN	multiple	€ -	€ 7.693	€ 7.693	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014527 - Install. alternating current drainage Theemsweg	N/A-new	RI	GRS	RDN	1	€ -	€ 13.248	€ 13.248	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014530 - Various components N-380 Wolvega	014530	RI	GRS	RDN	1	€ 188.000	€ 172.730	€ -15.270	-8%	-	-	-
I.014556 - Repl. reg line 4 W-070 Keilehaven	N/A-new	RI	GRS	RDN	1	€ -	€ 45.363	€ 45.363	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014568 - Repl. Geleen S-404 AFA 2 Chemelot RDN	N/A-new	RI	Valve set-up	RDN	1	€ -	€ 691.185	€ 691.185	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014573 - repl. reg. monitor W-276 Alphen a/d Rijn	N/A-new	RI	GRS	RDN	1	€ -	€ 45.009	€ 45.009	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014575 - Modify W187 PGI Alkmaar line 1	N/A-new	RI	GRS	HPGG	1	€ -	€ 18.101	€ 18.101	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014591 - Repl. various components N-029 Joure DE	N/A-new	RI	multiple	RDN	multiple	€ -	€ 168.622	€ 168.622	N/A	Unanticipated bottlenecks	Unexpected defect	None
I.014689 - Repl. regulator/pressure shutdown valve Z-120	N/A-new	RI	GRS	RDN	1	€ -	€ 48.457	€ 48.457	N/A	Unanticipated bottlenecks	Unexpected defect	None

Table V.2: List of completed investment projects – Major investments

Investment	TYNDP code	bottleneck code	EI/RI classification	location	network pressure (RDN/ HPGG)	expected year of commissioning	actual year of commissioning	commissioning variance	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.013166 - LNG PS Repl. EI and UCP	N/A	N/A	RI	Rotterdam	HPGG	2020	2022	2	€ 5.184.385	€ 5.785.000	€ 600.615	12%	Changes to timetable	New timetable drawn up after coordination with supplier	None
I.013556 - ZON: acquisition of ZEBRA network	N/A	N/A	RI	Zeeland/Brabant	HPGG	2020	2021	1	€ 3.768.000	€ 3.559.197	€ -208.804	-6%	Changes to timetable	New timetable drawn up after alternatives analysis	None
I.013556 - ZON: acquisition of ZEBRA network	N/A	N/A	RI	Zeeland/Brabant	HPGG	2020	2021	1	€ 3.768.000	€ 3.559.197	€ -208.804	-6%	Changes to timetable	New timetable drawn up after alternatives analysis	None
I.013712 - G-H conversion Shell Chemie Klundert	N/A	N/A	RI	Klundert	HPGG	2022	2022	0	€ 5.600.000	€ 6.488.993	€ 888.993	16%	-	-	-
I.013717 - G-H conversion Emmtec Services Emmen	N/A	N/A	RI	Emmen	HPGG	2022	2022	0	€ 5.300.000	€ 6.265.733	€ 965.733	18%	-	-	-
I.014385 - UGS Grijpskerk G-gas	N/A	I.014385	RI	Grijpskerk	HPGG	2022	2022	0	€ 5.860.000	€ 5.797.284	€ -62.716	-1%	-	-	-
I.014619 - Connection FSRU Eemshaven	N/A	PG-I.014619	RI	Eemshaven	HPGG	2022	2022	0	€ 7.000.000	€ 6.833.645	€ -166.355	-2%	-	-	-

Table V.3: List of completed investment projects – Connections and diversions

Investment	bottleneck code	diversion/ connection classification	EI/RI classification	network component category	network pressure (RDN/ HPGG)	no. of components or km	expected year of commissioning	actual year of commissioning	commissioning variance	estimated costs	actual costs	delta (abs)	delta (%)	type of variance	cause of variance	impact of variance
I.013606 - Diversion of Echt Havenweg Z-540-01-KR-026, A2V	N/A	diversion	RI	Pipelines	RDN			2022		€ 719.900	€ 852.082	€ 132.182	18%	-	-	-
I.013607 - Diversion of Echt Geleenbeek Z-540-01-KR-023, A	N/A	diversion	RI	Pipelines	RDN			2022		€ 1.162.100	€ 891.209	€ -270.891	-23%	-	-	-
I.013608 - Diversion of Echt Comp.dijk Z-540-01-KR-022, A2	N/A	diversion	RI	Pipelines	RDN			2022		€ 590.500	€ 456.633	€ -133.867	-23%	-	-	-
I.013609 - Diversion of Roosteren Z-540-01-KR-019, A2VK,	N/A	diversion	RI	Pipelines	RDN			2022		€ 842.800	€ 1.022.630	€ 179.830	21%	-	-	-
I.013611 - Diversion of Born VDL Z-540-26-KR-001, A2VK, K	N/A	diversion	RI	Pipelines	RDN			2022		€ 615.800	€ 647.046	€ 31.246	5%	-	-	-
I.013612 - Diversion of Born - Limbricht Z-540-01-KR-009,	N/A	diversion	RI	Pipelines	RDN			2022		€ 734.000	€ 797.045	€ 63.045	9%	-	-	-
I.013721 - Diversion of Roermond Z-540-01-KR-055/056 N280	N/A	diversion	RI	Pipelines	RDN			2021		€ 808.088	€ 713.248	€ -94.840	-12%	-	-	-
I.013731 - Diversion of A-531 Raamdonksveer A27 road widening	N/A	diversion	RI	Pipelines	HPGG			2021		€ 1.408.800	€ 1.302.912	€ -105.888	-8%	-	-	-
I.013739 - Capacity expansion Reko W-250-52 OLWR	N/A	connection	RI	GRS	RDN	1		2021		€ 79.000	€ 18.130	€ -60.871	-77%	Budget adjustment	Work carried out in house Construction costs lower than anticipated	None
I.013745 - Diversion of W-527-07-KR-018/017-2 Meteren	N/A	diversion	RI	Pipelines	RDN			2022		€ 861.600	€ 673.160	€ -188.440	-22%	-	-	-
I.013818 - W-755 GRS Rotterdam Stadionlaan	N/A	diversion	RI	GRS	RDN	1		2021		€ 2.000.000	€ 1.747.542	€ -252.458	-13%	-	-	-
I.013819 - Diversion of Venray Z-541 redevelopment N270 Vi	N/A	diversion	RI	Pipelines	RDN			2022		€ 840.000	€ 686.551	€ -153.449	-18%	-	-	-
I.013857 - New connection SGN Nieuw Rijsenhout	N/A	connection	RI	multiple	RDN	1		2021		€ 556.000	€ 511.362	€ -44.638	-8%	-	-	-
I.013955 - New Cathodic protection drainage channels Zeeland Tennet 380 KV	N/A	diversion	RI	Pipelines	HPGG	1		2021		€ 280.000	€ 219.039	€ -60.961	-22%	-	-	-
I.013973 - New gas heating system Z-004 Moerdijk	N/A	connection	RI	GRS	HPGG	1		2022		€ 150.000	€ 255.101	€ 105.101	70%	Budget adjustment	Scope of works determined more accurately after detailed engineering More work than previously estimated	None
I.013989 - Diversion of W-529-01 Aalsmeer Spoorl	13989	diversion	RI	Pipelines	RDN	1	2021	2021	0	€ 453.522	€ 423.371	€ -30.151	-7%	-	-	-
I.014369 - Increase throughput capacity GRS Schiedam W-230	14369	connection	RI	GRS	RDN	1	2022	2022	0	€ 192.596	€ 177.267	€ -15.329	-8%	-	-	-
I.014370 - SOLAR phase 2 - Install connection Moerdij	14370	connection	RI	Valve set-up	HPGG	1	2022	2022	0	€ 290.000	€ 290.000	€ -	0%	-	-	-
I.014371 - Diversion of W-531 at Waardenburg	14371	diversion	RI	Pipelines	RDN	1	2022	2022	0	€ 1.210.135	€ 1.460.602	€ 250.467	21%	-	-	-
I.014373 - Diversion of Tilburg Z-522-01 Industrial harbour	14373	diversion	RI	Pipelines	RDN	1	2022	2022	0	€ 891.800	€ 744.580	€ -147.220	-17%	-	-	-
I.014374 - Diversion of Keldonk Z-542-01 due to expansion of N279	14374	diversion	RI	Pipelines	RDN	1	2023	2022	-1	€ 985.700	€ 1.233.439	€ 247.739	25%	Changes to timetable	Project was accelerated at the request of the provincial authorities	None
I.014435 - Increase capacity W746 Neste Oil	14435	connection	RI	GRS	HPGG	1	2022	2022	0	€ 318.770	€ 321.582	€ 2.812	1%	-	-	-
I.014515 - Acquis. 3 connection lines Liander	14515	connection	RI	Pipelines	RDN	2.5km	2022	2022	0	€ 153.390	€ 131.658	€ -21.732	-14%	-	-	-

Appendix VI.1: Replacement of gas chromatographs

Information on major investment projects (look ahead to 2024-2033)	
a. Code	I.014727
b. TYNDP code	N/A
c. Bottleneck	Quality bottlenecks (obsolete systems)
d. Investment classification (EI or RI)	Replacement investment
e. Name and location of grid asset	This concerns gas chromatographs at gas receiving stations, metering and regulating stations, export stations, green gas boosters, blending stations and compressor stations.
f. Network pressure (RDN/HPGG)	HPGG
g. Project phase	Preparations
h. Year of FID	2024
i. Year of commissioning	2028
j. Investments per year	2023: (€ thousands) 300 2024: (€ thousands) 1,725 2025: (€ thousands) 1,726 2026: (€ thousands) 1,726 2027: (€ thousands) 1,726 2028: (€ thousands) 1,726 Total: (€ thousands) 8,929
k. Explanation of how the investment solves the bottleneck	Several types of gas chromatographs (GCs) used in GTS installations are obsolete and it will soon no longer be possible to maintain these. A GC is a measuring instrument that determines the composition of the gas being transmitted. Approximately 170 GCs have been installed in the GTS network to monitor gas quality and calculate energy content during gas delivery and export. Brand-new units of the current GCs have not been available since 2015. Since 2016, these GCs have had the status of obsolete and the supplier will only continue to provide best effort service for a number of years. Parts for maintenance were still available, until the supplier also declared a number of parts to be obsolete in 2022. In the study phase, the optimum replacement strategy was determined. This strategy involves all obsolete systems gradually being replaced and sufficient parts remaining available over the intended multi-year replacement period to ensure that the systems continue to function reliably.

l. Alternative assessment (if not in realisation phase by 1/1/2024)	
No-action alternative	Doing nothing means that the GCs will reach the end of their service life and there will be insufficient parts and service options available to ensure the reliability of these systems, with the result that GTS will not be able to meet the legal requirements for gas metering.
Alternatives	The following alternatives were investigated during the study phase: 1. Replacement within one year 2. Replacement over several years
Alternatives analysis (technical, financial and social effects)	Replacing all relevant GCs in one year means a greater strain on resources in GTS' and the contractors' organisations, as well as higher costs in that one year. Replacing all relevant GCs over several years will result in a better spread of activities at GTS and at contractors and the investment costs will be better spread. The investment costs of both alternatives are comparable.
Support for the estimation of impacts of the alternatives	With both alternatives, no impact on the environment is expected because the works take place at GTS' own properties. The works will also be scheduled in such a way that there will be no impact on gas transmission. With alternative 2, the impact on resources will be limited due to the works being spread over several years.
Rationale for selection of proposed alternative	Based on the alternatives analysis, GTS opts for alternative 2, which limits the impact on GTS' and the contractors' resources and leaves sufficient spare parts available for a proper phasing out of the obsolete components.
Concerning missing information	This project is in the preparation phase. The stated budgets and spread over the years are expectations based on a pilot.

Appendix VI.2: Green gas gathering pipeline A-601-west

Information on major investment projects (look ahead to 2024-2033)	
a. Code	PG-I.014852
b. TYNDP code	N/A
c. Bottleneck	Capacity bottleneck
d. Investment classification (EI or RI)	Expansion investments
e. Name and location of grid asset	A-601-west pipeline
f. Network pressure (RDN/HPGG)	HPGG
g. Project phase	Preparations
h. Year of FID	2024
i. Year of commissioning	2026
j. Investments per year	2023: (€ thousands) 50 2024: (€ thousands) 950 2025: (€ thousands) 1,000 2026: (€ thousands) 10,000 Total: (€ thousands) 12,000
k. Explanation of how the investment solves the bottleneck	This investment will solve two bottlenecks. • In order to keep the licence to operate for the A-601 pipeline, which is the 'Zuidwal' pipeline, the insides of this pipeline have to be inspected. Detailed studies have shown that this is highly technically complex for the western section of the pipeline, because there is too little gas flowing through the pipeline. The gas producer has stopped feeding gas into this pipeline, because there is no more production from the gas field. Additionally, the fact that there is just one party connected to this pipeline means there is virtually no gas offtake from this pipeline. • In the north-western Friesland region, more green gas is produced than is consumed. On top of that, GTS and the two RNOs have received various requests for new large green gas connections in this region. These developments create congestion for the offtake of green gas. A total capacity of over 20,000m3(n)/h of green gas production is being considered, whereby the expected potential of local biomass and green gas feed-in is even greater than currently stated by producers. Future green gas feed-in capacity cannot not be accommodated in the RNO networks. The RDN cannot accommodate the future supply of green gas in the summer either. The minimum offtake capacity in this RDN area was 10,000m3(n)/h last summer. The surplus green gas will, therefore, have to be transported to the HPGG over the summer periods.
	At present, planning permission applications have been submitted for an RNO-to-RDN green gas booster at three different sites. In addition, an extra booster station will be needed to compress gas that goes from the RDN to the HPGG over the summer periods, when more green gas is produced than is consumed. This has been worked out in alternative 2A. Alongside the option of having three RNO-to-RDN boosters and one RDN-to-HPGG booster, GTS has worked out a second alternative, which is to create a green gas gathering pipeline (alternative 2B). For both these bottlenecks, a preferred alternative has been selected as the solution. • The first bottleneck, i.e. the obligation to conduct an internal pipeline inspection, will be eliminated if the pipeline is disconnected from the HPGG for H-gas and used at a lower pressure. • The second bottleneck will be resolved by converting the western section of the A-601 pipeline (between Harlingen and Kootstertille) from an HPGG H-gas pipeline into a low-pressure green gas gathering pipeline.
l. Alternative assessment (if not in realisation phase by 1/1/2024)	
No-action alternative	Doing nothing means that the A-601 pipeline will have to be removed from the high-pressure gas transmission network, because it is not possible to confirm the pipeline's integrity. Additionally, the RNOs will be unable to accept the feed-in of green gas offered in the summer, which will negatively affect the profitability of the businesses wanting to feed in green gas. GTS will have to offer the parties wanting to feed in green gas in Harlingen an HPGG H-gas connection, which will result in higher quality requirements and high compression costs.
Alternatives	The RNOs have looked into whether they can solve the problem by expanding the service area for green gas by interconnecting RNO networks. Connecting RNO networks would be carried out by the RNOs in places where this is possible. While this increases offtake in those specific areas, it does not solve the green gas congestion throughout the entire area. The following alternatives have been worked out for the first bottleneck (pipeline integrity): • Alternative 0: No action. This is not an option, because pipeline integrity would not be guaranteed in that case. • Alternative 1: Internal pipeline inspection using nitrogen or another medium. This is highly technically complex and very costly due to the large volume of the pipeline, which is 45km long and has a diameter of 30". • Alternative 2: Disconnect the western section of the A-601 pipeline from the HPGG and dismantle it, or use it at a lower gas pressure, so that an internal inspection will no longer be needed. The following alternatives have been worked out for the second bottleneck (green gas transport): • Alternative 2A: Dismantle the western section of the A-601 pipeline and accommodate the feed-in of green gas using green gas boosters (GGBs). • Alternative 2B: Maintain the western section of the A-601 pipeline, switch it to a lower pressure, and use it as a green gas gathering pipeline between Harlingen and Kootstertille.

Alternatives analysis (technical, financial and social effects)	Given that alternative 1 is highly technically complex and involves high cost, alternative 2 is the preferred alternative. Alternative 2A, i.e. the use of green gas boosters to move the gas from RNO to RDN does not completely solve the problem given that green gas production will eventually exceed the offtake capacity in the RDN. This means that compressors must also be installed to compress gas moving from the RDN to the HPGG. The TCO of this alternative is € 48.3 million. Alternative 2B, i.e. using the Zuidwal pipeline as a green gas gathering pipeline, will enable transport of the gas to the HPGG in one compression step. The TCO of this alternative is € 13 million.
Support for the estimation of impacts of the alternatives	Alternative 2B, i.e. the green gas gathering pipeline, offers the option of transporting the surplus green gas out of the area and into the HPGG in one compression step. This means that there would probably be no need to install green gas compressors in the area. Additionally, the fact that alternative 2B has the lowest TCO makes it the preferred alternative from a financial standpoint. The single party connected to the western section of the A-601 (HPGG) pipeline will be connected to the nearby regional distribution network (RDN). Two envisioned green gas producers in Harlingen can also be connected to this new connecting pipeline (approx. 2.5km). With a green gas gathering pipeline between Harlingen and Kootstertille, GTS can transport the RNOs' surplus green gas to the HPGG for H-gas via a new compressor station on the site of the former Kootstertille blending station. With the complete reuse of existing infrastructure and sites, the impact on the environment is very limited.
Rationale for selection of proposed alternative	Based on the assessment of the alternatives, GTS chooses alternative 2 and subsequently alternative 2B. The transmission of green gas can be realised entirely using existing pipelines. The compressors can be installed at the site of the former Kootstertille blending station. Alternative 2B is the most robust and cost-efficient solution with the lowest impact on the environment.
Concerning missing information	This project is in the preparation phase. The stated budgets and spread over the years are expectations based on cost estimates from preliminary studies.

Appendix VII: Report on the security of supply

Article 52a of the Dutch Gas Act stipulates that the Minister must submit an annual report to the European Commission on the security of supply. Pursuant to the Decree on the

performance of duties under Article 52a of the Dutch Gas Act dated 1 July 2011, the Minister has assigned this responsibility to GTS. Most of the topics are included in this IP. The two remaining topics, peak supply and supply in the event of a licence holder's insolvency, are addressed below.

To guarantee the supply of gas to small-scale consumers, GTS has been assigned two statutory duties: firstly, it must ensure the supply to small-scale consumers during peak periods, and secondly, it must take certain actions in the event that a licence holder can no longer meet its financial obligations and the supply to small-scale consumers is endangered as a result. These two statutory duties are described in the Security of Supply (Gas Act) Decree.

Peak supply

Pursuant to the Security of Supply (Gas Act) Decree dated 13 April 2004, GTS has a statutory obligation to take measures to allow licence holders to continue to supply small-scale consumers (consumer category G1A and G2A) with natural gas during 'peak supply periods'. A peak supply period is deemed to be a period during which the mean effective 24-hour temperature is minus 9°C or lower. GTS provides all necessary facilities to enable licence holders to continue to supply all small-scale consumers in the Netherlands during such periods, including gas purchasing, flexibility services and gas transmission over the national gas grid. The measures taken and facilities provided must be such that peak supply can be provided on a day with a mean effective 24-hour temperature of minus 17°C, as measured at the Royal Netherlands Meteorological Institute in De Bilt.

Each year, GTS determines the capacity and volume required for peak supply for this service. The required volume and capacity is determined on the basis of historical temperature data series and consumption information for the previous winters at the relevant exit points. GTS arranges gas procurement and the procurement of flexibility services by tender; the required transmission capacity is reserved by GTS.

The obligation to provide peak capacity concerns a capacity of 22GW and a volume of 864.6GWh. The winter of 2017-2018 was the last winter in which a mean effective 24-hour temperature of minus 9°C or lower occurred.

Supply in the event of a licence holder's insolvency

When a licence holder is no longer able or deemed to be able to meet its financial obligations, ACM can make a decision to revoke that holder's licence. The decision will take effect no later than twenty working days after the decision is made. GTS can be asked to guarantee the payment of the procurement of gas for supply to small-scale consumers during this period.

If, on no later than the tenth working day after the decision has been made, not all small-scale consumers of the licence holder have been transferred to another licence holder, GTS will assign the remaining small-scale consumers to another licence holder. GTS will provide the receiving licence holder with the relevant data of the allocated small-scale consumers. The licensed suppliers who are assigned small-scale consumers as a result of this transfer can, if necessary, also ask GTS to guarantee the payment for the procurement of gas for these new customers for a period of up to two months.

The Dutch Energy Data Exchange Association (NEDU; currently called MFF-BAS) has drawn up a description of the processes relating to the administrative handling of a case of insolvency of a licence holder and the distribution of small-scale consumers among the other licence holders.

A protocol has been drawn up by ACM, TenneT and GTS for mutual cooperation and for cooperation with EDSN (Energie Data Services Nederland) in the event that the supply by a licence holder is endangered.

The situation in which a licence holder has become insolvent and ACM has withdrawn their licence has arisen several times in the past. Pursuant to the Security of Supply (Gas Act) Decree, in a few cases GTS guaranteed payment for the procurement of gas for supply to small-scale consumers.

Based on these experiences, GTS has drawn up sample texts that can be used for the guarantees. In several cases, GTS allocated the small-scale consumers of a licence holder to other licence holders. This was done in collaboration with TenneT and EDSN. This method was successful and can be used again for the next distribution of remaining small-scale consumers should such a situation arise again in the future.

Appendix VIII: Detailed calculation of the discount rate

The value of 1 risk point for a business value in the risk matrix corresponds to:

$$\frac{1}{10 \cdot \sqrt{10}} \text{year}^{-1} \cdot 1\text{M€} \approx 31.6\text{k€} \cdot \text{year}^{-1}$$

Select the economically relevant period N years (generally N=25 years). With a WACC equal to W and inflation equal to I, the discount rate r equals: $\mathbf{r} = \frac{\mathbf{1+I}}{\mathbf{1+W}}$

So for the present value CW of a risk R over a period of 1...N years:

$$\text{CW} = \text{R} \cdot \sum_{j=1}^{N} r^{j-1} = \text{R} \cdot \frac{1 - r^N}{1 - r}$$

For example: let's say the risk has been set at C3 (1 point, $\text{k€}\frac{31.6}{\text{year}}$), the WACC is 5.39% per year (before tax) and inflation is 2% per year. In that case:

$$r = \frac{1 + 0{,}02}{1 + 0{,}0539} = 0{,}9678$$

This means that the present value over a period of 25 years equals:

$$\text{CW} = \text{k€}\frac{31.6}{\text{year}} \cdot \frac{1 - 0.9678^{25}}{1 - 0.9678} \text{year} = \text{k€ } 31.6 \cdot 17.36 = \text{k€ } 549$$

Appendix IX: Biggest risks[66]

ID	Asset category	Event	Consequence	Explanation and measure	L	Su	R	T	Sa	Total risk points	NPV of risk (€ millions)
Biggest risks relating to bottlenecks											
1186	Pipelines	Various Wadden Sea pipelines are affected by soil cover shortfalls.	Soil cover shortfalls can pose additional risk due to the pipelines becoming damaged or exposed.	An annual programme will ensure that the soil cover will be kept, as much as possible, up to standard. Measure: operational solution.	D4	B4		D4	B4	413	226,7
1306	Compressor stations	The quality of components brings these below the rejection level.	The diminished quality of the components poses a risk of transmission-related loss or financial loss.	By means of a replacement investment the components are replaced with new ones.	3			683		686	376,6
1064	multiple	Obsolete metering equipment.	Without the equipment, GTS cannot comply with the legal provisions regarding measuring the quality of natural gas. The risk will only increase over time.	Through a replacement investment the obsolete metering equipment will be systematically replaced.	C5					270	148,2
Biggest accepted risks											
131	Metering and regulating stations	Odorisation outside area of work (<12mg/m3(n) or > 24mg/m3(n))	Supplying natural gas with a THT concentration (<10mg/m3(n)) outside agreements with RNO and competent authority without alarms.	Uncontrolled escape of natural gas is less likely to be noticed if the gas is not odourised. Risk points calculated using former methodology. Measure: tight monitoring of performance and quick action in event of station alarms.	B5	A5	B5		D3	155 (oud)	12,4
172	HPGG valve locations	Pinhole	Methane emissions	Several valve locations constantly leak small amounts of natural gas. Taken as a whole, these small leaks cause significant damage. Measure: locate leak and repair it and/or replace valve.	B5	B5				20	11,0
186	HPGG valve locations	Loss of function (open & closed)	Unable to depressurise line for scheduled works.	If a section of pipeline needs to be purged of gas for a project, the gas flow is shut off at the nearest upstream valve set-up to the works. If the gas flow cannot be shut off sufficiently, the next upstream valve location must be used, resulting in additional natural gas emissions and higher repair costs. Measure: operational solution, repair and/or replacement.	C5	B5		D3		120	65,9
198	RDN valve locations	Pinhole	Methane emissions	Several valve locations constantly leak small amounts of natural gas. Taken as a whole, these small leaks cause significant damage. Measure: locate leak and repair it and/or replace valve.	B5	B5				20	11,0
206	RDN valve locations	Loss of function (open & closed)	Unable to depressurise line for scheduled works.	If a section of pipeline needs to be purged of gas for a project, the gas flow is shut off at the nearest upstream valve set-up to the works. If the gas flow cannot be shut off sufficiently, the next upstream valve location must be used, resulting in additional natural gas emissions and higher repair costs. Measure: operational solution repair and/or replacement.	B5	B5		C3		21	11,5
210	Nitrogen installations	Short outage at nitrogen installation	Loss of gas transmission for approximately 24 hours.	With the loss of the extraction capacity of the Groningen field, the importance of nitrogen installations has increased. Measure: operational solution.	B5			E2	D1	20,1	11,0
214	High-pressure pipeline	Pipeline damage incidents	Dent	Around 2 to 3 damage incidents are expected per year due to mechanical excavation works by third parties. Measure: environs management.	B5					28,2	15,5

L: Loss tolerance
Su: Sustainability
R: Reputation
T: Transport security
Sa: Safety

Continued on next page

Biggest risks continued previous page

ID	Asset category	Event	Consequence	Explanation and measure	L	Su	R	T	Sa	Total risk points	NPV of risk (€ millions)
217	RDN pipelines	Loss of containment	Leak, no ignition	Mechanical excavation works may cause a leak (hole diameter 2cm). In most cases, a leak will not lead to ignition. Measure: environs management.	B4	B4		C4	A4	25,2	13,8
220	RDN pipelines	Loss of containment	Rupture, ignition	Mechanical excavation works may cause a rupture (hole diameter greater than or equal to pipe diameter). This will often lead to ignition and therefore poses a high safety risk. Measure: environs management.	C3	B3		C3	E3	89,6	49,2
223	High-pressure pipeline	Loss of containment	Leak, no ignition	Mechanical excavation works may cause a leak (hole diameter 2cm). In most cases, a leak will not lead to ignition. Measure: environs management.	C4	B4		A4		20,4	11,2
226	High-pressure pipeline	Loss of containment	Rupture, ignition	Mechanical excavation works may cause a rupture (hole diameter greater than or equal to pipe diameter). This will often lead to ignition and therefore poses a high safety risk. Measure: environs management.	D1	B1		D1	E1	76,2	41,8

L: Loss tolerance
Su: Sustainability
R: Reputation
T: Transport security
Sa: Safety

66 The risk matrix with a further explanation of the risk scores can be found in Section 4.4.3.2 of the description of GTS' Quality Assurance System (Quality Document).

Appendix X: Border station capacity

			GW																			
NAME VIP/IP	NWP	DIRECTION	Oct.-23	Oct.-24	Oct.-25	Oct.-26	Oct.-27	Oct.-28	Oct.-29	Oct.-30	Oct.-31	Oct.-32	Oct.-33	Oct.-34	Oct.-35	Oct.-36	Oct.-37	Oct.-38	Oct.-39	Oct.-40	Oct.-41	Oct.-42
VIP TTF-THE-L	301568	entry	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
		exit	28,9	24,2	19,4	14,6	9,8	5,1	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
underlying IPs:																						
Winterswijk (OGE)	300133																					
Zevenaar (OGE)	300132																					
Tegelen (OGE)	300138																					
Haanrade (Thyssengas)	300141																					
Dinxperlo (BEW)	300140																					
Oude Statenzijl (GTG Nord-G)	300136																					
Oude Statenzijl (GUD-G)[OBEBG]	300144																					
Oude Statenzijl (GTG NORD-H)	301550																					
VIP-TTF-THE-H	301569	entry	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3	21,3
		exit	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9	27,9
underlying IPs:																						
Bocholtz TENP (OGE - Flx TENP)	300139																					
Bocholtz Vetschau (Thyssengas)	301368																					
Oude Statenzijl (OGE]	300145																					
Oude Statenzijl (GUD-H)[OBEBH]	300146																					
Oude Statenzijl (Gascade-H)	300147																					
VIP-BENE	301546	entry	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0	18,0
		exit	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0	33,0
underlying IPs:																						
's Gravenvoeren (Fluxys)	300143																					
Zandvliet (Fluxys-H)	301184																					
Zelzate (Fluxys)	301111																					
VIP BENE-L	301576	entry	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
		exit	24,8	18,6	15,2	10,0	7,0	4,2	1,5	1,5	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
underlying IPs:																						
HILVARENBEEK (FLUXYS)	300131																					
VLIEGHUIS (RWE)	300142	entry	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
		exit	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7	3.7
EMDEN EPT (GASSCO)	301113	entry	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2	40,2
		exit	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
ROTTERDAM (GATE)	301345	entry	21,0	21,0	21,0	21,0[67]	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0	21,0
		exit	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0
EEMSHAVEN (Eems Energy Terminal)	301574	entry	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0	15,0
		exit	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0	0,0

67 Capacity expected to be increased to 27GW in 2026.

Appendix XI: Consultation matrix

Party	Number	Consultation response	GTS' response	Method of processing
	1.1	LNG: Following the proactive and effective LNG terminal capacity expansion in Eemshaven and Rijnmond and the connection to the national gas grid, VEMW welcomes further initiatives to explore options for new LNG capacity in the Netherlands and countries in our region.	GTS would like to thank VEMW for their response.	The response did not result in a change to the final version of the 2024 IP.
	1.2	Green gas: The European Union has set a green gas target of 35 bcm per year by 2030. The Dutch government wants to contribute 2 bcm towards that target by 2030. The Netherlands Authority for Consumers and Markets (ACM) states that network operators must facilitate the feed-in of green gas in line with the blending obligation (1.6 bcm). In addition, in the run-up to the next regulatory period, which starts in 2027, ACM wants to look into the overall costs caused by green gas producers on the grid, and how these costs can be compensated. While VEMW does not detract from the targets, it does have doubts about the feasibility of the targets. After all, green gas production currently stands at just 0.25 bcm. Production would therefore have to be increased eightfold (!) over a period of six years. The (un)feasibility may have consequences for the investments that GTS has included in the 2024 IP for things such as booster stations and pipelines (connections). Does GTS share these doubts? And if so, how does GTS intend to handle planned investments that turn out not to be effective and efficient, or that are only effective and efficient much later on?	"GTS has a duty to connect parties that want to be connected and is seeing a rise in the number of initiatives and requests for green gas feed-in on the GTS grid. An important development in this respect is the imposed blending obligation for green gas that has been set at 20% of gas consumption in the built environment by 2030. GTS takes into account regular and major investments for green gas connections, green gas boosters, green gas gathering pipelines, and connector pipelines for green gas feed-in. The 2024 IP provides an estimate of the investments that will be needed to facilitate green gas supply for the long term through to 2033 (see Section 5.2.3). The estimate of the annual investment level takes into account implementation of currently requested green gas connections, future initiatives and green gas targets set by the Dutch government. Needless to say, the actual annual investments for green gas connections will be based on requested connections that have actually been implemented. "	The response did not result in a change to the final version of the 2024 IP.
VEMW	1.3	Valuation of assets for transfer: VEMW would also like to go into the transfer of gas assets to the hydrogen network. On the back of the energy transition, utilisation of the natural gas network will diminish over the coming years and investment will be needed in the transition to green gas and hydrogen. VEMW appreciates the way Gasunie is addressing these challenges and engaging with network users and other players to take on these challenges in an efficient manner. GTS has indicated that part of the natural gas network can be taken over by the hydrogen network operator and that revenue can be used to lower natural gas network tariffs, so that only the efficient costs are charged, based on cost orientation at both the natural gas network user and the hydrogen network user. In the 2024 IP, GTS states that technical transmission-related and social-economic considerations are decisive in the decision-making process regarding the transfer of existing natural gas pipelines to HNS for reuse in the hydrogen transmission network with a permanent ability to guarantee natural gas transport security, as well as maintaining the efficacy of the gas transport network and gas transports. Transferring natural gas pipelines to HNS could have a positive effect on the development of GTS' tariffs, partly because the sales proceeds would be deducted from GTS' transport tariffs. VEMW essentially supports the intention to transfer existing natural gas pipelines using a valuation methodology based on the value of GTS' regulated asset base (hereinafter: 'RAB'), in accordance with ACM's official advice on this matter, which was amended in October 2023.	GTS would like to thank VEMW for their response.	The response did not result in a change to the final version of the 2024 IP.

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XI: Consultation matrix continued previous page

Party	Number	Consultation response	GTS' response	Method of processing
Energie Nederland	2.1	"Investments to reduce carbon emissions: GTS proposes a number of investments to cut carbon emissions over the coming years. Energie-Nederland is firmly in favour of efficient carbon emission reduction. However, the Investment Plan does not provide clarity as to why the proposed investments are necessary. Are they necessary based on (upcoming) EU regulations on methane emissions or based (in part) on GTS' corporate social responsibility policy? Additionally, it is not clear whether a final decision on these investments has to be made already, given that there is no final legislation yet. It would be sensible to postpone (final) investment decisions until legislation has been implemented and the obligations are clear. In addition, it is unclear how the investments relate to the degree of carbon reduction (€/tonne of CO_2). In a nutshell, Energie-Nederland would like to see a more extensive reasoning behind these investments, because they are considerable and it is very likely that they will be borne by network users."	"The possible investments to which Energie-Nederland refers are in the study phase, i.e. final decisions on these investments have yet to be made. Besides, these replacement investments are generally primarily prompted by other bottlenecks (as included under 'Studies into possible major investments', Section 5.2.4 of the 2024 IP). GTS would like to explain this. Most of the studies into replacement investments proposed on account of CSR and to cut emissions are primarily prompted by other bottlenecks. For example, GTS is launching a multi-year programme for the replacement of gas heating systems that have reached the end of their technical life. A possible option here is to replace these systems with alternatives (heat pump) that are more energy-efficient than the current heating systems. Postponing this choice may lead to an inefficient solution. Another example is the replacement of valves that need replacing due to inoperability or wear. Again, the choice is between, among other options, a conventional alternative and a sustainable (emission-reducing) alternative. For these investments, too, methane reduction is not the primary bottleneck. In the 2024 IP, GTS refers to ongoing studies that may lead to major replacement investments. Since these major investments may fall within the scope of the 2024 IP, GTS feels it should include these studies for information purposes. As and when these major investments materialise, the investments will actually be presented in an IP or in an addendum to an IP. In the studies into replacement investments, GTS takes into account expected EU legislation on methane emissions. If the studies lead to major replacement investments, the costs per tonne of carbon emissions avoided will be an essential factor in assessing the alternatives. These costs are determined by comparing the additional costs for a low-emission solution to the costs that would have to be incurred to replace the old systems with a conventional system."	The response did not result in a change to the final version of the 2024 IP.
	2.2	Expected use of the GTS network: The investment plan contains various tables detailing the projected use of the GTS network over the period through to 2034. The projected use of the network is a key element for system users in predicting future tariffs. Energie-Nederland would like to ask GTS to provide an additional table that translates the projected use through to 2034 to the forecasted contracted capacity for each of the eight segments corresponding to GTS' transport tariffs (which are Border, Storage, Production and LNG on the Entry side and Industrial, Regional network operators, Border and Storage on the Exit side). The transport tariffs for use of the GTS network are expected to go up considerably over the ten-year period. Further investments in the GTS network will have to be weighed against system users' general concerns over rising transport tariffs. Energie-Nederland does not agree with all risks being placed on system users. We dispute the basic premise of incorporating all investments into GTS' standardised asset value as standard, and therefore automatically requiring network users to foot the bill. The high costs resulting from the policy decision to close the Groningen gas field must not automatically have to be borne by users. Energie-Nederland is in separate talks about this with the Dutch Ministry of Economic Affairs and Climate Policy and the Netherlands Authority for Consumers and Markets (ACM).	"The investment plan provides an estimate of the required transport capacity to cover the total need for capacity over the coming ten years. The scenarios provide insight into the required transport capacity and do not show the projected contracted transport capacity. GTS of course understands how the projected contracted capacity relates to future tariffs. In its annual tariff proposal, GTS therefore provides information on the amount of projected contracted capacity during the current regulatory period. Under the NC TAR agreement that has already been signed, GTS will, to the extent possible and available, provide an estimate of the actual contracted capacity per segment over the previous calendar year. The forecasted contracted capacities will, as per these agreements, be presented in GTS' tariff proposal and not be included in the 2024 IP."	The response did not result in a change to the final version of the 2024 IP.
	2.3	All IT investments were recently transferred to Gasunie and GTS itself no longer invests in IT. As a result, Energie-Nederland is unable to establish the need behind the IT investments that Gasunie makes and ultimately passes on to users through GTS. Energie-Nederland would like to see GTS include a section on expected IT investments.	"The investment plan requires a statement of investments made by the network operator. Network-related IT investments are no longer made by GTS, but rather by Gasunie. This is why these investments have not been presented in the IP since the 2022 IP. GTS pays Gasunie an annual fee for the use of the IT assets. Given that current IT investments are not part of the investment plans but are part of the one-off correction in the tariff decision, GTS intends to provide insight into the background to the costs in the next tariff proposal. GTS is in talks about this with the Netherlands Authority for Consumers and Markets (ACM).	The response did not result in a change to the final version of the 2024 IP.

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Party	Number	Consultation response	GTS' response	Method of processing
Vereniging Gasopslag Nederand (VGN)	3.1	"The important role of gas storages in the period up to 2034: VGN is in favour of promoting the continued availability of both L-gas and H-gas storages in the Netherlands in the interest of a well-functioning gas market and security of supply. In particular, VGN supports the observations made by GTS in section "recent developments in the market" of IP 2024 concerning the importance of storage facilities for security of supply. VGN maintains the view, expressed earlier in its response to the draft Investment Plan 2020, that the existing infrastructure and market mechanism should be maintained for the benefit of all consumers. Following the closing of the Groningen field, existing gas storage facilities can serve an especially important role as key providers of flexibility and security of supply for the Dutch gas market as well as for other markets in the region. VGN is interested in hearing the views of GTS on potential measures to ensure that existing storages remain operational and closures are prevented, with due consideration of the full range of benefits provided by gas storages to the functioning of the gas market and security of supply.Here, VGN would once again like to draw attention to the level of transport costs as a risk factor for the continued availability of storage facilities. Transport tariffs for using the GTS transmission system are projected to increase significantly over the ten-year period until 2034 as is covered by the IP 2024.Further investments in the GTS transmission system, and any proposals for further market integration,should be balanced against the general concern of system users on the rising level of transport tariffs. Fundamentally, VGN does not agree with placing all demand risk on system users. This is a point that has been raised by VGN during the course of ongoing discussions with GTS and the ACM on the Method Decision 2022 (de Methodebesluit). VGN also does not agree with the principle that all investments are by definition included in the regulated asset base (hereinafter: RAB) of GTS and as such are automatically charged to system users. For instance, the high costs resulting from the policy decision to close the Groningen field, such as the investments for the nitrogen facility in Zuidbroek and for switching L-gas users to the H-gas system, should not be borne by system users. In parallel VGN is in discussions with EZK and ACM on this topic."	"GTS fulfils and will continue to fulfil a formal advisory role to the Dutch Ministry of Economic Affairs and Climate Policy with respect to security of supply. Under the current gas act, the annual security of supply (SoS) analysis results in advice on the extent to which gas from the Groningen gas field is needed to ensure security of supply. An amendment to the gas act is currently in the works, which will give gas storage facilities a prominent role in the SoS analysis. Based on this, GTS will be issuing advice every year on the required storage facility fill levels before the start of winter (i.e. on 1 November). In the SoS analysis, GTS will outline the measures needed to guarantee security of supply. Security of supply can be considered to be guaranteed when three prerequisites are met: the EU infrastructure standard (peak capacity), the EU gas supply standard (volume available for protected users in case of a cold spell of 7 and 30 days or a 30-day outage of the largest available source), and sufficient winter volume for a regular winter. GTS has developed a model that allows GTS to calculate on an annual basis how much winter volume the storage facilities need to contain. Recent analyses by GTS show that all seasonal storage facilities will be needed until around 2030. GTS will share its vision on security of supply and the results of its analyses with market parties within the foreseeable future. Independently of the above, current EU legislation dictates that a storage facility can only be closed once analysis by ENTSOG shows that closing that storage facility will not have any adverse effects on security of supply in the country in question. Closure must not have any adverse consequences for security of supply in the rest of the EU either. The ultimate decision on whether or not to close a storage facility is made by the Netherlands Authority for Consumers and Markets (ACM)."	The response did not result in a change to the final version of the 2024 IP.
	3.2	Forecasted usage of the GTS transmission system: VGN notes that IP 2024 contains various tables on the forecasted usage of the GTS transmission system in the period up to 2034. The forecasted usage of the GTS transmission system is of interest to system users as an important element for predicting future tariffs. In that respect, VGN would like to request GTS to provide an additional table where the forecasted usage up to 2034 is translated into the expected "Rekenvolume" for the eight segments corresponding to GTS transport tariffs (being for Entry: Border, Storage, Production, LNG; and for Exit: LDC, Industrial, Border and Storage).	GTS would like to thank VGN for their response and refers to response 2.2 for the answer.	The response did not result in a change to the final version of the 2024 IP.
	3.3	GTS proposes a number of investments to reduce carbon emissions. From the IP 2024 it is unclear whether these investments are required on the basis of (upcoming) EU regulations or if they are based on the CSR policy of Gasunie. VGN would like to see the business case underpinning these investments to determine if they are in fact necessary.	GTS would like to thank VGN for their response and refers to response 2.1 for the answer.	The response did not result in a change to the final version of the 2024 IP.
	3.4	Recently all IT investments have been transferred to Gasunie and GTS itself no longer executes IT investments. As a result VGN cannot determine the necessity of the IT investments made by Gasunie and charged to GTS. Ultimately these charges will be borne by the system users. VGN would like GTS to include a paragraph in the IP 2024 on the expected IT investments that are made by Gasunie on behalf of GTS and the resulting opex charges that Gasunie will make to GTS.	GTS would like to thank VGN for their response and refers to response 2.3 for the answer.	The response did not result in a change to the final version of the 2024 IP.
VTTI	4.1	"VTTI would like to applaud the extensive preparatory work which has gone into the Gasunie Transportation Services Investment Plan 2024. The Zeeland Energy Terminal will be an important contributor to the security- and optionality of energy supply for the Netherlands. Network access in the Vlissingen area for sufficient natural gas capacity will be a key enabler for the success of the undertaking. We recognize that there are some uncertainties in predicting the future mix of energy sources and energy carriers but remain confident that GTS will continue to respond to requests for capacity for natural gas according to its regulatory obligations."	GTS would like to thank VTTI for their response.	The response did not result in a change to the final version of the 2024 IP.

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Party	Number	Consultation response	GTS' response	Method of processing
Element NL	5.1	Forecasted usage of the GTS transmission system: Element NL notes that IP 2024 contains various tables on the forecasted usage of the GTS transmission system in the period up to 2034. The forecasted usage of the GTS transmission system is of interest to system users as an important element for predicting future tariffs. In that respect, Element NL would like to request GTS to provide an additional table where the forecasted usage up to 2034 is translated into the expected "Rekenvolume" for the eight segments corresponding to GTS transport tariffs (being for Entry: Border, Storage, Production, LNG; and for Exit: LDC, Industrial, Border and Storage).	GTS would like to thank Element NL for their response and refers to response 2.2 for the answer.	The response did not result in a change to the final version of the 2024 IP.
	5.2	"Investments to reduce carbon emissions: GTS proposes a number of investments to reduce carbon dioxide emissions in the coming years. Element NL would like to make three comments. Firstly, the IP (2024) doesn't elaborate on which basis these proposed investments are required. As there is no final legislation yet, it is not clear whether these investments are legally required. Is GTS anticipating on upcoming EU methane regulation? Secondly, the timing of these investments is not clear, what drives the need to include these in this IP. Thirdly, the efficiency of these investments is not clear. GTS indicates investments for reducing GHG emissions with an estimated cost of around €50 million, but doesn't provide clarity on the amount of GHG reduced. Therefore, it is not clear how the efficiency of these investments is demonstrated. E.g. how do they compare with the CO_2 price in the EU ETS system (currently around 80 €/ton) and the future price levels used for NL carbon tax purposes. In addition, the efficiency of the investments in the proposed replacement of heating systems for the gas receiving stations with the aim of reducing emissions has to be demonstrated. From our perspective these investments would not classify as efficient, as substantiated by the following assumptions/calculations: These investments are huge (€250 million) and would result in a reduction of 30 kilotonnes of CO_2 equivalent (GTS IP section 5.2.4). With an assumed depreciation period of 30 years for installations, a WACC of 4.6% (reconciliated WACC GTS herstelbesluit) and 1% OPEX, we estimate the yearly cost in the beginning at around €20 mln per year. This would imply a CO_2 costs of 667 €/ton. This is fay beyond the current (80 €/ton) and anticipated future CO_2 price levels. However, as stated before, we don't have enough information on the detailed assumptions behind the reduction measures to make a firm statement and expect an elaboration on the assumptions o which these proposed investments are based and how the efficiency is demonstrated."	"GTS will provide its answer to each question below. 1. For details of the basis of investments for carbon emission reduction, GTS refers to response 2.1. 2. The timing of the investments is not yet final. In the 2024 IP, GTS refers to ongoing studies that may lead to major investments. As and when these major investments materialise, the investments will actually be presented in an IP or in an addendum to an IP. 3. The costs per tonne of carbon emissions avoided will be an essential factor in assessing the alternatives. In the example put forward, these costs are the additional outlay that would be required for a hybrid solution consisting of a heat pump with a green gas-fired heating boiler compared to the costs that would be involved in replacing the old heating systems with a conventional system. The studies mentioned, which focus on possible major investments (Large-scale replacement of GRS heating systems and Measures for GHG emission reduction), are still in the study phase. As a result, GTS is not yet able to provide a specific cost estimate for these possible major investments because they are still in the preparation phase as studies. With the above explanation of costs per tonne of carbon emissions avoided in mind, GTS does, however, expect the amount per tonne of carbon emissions avoided to be significantly lower than the €667 per tonne of carbon emissions avoided that Element NL mentions in its response."	The response did not result in a change to the final version of the 2024 IP.
	5.3	Recently all IT investments have been transferred to Gasunie and GTS itself no longer executes IT investments. As a result ElementNL cannot determine the necessity of the IT investments made by Gasunie and charged to GTS. Ultimately these charges will be borne by the system users. Element NL would like GTS to include a paragraph in the IP 2024 on the expected IT investments that are made by Gasunie on behalf of GTS and the resulting opex charges that Gasunie will make to GTS.	GTS would like to thank VGN for their response and refers to response 2.3 for the answer.	The response did not result in a change to the final version of the 2024 IP.
OMV GMT	6.1	We are well aware of the fade out schedules on L gas in Belgium and Germany. In appendix X (p 126) GTS project that technical exit capacity at L gas borders will therefore gradually drop to zero until 2029-2031. Could you let us know what will happen to the underlying infrastructure; moreover, will it be removed from the RAB?	"First and foremost, dismantling an asset will not go at the expense of the safety, efficacy, reliability and transport security of the natural gas network. GTS goes through several steps prior to proceeding to dismantle a specific asset. First of all, GTS analyses whether the assets in the transport scenarios for natural gas are really no longer needed. This also includes an assessment of whether pipelines that used to be used to transport L-gas could be used for H-gas transport. After that, GTS analyses whether the assets can be reused either by transferring them to a third party for natural gas transmission or by repurposing them for use for other energy carriers, such as hydrogen and CO_2. If none of these options are possible, the asset will be dismantled. If an asset is transferred or dismantled, it is depreciated in one go and removed from the RAB (in compliance with financial regulations)."	The response did not result in a change to the final version of the 2024 IP.

Colophon

Design
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