Memorandum on Scope and Level of Detail

National Programme for Sustainable Use of the Deep Underground

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Project number 0503324.100
Final revision 03
21 January 2026

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Contents

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1. Towards a National Programme for the Deep Underground

1.1 Big challenge: underground gains urgency due to energy transition

The Dutch State is committed to keeping the Netherlands sustainable, liveable and prosperous. Not just today, but also for future generations. By gradually and responsibly reducing our dependency on fossil fuel, we can improve the Dutch energy system's strategic autonomy and create a climate-neutral energy system for the future. This requires an energy system based around alternatives to fossil fuel. For that to be feasible, energy and raw materials must be available in sufficient quantity and extracted or stored responsibly. The deep underground[1] has an important role to play in this regard. It is a source of fossil fuel (oil, natural gas), renewable (geothermal) energy and raw materials (salt), as well as being suitable for large-scale storage of (renewable) energy. That makes the deep underground a valuable resource when it comes to keeping the Netherlands liveable and prosperous.

This Memorandum on Scope and Level of Detail (NRD) is one of the first steps in the creation of an environmental impact report for the Programme for Sustainable Use of the Deep Underground (DGDO programme). The present draft Memorandum was drawn up based on the knowledge available in January 2026.

The energy system will be taking up increasing amounts of space deep underground in future, potentially affecting spatial availability on the surface as well. Other applications also have their own spatial requirements, such as housing, military defence, groundwater and drinking water. The amounts of space are finite, meaning choices must be made. The deep underground can play an important role in spatial planning, as underground activities have a relatively low impact on the use of surface space while still providing answers to societal challenges. Even in the deep underground, however, spatial choices remain necessary. Examples include decisions about the use of underground spaces, often affected by geological restrictions, the use or reuse of infrastructure and the sharing of financial burdens. To that end, we need to know which applications are desirable, which additional frameworks are required to ensure a safe and responsible implementation and how to balance the various spatial interests at national and regional levels. Among other constraints, this requires alignment with choices made by the State in its Programme for Soil, the Underground and Groundwater (BOG programme)[2]. Through the National Programme for Sustainable Use of the Deep Underground (DGDO programme), the State can implement its vision on the use of the deep underground and make spatial choices regarding this use.

The DGDO programme will present an overarching vision on use of the deep underground onshore. It will bring together existing policies and where necessary, further refine the conditions for spatially responsible use of the underground. This ensures a clear framework for siting of applications deep underground. To that end, the programme will establish a spatial planning framework in line with the legal assessment requirements from the Mining Act and its planned revision[3]. The DGDO programme's content will be coordinated with that of the BOG programme for the shallow underground, which is yet to be drawn up. The DGDO programme is not a replacement for licencing assessments, which remain mandatory for all activities. Depending on the choices and conditions defined in the DGDO programme, conditions and requirements may be laid down in regulations and serve as an additional assessment framework for licence applications.

[1] The deep underground refers to that part of the underground covered by the Mining Act; deeper than 100 metres underground for minerals and deeper than 500 metres for geothermal energy.
[2] A strategic environmental assessment (SEA) procedure for the DGDO programme is currently ongoing. The Netherlands Commission for Environmental Assessment (NCEA) issued an advisory report on this procedure on 5 November 2025 (www.commissiemer.nl, project 3858)
[3] Ministry of Climate Policy and Green Growth. (2025, 31 January). *Letter to Parliament on Mining Act revision*. House of Representatives, parliamentary year 2024–2025, PDGGO-DTDO/96438802.

1.2 Focus of the DGDO programme

The DGDO programme focuses on spatial planning of future onshore activities deep underground up to 2050. These activities fall under the Mining Act.

Mining Act (Mbw)
The DGDO programme focuses on underground activities covered by the Mining Act. The State plans to update this Act. These planned changes are listed in an outline memorandum (ref. …). Section 3.2 of the present Memorandum provides more details on the content of the Mining Act. This section also describes what has been done to take the planned changes to the Mining Act into account in the SEA report (SEA = Strategic Environmental Assessment).

The DGDO programme manages activities deep underground, including their timing if possible, based on national and regional interests and taking into account all competing demands, both underground and on the surface, as well as the impact on the living environment. The DGDO programme explicitly does not specify any targets per activity, although it does aim to ensure that future demands for energy and raw materials can continue to be met. The DGDO programme offers insight into whether activities will or won't be suitable for certain locations, or only under certain conditions, along with the underlying reasons for these conditions. Besides the DGDO programme, the SEA report also considers national and regional interests and the impact on the living environment in line with the provisions of the Outline Memorandum, the revised Mining Act and the Sector Agreement on Gas Extraction in the Energy Transition (hereinafter: Sector Agreement).

The DGDO programme concerns activities deep underground for which the Minister of Climate and Green Growth is the competent authority under the Mining Act. These are activities taking place deeper than 100 metres underground, or deeper than 500 metres for geothermal energy. More specifically, the programme concerns the following activities deep underground:

- Exploration and extraction of minerals such as salt, natural gas and petroleum
- Exploration and extraction of geothermal energy
- Storage of substances such as natural gas, petroleum and hydrogen

The Ministry of Infrastructure and Water Management is also working on a Programme for Soil, the Underground and Groundwater (BOG) regarding sustainable use of the **shallow** underground. This programme will be used to make choices regarding soil, the underground and groundwater. The aim of the BOG programme is to *support healthy soil, efficiently and sustainably configured underground spaces and sustainably balanced groundwater systems*. A Strategic Environmental Assessment (SEA) procedure for the BOG programme is currently ongoing[4]. The DGDO programme's SEA report will align with the BOG's SEA procedure.

The DGDO programme focuses on future onshore activities **deep underground**. These are 'future' activities, as the programme does not cover activities that are already operational. 'Onshore' refers to all Dutch territory besides the North Sea and the Caribbean Netherlands. Insights and agreements regarding offshore activities are covered by the North Sea programme.

The goals of the DGDO programme:

- Insight into future onshore spatial developments
- Spatial framework for use of the deep underground, with consideration for other national and regional challenges
- Better relations with the regions

The DGDO programme will be subject to review in 2035.

[4] As is customary, this Memorandum uses the term 'SEA report' to refer to the environmental impact assessment report and 'SEA' for the environmental impact procedure. The DGDO programme's Strategic Environmental Assessment is being used to establish a framework, necessitating both an SEA report and an SEA procedure.

1.3 Focus of the SEA report

As statements in the DGDO programme will be used to establish a framework for use of the deep underground, completion of an environmental impact procedure (SEA) is mandatory. This is achieved through an SEA report. The SEA report generates environmental and other information to support choices on content for the DGDO programme. Section 2 of this Memorandum addresses the SEA report's content and procedure.

The DGDO programme is intended to provide a coherent collection of national policy directions and choices for activities deep underground. The SEA report describes the environmental impacts of various alternatives, as well as their impact on the living environment. The alternatives being assessed represent the **boundaries of the policy field**. Based partially on information from the SEA report and in consultation with stakeholders, the Ministry of CGG will define a strategic trajectory for development of the deep underground; this so-called **preferred alternative** will be included in the (draft) DGDO programme. For the preferred alternative, too, the SEA report will assess its environmental impact and determine the suitability. As the activities deep underground are weighed individually, the preferred alternative can vary by activity, and may in fact deviate from the assessed alternatives.

The SEA report for the DGDO programme focuses on the following onshore activities deep underground:

- Natural gas extraction
- Geothermal energy extraction
- Salt extraction[5]
- Hydrogen storage

The DGDO programme will be used to make spatial choices in relation to these four activities in the deep underground.

State of affairs as of January 2026
The DGDO programme has not been finalised yet. This Memorandum is based on the knowledge available as of January 2026. Additional information may become known in the course of the SEA report's creation due to new research, responses to this Memorandum or newly proposed measures and building blocks. The SEA report will incorporate such information insofar possible.

1.4 Activities not included in the SEA report

In addition to the aforementioned activities, the DGDO programme may also address other activities covered by the Mining Act such as petroleum extraction and natural gas storage. As the programme does not involve any spatial choices with respect to these activities, they fall outside the scope of the SEA report. The DGDO programme thus has a more extensive scope of activities than the SEA report. This concerns the following activities in the deep underground:

Oil extraction

There are two onshore oil fields for petroleum extraction in the Netherlands, one by Rotterdam and one by Schoonebeek. Unlike natural gas, oil extraction is not critical to the security of energy supply to households. Current policy prohibits new exploration licences for onshore oil extraction, although it is still possible to apply for a new extraction licence or the approval of an extraction plan in a previously licensed area. With an eye to reducing fossil fuel dependency, no new onshore oil extraction is anticipated.

Shale gas extraction

During the parliamentary meeting on mining of 15 February 2018 (Parliamentary Papers 32849 and 33529 no. 126), the Minister of Economic Affairs and Climate Policy declared that shale gas would no longer be extracted in the Netherlands going forward. Exploration and extraction of shale gas is prohibited for the entire planning area covered by the Structural Vision for the Underground (STRONG). This also serves as implementation of the motion put forward by Eric Smaling (Parliamentary Papers II, 2016–2017, 33 118 no. 91).

[5] Regarding critical metals and minerals, only magnesium salt is relevant. Most salt extraction involves halite, or 'rock salt'.

Carbon capture and storage

The Netherlands is aiming for a carbon-free energy system by 2050. This was laid down in a Climate Agreement. One solution to help achieve the goals from the Climate Agreement is the capture and storage of carbon dioxide. This is known as carbon capture and storage (CCS). The Dutch government does not have any plans for onshore underground storage of carbon dioxide at this time. As noted in the outline memorandum on the Mining Act revision, the new Mining Act is expected to include a temporary prohibition. This means that for now, CCS storage can only take place in empty gas fields and possibly aquifers under the North Sea.

Natural gas storage

Five gas storage facilities have been operational in the Netherlands since 1997. Four of these facilities use gas fields for storage (Norg, Grijpskerk, Alkmaar, Bergermeer), with one facility relying on salt caverns (Zuidwending). With an eye to reducing fossil fuel dependency and further reducing the demand for natural gas, no new onshore storage facilities are anticipated. At some point, there will be applications to extract the remaining cushion gas.

Compressed air

Compressed air plays a limited role in the Netherlands' national security of energy supply. This was stated previously in a Letter to Parliament on the security of energy provision and supply (Parliamentary Paper 29023, no. 270). There are only a limited number of salt caverns suitable for energy storage in the Netherlands. Hydrogen storage is a higher priority than compressed air. This policy principle was laid down in the National Energy Network Development Plan (PEH, Parliamentary Paper 31239, no. 388). Spatial planning of compressed air facilities therefore falls outside the scope of the DGDO programme.

Final disposal of radioactive waste

In September 2024, the government announced its intention to come to an earlier decision on the final storage or so-called 'final disposal' of radioactive waste than originally planned. This had not been scheduled to be decided before 2100. The government wants to determine the final disposal method and location at an earlier date. The decision-making process will be gradual and highly meticulous, starting after 2027. The aim is to have decided on a location by 2050. That ensures plenty of time for a carefully considered process, with room for public consultation and participation at various stages. Considering the timeline, this topic falls outside the scope of the DGDO programme for now. The Ministry of Infrastructure and Water Management is responsible for policy on the final disposal of radioactive waste, with close involvement by the Ministry of Climate Policy and Green Growth (Ministry of CGG).

Critical and strategic raw materials

The Schoof administration has concluded that the extraction of critical raw materials from deep underground in the Netherlands is not relevant at this time (Letter to Parliament on National Exploration Programme). The currently identified potential is insufficient. Further research is required to enable an accurate estimate of the potential for critical raw materials in the assessed mineral systems in the Netherlands. Later reviewing of this programme could result in critical and strategic raw materials receiving more attention as their relevance increases. When the time comes, their importance will be carefully weighed based on such factors as spatial planning, safety and societal added value.

1.5 National programme under the Environment and Planning Act

The DGDO programme is a voluntary programme under the Environment and Planning Act[6] and serves as an elaboration of policy on use of the deep underground as part of the physical living environment. The programme derives from the National Strategy on Spatial Planning and the Environment (NOVI). The DGDO programme will implement the guiding principles from the NOVI/National Spatial Strategy:

1. Doing justice to following generations by not shifting the burden to them insofar possible
2. Doing justice to scarcity through multifunctional land use
3. Doing justice to distinctiveness by respecting area characteristics

Energy supply in the NOVI
The NOVI also designates the energy supply as being of national importance due to its vital role in ensuring security of supply, affordability, sustainability and strategic autonomy. The Netherlands aspires to a robust, future-proof and largely self-sufficient energy system with less risky foreign dependency. This calls for extensive expansion and upgrading of energy infrastructure such as power grids and hydrogen networks and for spatial choices that offer room for energy-intensive industrial clusters, sustainable generation (such as offshore wind), storage and transport. The energy supply is closely related to other national interests such as economic vitality, national safety, climate change adaptation, flood risk management and spatial quality. That is why energy planning is being made an integral component of spatial planning, with area-specific approaches and cooperation between national and regional governments.

The DGDO programme is self-binding and serves as a framework for implementation by the State, e.g. for licencing decisions where the State is the competent authority. The programme content may also be used to influence provincial and municipal strategies and plans, by means of various general administrative orders for example. This allows provincial and municipal policy frameworks for use of the deep underground to be brought in line with national principles.

1.6 Alignment with draft National Spatial Strategy

The DGDO programme derives from the NOVI and also serves as an update to the existing spatial framework from the Structural Vision for the Underground (STRONG). The NOVI is currently being updated under the name National Spatial Strategy, with a draft published in September 2025. With this National Spatial Strategy, the State is resuming national control of spatial planning for the physical living environment. Cohesive spatial choices are a key element. These choices will be used to guide spatial development in the Netherlands and ensure a better balance between protection and use of the physical living environment. The draft Strategy refines on the qualities of each region and is aimed at the improvement of:

- Living, working and accessibility
- Economy and energy
- Nature and agriculture
- Water and soil

In its draft National Spatial Strategy, the State announced its intention to make use of soil and the underground's potential for applications such as soil energy systems, geothermal energy, the extraction and storage of minerals and carbon dioxide and the construction of new infrastructure. Additionally, the State wants new spatial developments to consider the surface and the underground in conjunction with each other and to weigh various factors in the event of concurrent use of underground spaces. Those factors include e.g. drinking water extraction, geothermal energy extraction and energy storage. While these three functions don't always go together, they all contribute to making the Netherlands more future-proof and climate-resilient. According to the draft National Spatial Strategy, the State will carefully and comprehensively plan the three-dimensional use of underground spaces to make room for as many functions as possible, while also continuing to ensure the optimal protection and use of groundwater sources of drinking water.[7] For example, this could involve angled drilling below groundwater sources of drinking water and thermal storage (less than 500 metres underground) to extract geothermal energy from farther down (more than 1,500 metres underground). Angled drilling would make it possible to combine both functions without drilling through protected areas. This isn't yet feasible in

[6] Voluntary programme | Information Point for the Living Environment
[7] Ministry of Housing and Spatial Planning (2025). *Draft National Spatial Strategy*. Parliamentary paper presented to the House of Representatives on 26 September 2025.

many areas, however. For one thing, groundwater protection areas don't have a lower limit, preventing 3D planning.

1.7 Successor to Structural Vision for the Underground

The Structural Vision for the Underground (STRONG), created in 2018, was the first document to address underground spatial planning. STRONG was aimed at ensuring sustainable, safe and efficient use of soil and the underground, with a good balance between usability and protection. It was a joint effort by the Ministry of Infrastructure and Water Management and the then-Ministry of Economic Affairs and Climate Policy. Due to new knowledge, insights and technological developments, STRONG is now in need of a review and update. It will be succeeded by the Ministry of Climate and Green Growth's DGDO programme and the Ministry of Infrastructure and Water Management's BOG programme. These two programmes replace the current STRONG vision. Policy will be based on the three guiding principles from the NOVI/National Spatial Strategy.

One of the items addressed in the BOG programme is underground siting, generally to a depth of 500 metres. The BOG programme falls under the purview of the Ministry of Infrastructure and Water Management, which bears system responsibility for soil, the underground and groundwater. This complements the Ministry of Climate and Green Growth's authority over activities deep underground. The BOG programme focuses on siting of cables and pipelines, groundwater and groundwater reserves, etc.

1.8 TNO spatial planning assessment as starting point for DGDO programme and SEA report

The Ministry of CGG commissioned TNO to create the report 'Ruimtelijke Verkenning Duurzaam Gebruik Ondergrond – Diepe Ondergrond' (Spatial Planning Assessment for Sustainable Use of the Underground – The Deep Underground)[8]. This report provides insight into future demand for activities deep underground through 2050 based on research of various energy scenarios. In addition, it describes the geological potential based on publicly available data. Both the DGDO programme and the SEA report will use these findings as starting points in determining what will and won't be possible underground through 2050. The SEA report uses the data to define reference situations, for example.

[8] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

2. Procedure and Methodology for Environmental Impact Report

2.1 Mandatory SEA procedure

The Environment and Planning Act requires an environmental impact report (SEA report) to be drawn up[9] for plans and projects with a potentially significant environmental impact. These can be projects with the potential to directly impact the environment or plans used as a framework for such projects. The DGDO programme will serve as the spatial framework for future activities deep underground. That means a SEA report is required to support the draft DGDO programme's creation. The Minister of Climate and Green Growth initiates and is the competent authority for the SEA procedure.

The Environment and Planning Act also requires a so-called 'suitability assessment' of the draft DGDO programme to be carried out alongside the SEA report. The suitability assessment evaluates whether (new) policy choices from the DGDO programme are expected to have a significant adverse impact on conservation objectives for Natura 2000 sites. The suitability assessment is another reason a SEA report is mandatory for this programme.

2.2 Objective of this environmental impact report

The SEA procedure and creation of an SEA report are used to support decision-making on underground policies in the DGDO programme and national policy choices made through this programme. That way, planning preparations can take concerns relating to the physical living environment into account as early as possible. There are two key goals in this respect. First, to provide insight into the impact of activities deep underground on the physical living environment. To achieve this, we need to know the current state of the physical living environment (referred to as a 'snapshot of the living environment'), which trends, developments and current policy affect that environment and what it would look like if the policy were to continue unchanged (the 'reference situation'). Second, to provide insight into the assessed alternatives' impact on the achievement of (new) policy objectives. These alternatives are a key element of the DGDO programme's SEA report. The SEA report also includes an investigation into the impact of the final choices for the draft DGDO programme on the physical living environment and a suitability assessment to determine their impact on Natura 2000 sites.

Alternatives to be assessed
The SEA report is used to assess alternatives for inclusion in the DGDO programme. The alternatives to be assessed are possible choices that can be made. The alternatives' impact on the physical living environment is determined. This impact can then be used to substantiate the final choices. The alternatives the ministry is interested in assessing are worked out in more detail for each activity in the deep underground. These are described in Sections 4 through 7. Some alternatives are correlated. These correlations are described in Section 8. Together, the alternatives being assessed define the 'playing field' of choices for the DGDO programme. Besides assessing these alternatives, the SEA report also describes the impact of an underground activity's termination, in which case the necessary extraction and storage must be achieved by other means. While this is not being included as an alternative, the description does put the impact of the alternatives in a broader perspective.

The Environment and Planning Act first introduced the concept of a 'physical living environment'. It does not provide a standard definition of this term. It does provide a non-exhaustive list of included items, namely structures, infrastructure, waterways, water, soil, air, landscapes, nature, cultural heritage and world heritage. This living environment can be further divided into layers, for example (underground, soil, surface and airspace), or by type of area (rural and urban areas).

[9] The environmental impact reporting procedure is commonly referred to as the 'SEA procedure' or 'SEA'. The 'SEA report' is the environmental impact assessment report resulting from this procedure. A 'SEA report' is an environmental impact assessment report for decisions used to establish a framework. The procedure for specific decisions is called an 'EIA' (Environmental Impact Assessment). For the DGDO programme, the SEA procedure must be completed and a SEA report drawn up.

The 2019 National Strategy on Spatial Planning and the Environment introduced the 'Wheel of the Living Environment', a tool for the determination of impact on the living environment, see Figure 1. This Wheel was also used as a basis for the impact descriptions and assessments in the DGDO programme's SEA report. Besides the impact on the physical living environment, this method also considers societal and economic impacts. Chapter 9 provides more details.

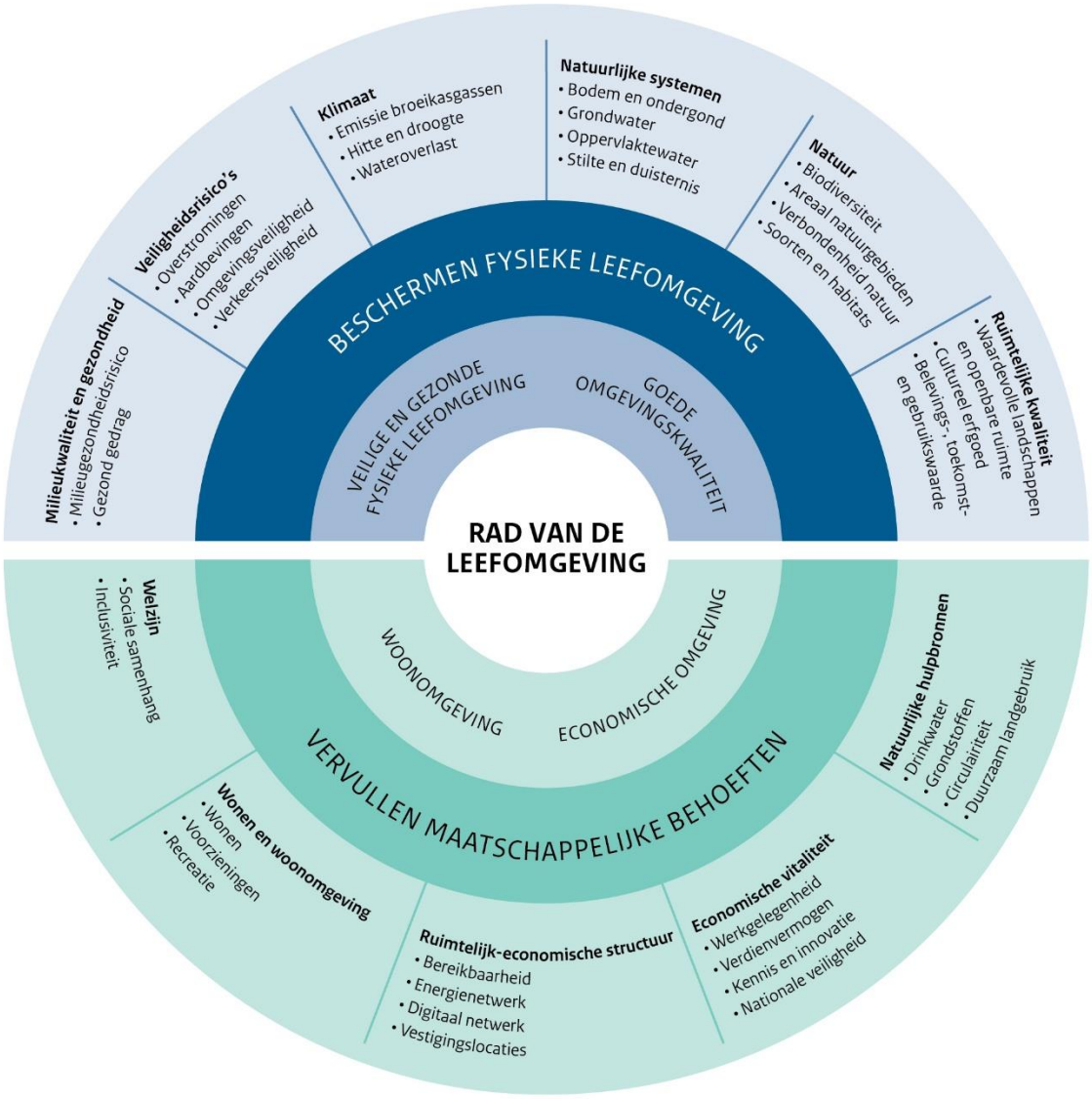

Figure 1: Wheel of the Living Environment as assessment framework for the physical living environment

2.3 SEA procedure to be completed

An SEA procedure consists of a number of mandatory steps. Figure 2 depicts these steps, which are subsequently explained in more detail.

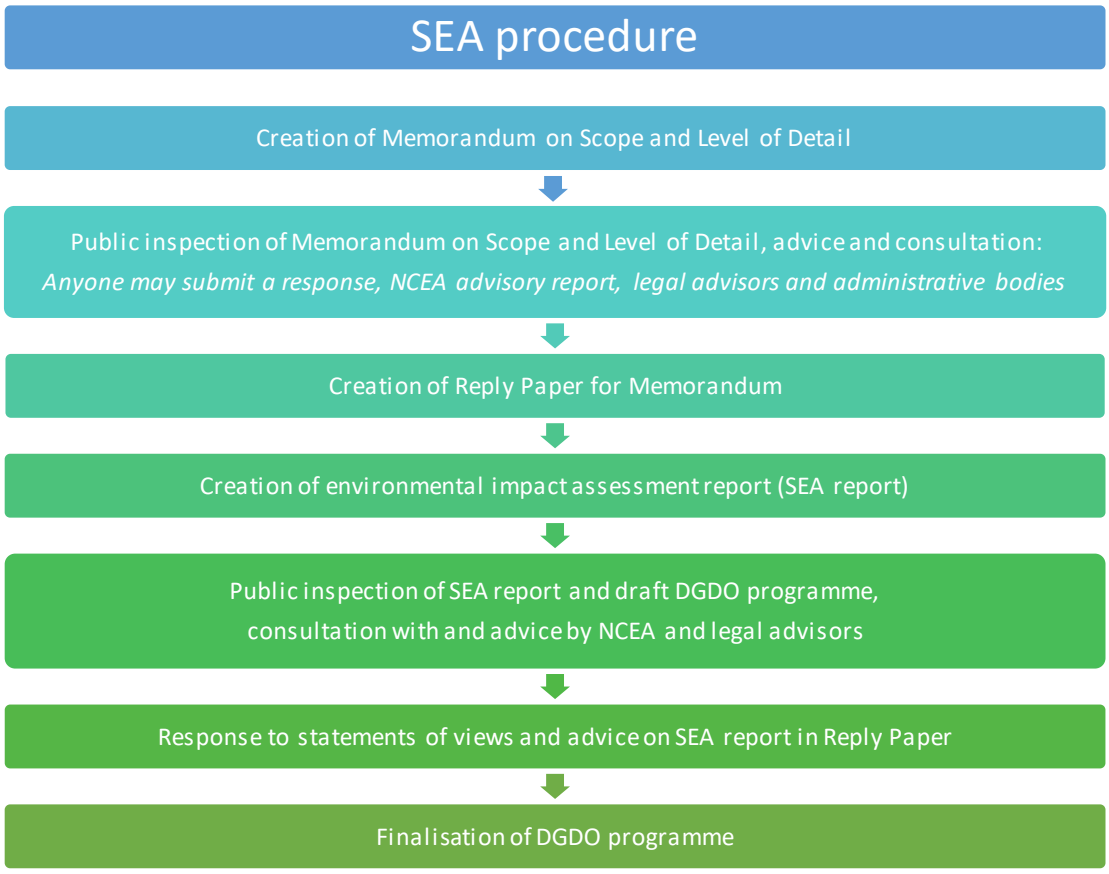

Figure 2: SEA procedure for the SEA report for the National Programme for Sustainable Use of the Deep Underground

Public inspection of Memorandum on Scope and Level of Detail, advice and consultation
After publication of the public announcement and this Memorandum on Scope and Level of Detail (NSD), anyone may submit a response and legal advisors, relevant administrative bodies and the Netherlands Commission for Environmental Assessment (NCEA) may provide advice on which items the SEA report should assess. This is possible for six weeks after publication. The NCEA's advisory report is published on the NCEA website.

As local authorities play an important role in the implementation of underground policies, they also need to be informed. The plans could also affect the environment in neighbouring countries such as Germany and Belgium, meaning the relevant administrative bodies in these countries have to be informed as well. In addition, the State's legal advisors will be consulted on the impact assessment's scope and level of detail. These are the Minister of Infrastructure and Water Management, the Minister of Agriculture, Fisheries, Food Security and Nature, and the Cultural Heritage Agency on behalf of the Ministry of Education, Culture and Science.

Advice and responses received through consultation on the Memorandum will, following evaluation by the competent authority, inform the SEA report. The competent authority will respond to the content of all the submitted advice and responses by means of a Reply Paper.

How are responses submitted?

The Memorandum is available for inspection between Friday 10 april 2026 and Thursday 21 May 2026. During this period, anyone who wants can submit a response to the Netherlands Enterprise Agency (RVO), the Ministry of CGG's implementing agency. Digital responses are preferred. These can be submitted through www.rvo.nl/dgdo/proces.

Responses may also be sent to the following address by regular post:
P.O. Box 111, 9200 AC Drachten

Creation of SEA report and draft DGDO programme

Based on this Memorandum and the responses and advice received, an SEA report will be created in the first half of 2026. In the second half of 2026, the results of the SEA report will be discussed with stakeholders. The SEA report will be finalised in the last quarter of 2026. The contents of the SEA report will inform the spatial choices, prioritisation and conditions for use of the deep underground to be included in the draft DGDO programme by the Ministry of Ministry of Climate Policy and Green Growth (CGG).

The SEA report will be made available for inspection at the same time as the draft DGDO programme and the suitability assessment. Everyone is free to submit their views on these documents in accordance with the procedure on statements of views (Part 3.4 of the General Administrative Law Act). Neighbouring countries Belgium and Germany will be informed of the SEA report and draft programme. The SEA report will also undergo an assessment by the NCEA. The SEA report and the draft programme will be presented to the House of Representatives at the same time.

Finalisation of DGDO programme

After consultation and advice and after making any modifications required, the Minister of CGG finalises the DGDO programme. This finalisation includes a description of how the environmental impact report, statements of views and advice were taken into account.

2.4 Methodology for the SEA

The official purpose of the environmental impact report is ensuring that decision-making gives full weight to environmental aspects, in this case regarding the creation and finalisation of the DGDO programme. The Ministry of CGG also considers it important for the SEA report to support and enhance this programme and to promote both formal and informal participation. In addition, the SEA report plays a role in the organisation of the decision-making process.

Participation in the DGDO programme is achieved through a broad civic dialogue with other public bodies, civic organisations, businesses and residents to involve them in the policy's development and refinement. This dialogue will be structured around themed roundtables and workshops where key stakeholders and local authorities can explore interests and perspectives together. Residents' participation took the form of an online Participative Value Evaluation (PWE) where citizens could state their opinions on requirements and spatial considerations for the use of the deep underground. These participative processes serve as input for the SEA report's assessment framework.

Alternatives to be assessed
An SEA report is commonly used to assess a range of alternatives that can be used to achieve a specific goal. This SEA report refers to these alternatives as **alternatives to be assessed**, as they concern the different options available to the Ministry of CGG regarding the content of (parts of) the DGDO programme: what policy choices can be made, and how much flexibility in scope and room for variation is there? The various alternatives to be assessed represent the **boundaries of the policy field**.

The alternatives' impact is compared to a **reference situation**. This is the future situation expected to occur based on autonomous developments and established policy.

Sections 4 through 7 of this Memorandum describe the alternatives to be assessed in the SEA report. These alternatives are based on the issues per type of activity deep underground for which choices can be made as part of the DGDO programme. The alternatives are used to assess the **'corners of the playing field'** for each activity. Input from the participation process is also taken into account.

The initial approach for each activity deep underground is based on supply, prioritisation and possible areas. Demand for e.g. natural gas or geothermal energy was not used to inspire any alternatives for assessment, as this is covered by other policy domains. The various options for the State to exert control were not included as variables for the alternatives. Investigation of options for control by the State will take place after the impact assessment. See Section 10 of this Memorandum. The following table summarises the various alternatives.

Table 1 Summary of alternatives to be assessed

Activity	Alternative to be assessed	Description
Natural gas extraction	Reference situation	Reduced extraction from small fields in line with current trends and agreements, including the Sector Agreement, and with current policy
Geothermal energy extraction	Reference situation	Continuation of existing geothermal energy supply
	Alternative W1a	Achievement of contingent supply
	Alternative W1b	Achievement of contingent and prospective supplies
	Alternative W2	Extraction in protected zones; angled drilling from adjacent areas
Salt production	Reference situation	Continuation of existing salt extraction
	Alternative Z1	Concentration of additional extraction in existing areas
	Alternative Z2	Deliberate spreading out of new salt extraction areas to mitigate impact
Hydrogen storage	Reference situation	Creation of four storage locations in salt caverns in Zuidwending
	Alternative O1	Lower limit for demand met up to 2050
	Alternative O2a	Upper limit for demand met up to 2050 through supplementary storage in salt caverns with two cavern clusters, including Zuidwending.
	Alternative O2b	Upper limit for demand met up to 2050 through supplementary storage in salt caverns with multiple cavern clusters.
	Alternative O3	Upper limit for demand met through supplementary storage in gas fields (in addition to caverns)
Linked salt extraction and hydrogen storage	Alternative S1	Hydrogen storage choices are definitive, determining the salt extraction locations.
	Alternative S2	Salt location choices are definitive, determining the hydrogen storage locations.

The intention is to limit the exploration of impacts and target achievement in the SEA report to the level of the alternatives being assessed and not to develop any overarching, more comprehensive alternatives. As described in Section 8 of this Memorandum, the SEA report does explore the accumulated impact of combining various types of use of the deep underground and how and to which extent different activities deep underground may affect each other[10].

Besides assessing the impact of the alternatives being assessed, where relevant, the SEA report also reflects on the potential consequences of more extreme, functionally unrealistic restrictions on activities deep underground. This is helpful in putting the alternatives' impact on the living environment into perspective.

[10] For more information, see the TNO report "Spatial Planning Assessment for Sustainable Use of the Underground – The Deep Underground", available at www.nlog.nl/media/3599.

The Ministry of CGG will use the DGSO programme document to define a strategic trajectory and **policy choices** for the various activities deep underground. The SEA report's impact assessments for the alternatives will serve as input for this document along with other sources of information. The SEA report also assesses the impact of these policy choices.

Changes to the Mining Act are currently underway. As these changes have not yet been finalised and that is not expected to happen until after the SEA report's completion, they have **not** been included as autonomous developments in the SEA report. The SEA report notes the planned changes to the Mining Act and reflects on whether and to what extent they will affect the reference situation and the alternatives' assessment.

3. Policy and Legal Frameworks for the Deep Underground

3.1 Introduction

Together, the Mining Act and the Environment and Planning Act make up the legal framework for (deep) use of the underground in the Netherlands. The Mining Act covers methods to ensure safe, responsible use of the deep underground. The Environment and Planning Act covers activities in the physical living environment. Spatial policy on use of the underground is laid down in national policy, primarily in the Structural Vision for the Underground. There are also various other policy pieces that relate to the underground, such as the policies on energy and drinking water.

3.2 Mining Act

Mining for minerals and other types of use of the deep underground are covered by the Mining Act and the underlying general administrative order (Mining Decree) and Ministerial Regulations (Mining Regulations). The Mining Act governs mining for minerals at depths below 100 metres, the storage of substances below 100 metres and geothermal energy extraction below 500 metres.

Under the Mining Act, all minerals at depths of 100 metres or below are State property. For all activities relating to mineral rights, the Minister of CGG represents the State. The Minister can grant licences for the exploration and extraction of minerals. Upon extraction, the minerals become the property of the licence holder.

The Minister can ask local authorities (provinces, municipalities, water boards) for advice on mining licence applications. In addition to mining licences, mineral exploration and extraction can also require other licences such as an environment and planning permit. The local authorities play a role here as well, in case of pipeline construction for example. In addition to their advisory role, provinces have the authority to ban mining in certain areas in order to protect the quality of the groundwater in groundwater protection areas[11]. As part of the application process for a mining licence or environment and planning permit, an environmental impact report may be required.

The Mining Act stipulates the financial and risk-bearing involvement of Energie Beheer Nederland (EBN) for all mineral and geothermal energy extraction. EBN is a fully State-owned company.

Extraction of natural gas and petroleum (hydrocarbons)

Onshore exploration and extraction of natural gas and petroleum are subject to legal frameworks of the Mining Act.

The Mining Act uses a system of licences:

- An **exploration licence** grants the licence holder the right to search for supplies of natural gas and petroleum in a specific area.
- If this exploration leads to the discovery of a reservoir (site containing e.g. natural gas or petroleum), the exploration licence holder may apply for an **extraction licence**. When combined with an approved extraction plan, this licence grants the right to extract the minerals. Licenses include restrictions to ensure that extraction happens safely and responsibly.
- Minerals may only be extracted from a reservoir in accordance with an **extraction plan** created by the extraction licence holder and approved by the Minister.[12]

[11] See the environmental regulations as referred to in Article 2.6 of the Environment and Planning Act and the eight provincial tasks as described in Article 2.18 (1)c of the Environment and Planning Act.
[12] See e.g. Article 36 of the Mining Act for the grounds for refusal for extraction plans.

Under current policy, no new exploration licences will be granted for onshore natural gas extraction. It does remain possible to apply for and be granted extraction licences and extraction plan approvals as long as these comply with the legal restrictions. The Mining Act specifies that no more natural gas may be extracted from the Groningen gas field (Article 52c(1) of the Mining Act). For the Wadden Sea, no extraction or exploration licences may be granted (Article 7(3) of the Mining Act), nor expansions of existing extraction plans approved (Article 36(4) and (5) of the Mining Act).

Market operators decide when and for which locations to apply for these mining licences. The licence determines at which times and in which quantities the natural gas may be extracted from a gas field. The operators make decisions and weigh their choices based on technical and commercial factors. Technical factors that can play a role include the available drilling capacity, presence of pipelines, pipeline pressure, etc.

Salt

In principle, the same legal frameworks apply to salt extraction as to the extraction of hydrocarbons. Unlike for natural gas, there are no restrictions on applications for salt extraction licences.

Geothermal energy

Section 2a of the Mining Act sets out a licencing system for the exploration and extraction of geothermal energy. Without a licence, geothermal energy exploration or extraction is not permitted. The licensing system works as follows:

- It is possible to apply for allocation of a geothermal search area; this **search area allocation** grants the exclusive right to explore the allocated area's potential for geothermal energy resources and to subsequently apply for a geothermal start-up licence if desired.
- The holder of the search area allocation can apply for a **geothermal start-up licence**. A start-up licence is mandatory for geothermal energy exploration and extraction. The holder of a geothermal start-up licence is entitled to drill and test geothermal wells and to extract geothermal energy for a limited period. The data thus collected may be used to apply for a follow-up licence.
- To be permitted to carry out the activities covered by the start-up licence, the start-up licence holder must designate a geothermal energy provider. This provider can be the start-up licence holder or another party, and is the party actually carrying out the activities.
- The start-up licence holder may subsequently apply for and be granted a **geothermal follow-up licence** for further long-term extraction of geothermal energy.

The licences determine which soil layers may be explored or used to extract geothermal energy and under which conditions the exploration and/or extraction may take place. This ensures safe and responsible extraction. Search area allocations have a legal duration of four years, while a start-up licence has a duration of two years. Both of these terms can be extended once by an additional year. The licensing process may involve advice from local authorities and legal or otherwise relevant advisors.

Similarly to minerals, market operators decide when and for which locations to apply for these geothermal extraction licences. The licence determines how much geothermal energy may be extracted.

Storage of substances

Under the Mining Act, a **storage licence** is mandatory when storing substances underground. Additionally, the market operator must submit a **storage plan**. According to the Mining Act, this plan must include such details as the substances to be stored, estimated annual quantities, storage duration and methods, a risk assessment for local residents, buildings and infrastructural works, and information on soil motion[13]. Storage may take place in salt caverns or in depleted gas fields. The associated licences must have been obtained previously.

[13] The Mining Act uses the term 'soil motion' (*bodembeweging).* Soil motion can take various forms, including vibration (earthquakes), subsidence and creep in case of salt caverns.

Mining Act revision

The Mining Act revision aims to create an updated legal framework to ensure safe and financially, socially and spatially responsible use of the deep underground, with greater government control ("No, unless") and in conjunction with the Sector Agreement and other instruments to promote the energy transition and sustainable use of the underground.

Due to the DGDO programme's alignment with the scope of the Mining Act, it is also affected by this law's upcoming revision. The Mining Act is being updated to be more in line with contemporary sensibilities. With regard to the guiding principles of 'safety' and 'responsibility', the Mining Act revision focuses mainly on safety and financial responsibility, while the DGDO programme is also concerned with spatial responsibility. Where necessary, the results of the DGDO programme will be legally assured through a revision of the Mining Act.

3.3 Environment and Planning Act

The Environment and Planning Act governs aspects of mining projects such as the siting, environmental impact (noise, soil contamination, external safety, etc.) and construction activities. Because activities that require mining facilities are considered 'environmentally harmful activities', the initiator must apply for an environment and planning permit. Regarding 'environmentally harmful activities' in the context of mining facilities, the Environment and Planning Act distinguishes between 'singular' and 'combined' applications for environment and planning permits.

For a singular application, the Ministry of CGG is the only competent authority. If multiple environmentally harmful activities are involved, a combined application is required, the municipality becomes the competent authority and monitoring is handled by the environmental service. If this is a combined application for geothermal energy, the Ministry of CGG takes an interest and also gives its approval and advice. Additionally, the Environment and Planning Act requires a participation project to be completed. For combined applications for other types of use of the underground, the Ministry of CGG is the competent authority.

3.4 National programmes

The DGDO programme intersects with various other national plans and programmes. Section 1.5 notes the National Spatial Strategy's importance as a basis for the DGDO programme and Section 1.6 discusses the BOG programme. In addition to these plans and programmes, the following plans and programmes also intersect with the DGDO programme.

National Energy System Plan (NPE) and National Energy Network Development Plan (PEH)

The National Energy System Plan (NPE) lays out a clearly defined developmental trajectory for the energy system up to 2050. The State is using the NPE to chart how the energy system may develop in future. The DGDO programme fits in with the NPE's strategic trajectory, e.g. full commitment to renewable energy supplies. The NPE categorises the future energy system according to four primary chains; electricity, carbon, heating and hydrogen. The DGDO programme is an implementation of portions of the latter three chains, determining the spatial planning of geothermal energy extraction, natural gas extraction and hydrogen storage deep underground.

The National Energy Network Development Plan (PEH) aims to provide insight into which new national energy infrastructure will be required leading up to 2050 and the most suitable locations for such infrastructure. In this way, the State can anticipate the national energy network's future spatial needs and govern the spatial planning of the various national components of the onshore energy system. The DGDO programme supports these ambitions through the identification and careful positioning of underground elements of the energy infrastructure such as geothermal energy extraction and energy storage.

North Sea Programme

The DGDO programme does not concern the North Sea as this falls under the scope of the 2022–2027 North Sea Programme, which is part of the 2022–2027 National Water Programme (NWP). The North Sea Programme is concerned with the spatial planning of the North Sea and the achievement of favourable environmental conditions. The main challenge for the North Sea Programme 2022–2027 is determining the right societal balance for the North Sea's spatial development. This development must be efficient and safe and fit the requirements of a healthy ecosystem. The programme describes policy regarding strengthening of the ecosystem, the transition to a sustainable food supply and the transition to a renewable energy supply. A partial revision of the North Sea Programme is currently underway.

4. Alternatives for Natural Gas Extraction

4.1 Description of use of the deep underground

Why is the Netherlands still extracting natural gas?

The State is working toward a cleaner, future-proof economy with an affordable, reliable and sustainable energy system by 2050 at the latest. That includes a transition from fossil fuel to renewable energy. This process takes time. For now, fossil energy sources such as natural gas remain essential.

At the moment, approximately a third of Dutch households and industry's primary energy consumption is fuelled by natural gas. The total demand for natural gas in the Netherlands is around 30 billion m3. The Netherlands's total onshore and offshore gas production covers approximately 30% of this demand. Onshore natural gas extraction has lessened and will be responsibly phased out leading up to 2050. To keep the system operational, existing or new extraction may be added temporarily at times. As long as natural gas remains essential, extraction within the Netherlands, where safely and responsibly achievable, is preferable to importing gas from other countries. Natural gas from the Netherlands is often cleaner and requires less transport than imported gas.

On 23 April 2025, the State and natural gas companies concluded a 'Sector Agreement on Natural Gas Extraction in the Energy Transition'. The provisions in this agreement are aimed at ensuring a stable investment climate and predictable policies on natural gas extraction. An important part of this Sector Agreement relates to the North Sea. Further provisions will be made with respect to onshore natural gas extraction. These aim to provide more clarity regarding onshore natural gas extraction during the transition period.

Extraction of natural gas

Onshore, natural gas is obtained from various small gas fields. These small fields are basically all natural gas reservoirs in the Netherlands apart from the Groningen gas field. In principle, no more onshore exploration licences are being issued for natural gas. Existing extraction licences are being re-assessed and may be reduced. Exploration licence holders can still apply for an extraction licence, however. Such licence applications may only be rejected for the grounds for refusal listed in the Mining Act. To actually be permitted to extract the gas, additional licences such as an environment and planning permit are required. Licences for offshore extraction remain available. Offshore extraction falls outside the scope of the DGDO programme.

To extract natural gas, wells are first drilled underground (mining facilities). Pipelines transport the extracted gas to processing plants, after which the processed gas enters the national gas distribution system. Natural gas extraction's spatial impact on the surface concerns both the extraction site and the (shallow) infrastructure for transport and processing. Gas extraction can also have an impact underground. Soil motion, e.g. soil vibration or subsidence, is the most noticeable effect.

The mining facilities required for extraction must be safely and responsibly removed once the natural gas has been extracted. Removing these facilities frees up surface space for other uses.

4.2 Stocks, supply and demand

Stocks

Discovered and contingent natural gas stocks amount to 1593 PJ offshore and 893 PJ onshore[14]. The Netherlands currently has 91 productive onshore gas fields, 44 as yet undeveloped fields and 72 (temporarily) abandoned fields, see also Figure 3. There are another 200 sites or so with potentially viable amounts of natural gas. In 2023, the supply of natural gas from small onshore gas fields was around 2.9 billion m³, approximately 28% of total gas production in the Netherlands.

[14] See TNO, 2025: Discovered stock: proven gas reserves that are commercially viable to extract; contingent stock: proven gas reserves not viable to extract until certain conditions are met. Data about supply based on the exploration and extraction licences issued, information the mining companies must provide according to Article 113 of the Mining Act.

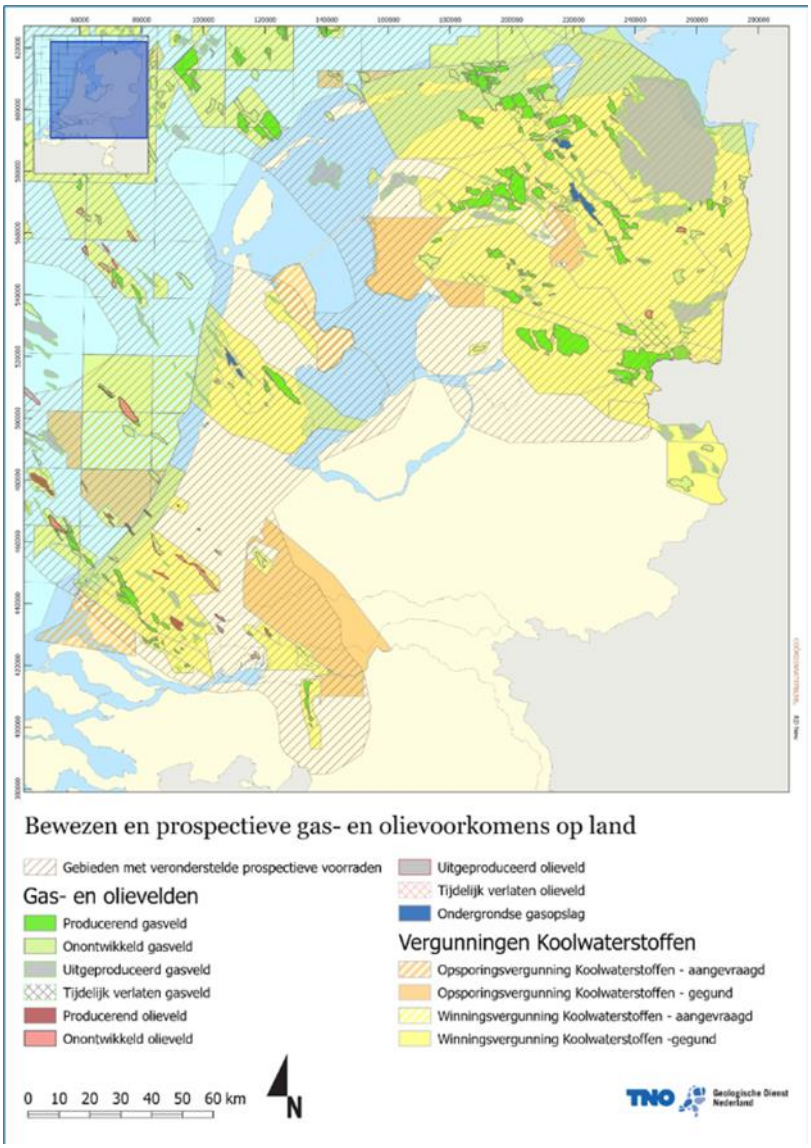

Figure 3: Potential onshore gas and oil (source: TNO, 2025[15])

Demand

The Netherlands consumed approximately 32 billion m³ of natural gas in 2023 (TNO, 2025[16]). There will continue to be a demand for natural gas in the Netherlands until at least 2050. The Netherlands is a net importer of natural gas, as domestic production is lower than the demand. In scenarios with a slower transition to renewable energy, the demand for natural gas remains comparable to current levels. The other scenarios show a sharper decrease in demand due to the energy transition and more sustainable housing and industry.

TNO[17] has created a forecast for the quantities of gas that will be obtained from small fields in the coming years (see Figure 4). These small fields' contributions to the gas supply will decrease, both in an absolute sense (supply per annum) and relative to demand. To be able to continue meeting demand, more gas will need to be obtained by other means.

[15] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[16] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[17] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

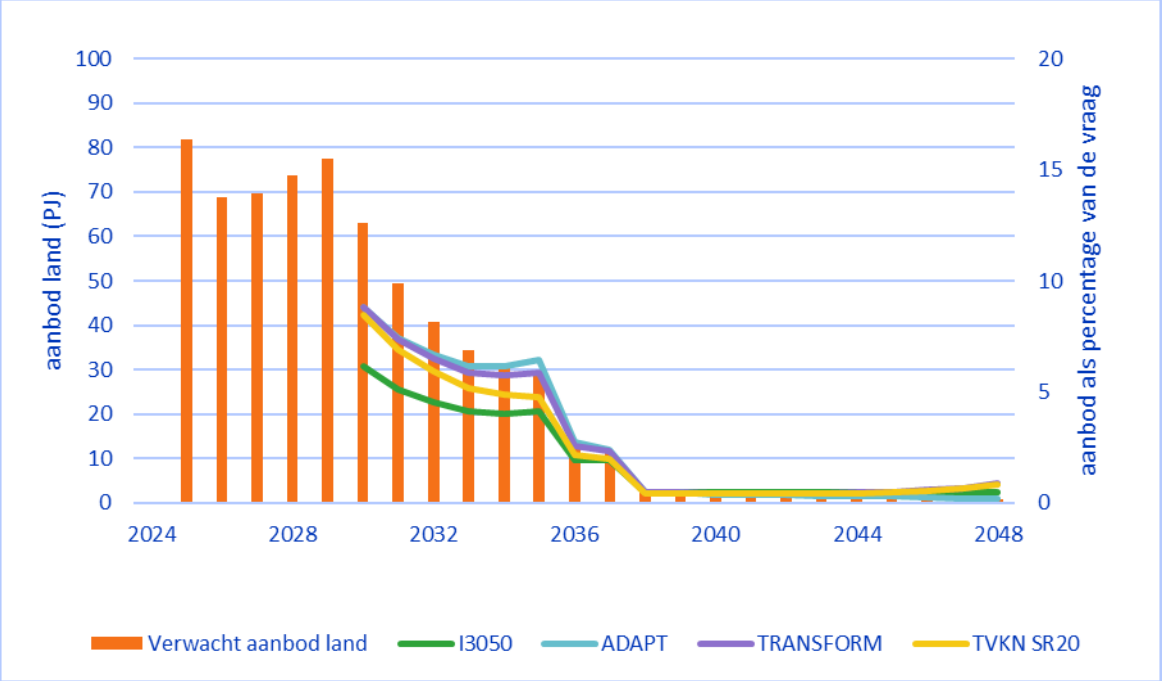

Figure 4: Predicted supply of natural gas from small onshore gas fields and percentual supply compared to demand, for different scenarios for trends in demand (based on data from TNO, 2025[18])

4.3 Reference situation

For natural gas extraction,[19] the Sector Agreement on Natural Gas Extraction in the Energy Transition of 24 April 2025 applies (see Section 4.1). Further agreements have been made with respect to onshore extraction (Sector Agreement, Article 10). These were signed by the Ministry of CGG, Element.nl and EBN B.V. on 16 January 2026.

According to the Letter to Parliament of 6 December 2024, the Sector Agreement is to be included in the DGDO programme[20]. For the SEA report, this means the Sector Agreement is considered part of autonomous developments. Researching alternatives to the Sector Agreement (or an adapted agreement) is thereby outside the scope of the SEA report.

Considering the above, the SEA report uses the following approach to describe the reference situation for natural gas extraction:

- The reference situation is based on current policy (with no additional onshore exploration licences in principle) and, if applicable, any relevant agreements arising from the Sector Agreement; no extraction under the Wadden Sea.
- In describing the reference situation and the environmental impact of the alternatives, where relevant, the SEA report also includes a reflection on the Sector Agreement's influence.

[18] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[19] In this section, unless otherwise stated, 'gas extraction' refers solely to onshore natural gas extraction.
[20] Ministry of Climate Policy and Green Growth. (2024, 6 December). Letter to Parliament on responsible reduction of onshore natural gas extraction. Parliamentary Paper 32849, No 266.

4.4 Objective and scope

Objectives of the DGDO onshore natural gas extraction programme:

- Consolidation of current policy and policy agreements, including sector agreements;
- Ensuring sufficient space underground to be able to meet the Netherlands' demand for gas through 2050;
- Determination of the associated spatial preconditions.

Matters the State wants to decide with respect to the onshore extraction of natural gas:

- Consolidation of the current policy and policy agreements;
- Need for a supplementary policy on small gas field extractions;
- Determination of the associated spatial conditions.

4.5 Alternatives to be assessed

The **reference** for onshore natural gas extraction consists of reduced extraction in line with current trends and current policy (so, no further exploration licences) and the agreement signed on 16 January 2026 regarding Article 10 of the Sector Agreement.

Consequently, the SEA report does not assess any alternatives for onshore natural gas extraction. The reflection does explore the impact of natural gas extraction insofar as this is applicable in the reference situation. This means that e.g. gas extraction's impact on subsidence is also considered. The SEA report will assess additional subsidence due to natural gas extraction compared to other causes of subsidence, based on data such as ongoing research by Deltares and TNO.

Not assessed

Several other options will not be assessed in the SEA report. The first of these is enabling extraction from the Groningen gas field. The State does not consider this a realistic option, as it would violate the Mining Act, have seismic consequences and contravene previous agreements in this regard.

Nor is prioritising gas extraction from small fields which can subsequently be used for hydrogen storage considered useful at this time. However, this option is likely to be reconsidered during a future re-evaluation of the DGDO programme.

5. Alternatives for Geothermal Energy Extraction

5.1 Description of use of the deep underground

Geothermal energy is a reliable, renewable and continuous source of heat that can help enable more sustainable heating in greenhouse horticulture, business and the built environment. Current energy scenarios assign geothermal energy a major role in the energy transition[21]. Use of geothermal energy supports achievement of the Climate Agreement's heating goals. Using geothermal energy reduces the Netherlands' dependence on foreign energy sources and improves the security of supply. Geothermal energy has the potential to fulfil a quarter of the demand for sustainable heat in 2050[22]. While electricity is the backbone of the new energy system, relying exclusively on electrification is neither spatially feasible nor desirable. By making good use of heat sources such as geothermal energy, residual heat, soil energy, solar and aquathermal energy and establishing district heating networks, aboveground spatial demands decrease and electricity systems are under less pressure.[23]

According to the method most commonly practised in the Netherlands, geothermal energy extraction involves the extraction of thermal energy from groundwater reservoirs located in rock strata at depths of between 500 and 3,000 metres underground. The system consists of a pair of production and injection wells. This setup is known as a doublet. The production well pumps up hot water from underground, heat is extracted from this water aboveground and then the injection well is used to return the cooled-off water to its original soil layer. The spatial impact concerns the well locations, well pads on the surface and the infrastructure required to distribute heat to users. Underground, the land take consists of the production and injection wells' areas of thermal and geohydrological influence.

Legislation

Current legislation ensures that space is not reserved unnecessarily, without any extraction taking place:

- In case of a 'search area' application, the potential demand for heating is assessed;
- In case of a 'start-up licence' application, the actual demand for heating is assessed. Proof of such demand could take the form of a letter of intent, or the presence of an existing district heating network;
- In case of a 'follow-up licence' application, the presence of heat supply agreements is assessed.

The search area can be explored for geothermal reservoirs for the duration of the allocation. No drilling is permitted at this time. Search area allocations are often relatively generous to allow for the exploration of multiple possibilities. Once a start-up licence has been obtained, drilling may start and production wells be constructed. This must be done within the area specified by the licence. In theory, the licensed area corresponds to the exploitation area; the space underground actually used for the extraction. In practice, the extraction area can be smaller than the licensed area, for example if a licence is for more wells than end up being viable.

5.2 Stocks, supply and demand

Stocks

TNO's Spatial Planning Assessment charts the potential for customary geothermal extraction methods[24]. This does not include ultra-deep geothermal energy extraction at depths below four kilometres.

The Netherlands' geological potential for geothermal energy is more than sufficient to meet predicted heating demand up to and far beyond 2050. However, this potential is not evenly distributed within the Netherlands. The viable geothermal potential is much higher in certain areas (see Figure 5). The province of Zuid-Holland has great potential, for example, particularly in the 'West-Nederlands Bekken'.

[21] Examples: National Energy System Plan, PBL Netherlands Environmental Assessment Agency – Exploratory Study on Welfare, Prosperity and the Human Environment: Climate and Energy (2025)
[22] Development Perspective for Sustainable Heat Sources, December 2024, Ministry of CGG
Development Perspective for Sustainable Heat Sources | Report | Rijksoverheid.nl
[23] Ministry of Housing and Spatial Planning (2025). Draft National Spatial Strategy. Parliamentary paper presented to the House of Representatives on 26 September 2025.
[24] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

The charted potential does not yet include the results from Energie Beheer Nederland's so-called 'SCAN' study[25]. This study explores the geothermal potential of specific spots in the Netherlands in more detail. The identified areas with potential from Figure 5 could be either smaller or larger than assumed[26]. This report is based on the currently identified areas with potential from TNO's Spatial Planning Assessment[27], along with any additional areas revealed to have potential during the creation of this SEA report by the SCAN study.

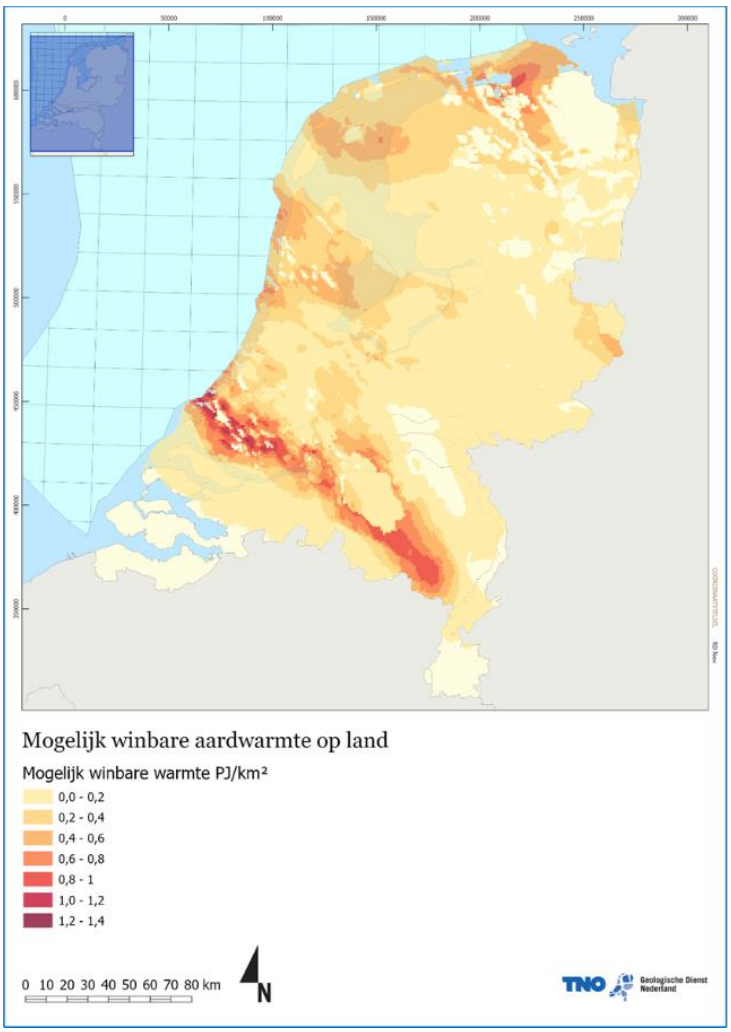

Figure 5: Geothermal energy potential in the Netherlands (source: TNO, 2025[28])

Supply and demand

Total geothermal energy production in 2024 amounted to 7.491 PJ; this is the current supply. At the moment, most of this supply is used for greenhouse horticulture. The majority of the built environment and greenhouse horticulture's heating needs are currently being met with the help of fossil fuel, natural gas in particular. Only a small fraction is met using geothermal energy. Geothermal energy usage may see significant increases in the built environment and light processing industry. The supply includes both current and future production by geothermal wells with start-up or follow-up licences and wells that are still under development. The total current supply is 11 PJ.

[25] EBN is a national public energy company which actively works to ensure a renewable, reliable and affordable energy supply for residents and businesses in the Netherlands (About EBN).
[26] Areas included in the SCAN study have been indicated in the online GIS map for TNO's spatial planning assessment (TNO, 2025).
[27] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[28] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

The current geothermal energy supply is not enough to meet predicted future demand. The development of additional supply follows demand; to launch a new geothermal project, the demand must first be identified and declarations of intent for the heat supply signed. Lagging demand for heating in the built environment, unfamiliarity with the underground, grid congestion and excess nitrogen emissions have all delayed geothermal energy's development. Furthermore, there are only a number of limited drilling facilities available for geothermal energy currently. It takes several years to develop a productive geothermal doublet.

Geothermal energy cannot be transported over long distances. A geothermal energy source can never be farther than approx. 20 kilometres from the demand due to heat loss and increasing costs.[29] Geothermal supply and demand are inextricably linked: the location of the demand determines where geothermal energy can be utilised. In many cases, efficient use of a geothermal energy source makes seasonal storage desirable. Preferably, this is done in underground water-bearing layers (aquifers). Such storage often happens at 500 metres underground or less, but deeper is theoretically possible. Underground 'high or medium-temperature' thermal energy storage is still under development. In the Netherlands, only a few projects using such seasonal storage are currently operational. This is not a significant factor in geothermal energy use so far, but becomes more important for projects in the built environment.

In most current energy scenarios, demand for geothermal energy shows a gradual increase. Technological developments regarding storage and transport may affect both supply and demand substantially. Figure 6 depicts the forecast for the average predicted geothermal supply compared to predicted demand.

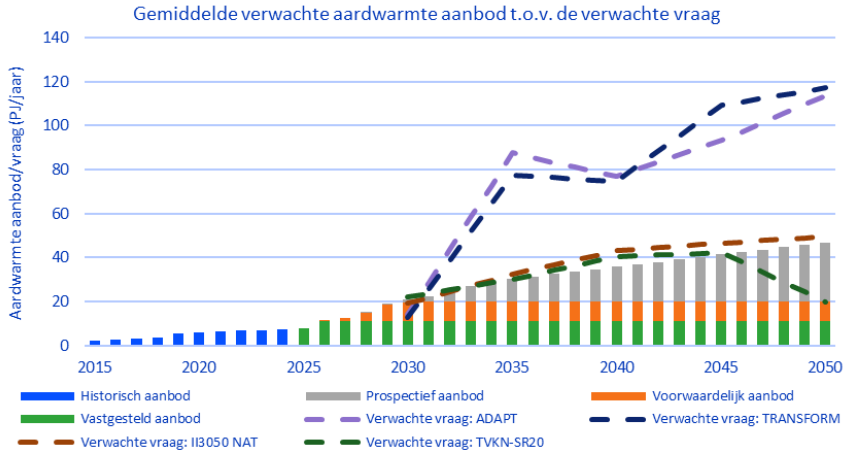

Figure 6: Average predicted geothermal energy supply compared to predicted demand (source: TNO, 2025[30])

The lifespan of a geothermal doublet is generally around 30 years, sometimes longer. After that, energy production can drop. This may necessitate drilling a new doublet. A new licence must be applied for in that case.

[29] This distance derives from an example in Moerdijk, where geothermal heat will be needed to supply the Amernet heat network. In other words, that maximum of 20 km is based on a situation with an extremely high potential consumption.
[30] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

5.3 Reference situation

There are 33 geothermal energy plants in the Netherlands. In 2024, 23 of those 33 wells were used to produce geothermal energy, 6 were preparing to start production and 4 were inactive all year. The Netherlands produced 7.491 PJ of geothermal energy in 2024. Of the 33 geothermal energy wells, 18 have follow-up licences for long-term production. The other operational wells all have start-up licences. These wells will need to apply for a follow-up licence before the start-up licence expires. The six wells currently preparing for production should be operational within the next two years, and are therefore included as confirmed geothermal energy resources.

The reference situation is based on the existing (confirmed) supply calculated in TNO's Spatial Planning Assessment[31]. This supply is based on the start-up and follow-up licences that have already been granted (acquired rights). In the event of autonomous development, without a DGDO programme, the assumption is that more search areas could be allocated and more licences granted. The reference situation in this SEA report is limited to the existing, confirmed supply. Increasing supply is a factor in the assessed alternatives, and its impact is assessed explicitly and with a good level of comparability.

Groundwater and drinking water protection zones

When extracting geothermal energy, groundwater and drinking water protection zones must be taken into account. There are various types of zones, with different protection levels and competent authorities. The table below provides an overview.

Table 2 Groundwater protected zones, competent authorities and current geothermal energy restrictions

Type	Competent authority	Current geothermal energy restrictions
Water catchment area	Provincial authorities	Very strict protection, direct source of drinking water. Geothermal energy extraction prohibited everywhere.
Groundwater protection areas, groundwater protection zones, areas where physical soil degradation is prohibited, zones where deep drilling is prohibited, infiltration areas, no-drill zones, urban groundwater protection zones, cooling/heating storage-free zones, vulnerable drinking water reservoirs, less vulnerable drinking water reservoirs, surface water supply protection zones, 100-year attention areas, (moderately) vulnerable strategic groundwater supplies, groundwater protection areas or supplementary strategic supply areas.	Provincial authorities	Characteristic of these areas is the fact that there is no vertical depth limit. Most provincial environmental regulations prohibit geothermal energy extraction in such areas. However, provinces can still grant environment and planning permits for geothermal energy within these areas as long as certain conditions are met and the area is not excluded by law[32].
NGR – National Groundwater Reserves	State	The Ministry of Infrastructure and Water Management's Programme for Soil, the Underground and Groundwater (BOG) will designate National Groundwater Reserves (NGR areas); sources of clean groundwater at greater depths for long-term and emergency use. The protection scheme for NGR areas still needs to be finalised. Under current policy as defined in STRONG, geothermal projects are still permitted in these areas. Once the BOG programme has been finalised, the NGR areas' impact on geothermal development opportunities will be clearer. Together, the DGDO and BOG programmes will attempt to establish a good balance between protection of groundwater reserves and the exploitation of these areas' geothermal energy potential, see also Section 10.1. Characteristic of NGR areas is the fact that they will be defined in three dimensions and have a vertical depth limit.

[31] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[32] See Article 24w of the Mining Act, see Explanatory Memorandum Detailed report of bill for Collective Act on Climate and Green Growth | Parliamentary Paper | Rijksoverheid.nl

Natura 2000 sites

Under the Mining Act, geothermal extraction is permitted in Natura 2000 and Nature Netwerk Nederland (Nature Network Netherlands) sites with the exception of the Wadden Sea. As elsewhere, however, the Environment and Planning Act does mandate environment and planning permits for drilling that take the potential impact on nature into account, including a 'nitrogen assessment'. In practice, this imposes strict conditions for geothermal extraction in conservation areas.

5.4 Objective and scope

The DGDO programme's primary objective for geothermal energy extraction is the facilitation of an increased geothermal energy supply and determination of the associated spatial conditions required to achieve this, e.g. producing geothermal energy while also protecting groundwater sources. To that end, the DGDO and BOG programmes will need to work together to establish objective conditions and frameworks that weigh geothermal use of the underground against groundwater protection in three dimensions. One potential solution is the addition of a vertical depth limit for existing groundwater and drinking water protection zones. The provinces (and, in future, possibly the State for NGR areas) are and remain the competent authority for environment and planning permits.

The DGDO programme is NOT concerned with policies to increase demand for geothermal energy. This is addressed through other energy policy frameworks, such as the National Energy Network Development Plan and the accelerated geothermal energy development challenge[33].

Geothermal systems shallower than 499 m in depth are not covered by the Mining Act and fall outside the scope of the DGDO programme.

Finally, the DGDO does not consider 'ultra-deep' geothermal energy from more than 4 kilometres below the surface. While progress is being made, this technology is not yet in use in the Netherlands currently due to the high initial costs and uncertain results. Developments are ongoing and these considerations may change in future. This option will be re-considered when the DGDO programme is reviewed in 2035.

Matters the State wants to decide with respect to geothermal energy:

- Establishment of conditions and frameworks for the safe, responsible promotion of geothermal energy within the context of groundwater protection;
- Determination of the associated spatial conditions.

5.5 Alternatives to be assessed

The **reference situation** assumes an existing confirmed supply of 11 PJ per annum (see Figure 6, green bars). This supply is based on the start-up and follow-up licences that have already been granted. Furthermore, in the reference situation, provincial regulations mean no geothermal energy extraction is permitted in designated groundwater or drinking water protection zones. The SEA report will assess the following alternatives for geothermal energy extraction:

- **Alternative W1**: Alternatives regarding the supply.
  These alternatives are based on the II3050 demand scenario and the supply scenarios from TNO's Spatial Planning Assessment[34] (see Figure 6). The II3050 demand scenario is the most realistic, as this aligns with the drilling capacity available in the Netherlands. Based on this capacity, drilling ten new doublets (geothermal sources) annually is assumed to be the maximum feasible number at this time.
    - ***Alternative W1a***: Situation in which the contingent supply from TNO's Spatial Planning Assessment[35] (Figure 6, orange bars) is achieved. The contingent supply is 9.2 PJ/annum, in addition to

[33] Overheid.nl (2025). Stimulation of Sustainable Energy Production and Climate Transition Decision Via: Stimulation of sustainable energy production | House of Representatives of the States General
[34] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[35] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

the existing supply of 11 PJ/annum, and has not yet been proved through drilling[36].

- ***Alternative W1b***: Situation in which the prospective supply from TNO's Spatial Planning Assessment[37] (Figure 6, grey bars) is also achieved. The total prospective supply is 26.7 PJ/annum, and is in addition to the current supply of 11 PJ/annum and contingent supply of 9.2 PJ/annum. This is the upper supply limit based on predicted demand according to the II3050 scenario[38].

- **Alternative W2**: Situation where a geothermal well pad is constructed outside the protected zone and angled drilling used to extract geothermal energy from under the protected zone. Currently, if there is a provincial prohibition against drilling for geothermal energy, it is generally also not permitted to construct a well pad outside the protected zone and then drill under the protected zone at an angle. Provinces do have room in their policies to issue an environment and planning permit for this under specific conditions This alternative assumes a three-dimensional delineation of current protected zones with a vertical depth limit. That would enable drilling for geothermal energy under a protected zone.
  This alternative explores the environmental impact of angled drilling and analyses the feasibility of its use for the safe extraction of geothermal energy from under protected zones. An additional goal for this alternative is the exploration of the impact of geothermal energy extraction under future NGR areas.

  We also considered assessing an alternative where the geothermal well pad is located inside a groundwater protection area. Instead, it was decided to assess this in a separate process which quantifies the impact of geothermal drilling within these protected zones and explores the feasibility of safely extracting geothermal energy from under such zones.

Based on the impact of alternatives 1a and 1b, the SEA report includes a reflection on a future in which the supply could be even higher.
For alternative 2, the reflection explores the general impact of a situation without any new geothermal energy sources. This appears quite unrealistic, but does offer a fuller picture of the usefulness, necessity and consequences of geothermal energy extraction relative to other heat sources.

Various urban factors, such as lack of space and soil contamination, are also relevant. These factors are included in the impact assessment.

[36] Licences with a so-called 'SDE++' grant count towards the total contingent geothermal energy supply. These can be either start-up licences or search area allocations. That means no wells have been drilled yet. Basically, these are exploration projects with extensive plans for further development. This development will still require some time to complete due to factors such as the required licensing and finalisation of investment decisions.
[37] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[38] The prospective geothermal energy supply consists of the estimated potential production for the allocated search areas (without an SDE++ grant) plus the supply available outside these allocated areas. TNO assumes that the supply outside the allocated search areas is limited by the Netherlands' drilling capacity. It is assumed that no more than ten new doublets can be drilled in a year.

6. Alternatives for Salt Extraction

6.1 Description of use of the deep underground

Salt extraction in the Netherlands involves the industrial extraction of rock salt and magnesium salt from underground. Rock salt is extracted mainly in Groningen, Friesland, Drenthe and Overijssel. Salt formations present in these areas allow for easy extraction, with 'salt diapirs' in the north and shallow 'laminated' salt layers in Twente. Magnesium salts are relatively rare and are only extracted in Veendam, Groningen.

The salt extraction method used in the Netherlands is known as solution mining. Fresh water is injected underground by means of a borehole, dissolving the salt so it can be pumped up as brine. The brine is transported to another location for processing. There, the water is evaporated from the brine, leaving behind a salt residue for further processing and use. The resulting salt is very pure and suitable for use in the chemical industry or various applications related to the energy transition such as chlor-alkali for LED lighting, solar panels, insulation and batteries. Dissolving the salt creates 'salt caverns', brine-filled underground cavities. The extraction method can be adapted to influence the shape of the cavern and thus, the stability.

Salt extraction in the Netherlands is important for a few specific chemical industries and also in a broader range of applications. Salt's value is described in e.g. the study '*Maatschappelijke en economische waarde van zoutwinning voor Nederland*' (Social and Economic Value of Salt Extraction for the Netherlands)[39] and the related Letter to Parliament[40]. In this Letter to Parliament, the State designates salt extraction as being partially 'of national importance'[41]. The current Structural Vision for the Underground only considers salt extraction for storage to be of national importance. The State can use the DGDO programme to prioritise certain areas, however. Additionally, the National Energy Network Development Plan explicitly identifies underground hydrogen storage in salt caverns as an activity of national importance.[42] This is why the SEA report is also investigating salt extraction and it may be included in the DGDO programme.

Salt caverns can be used to store other substances such as gases (hydrogen, natural gas, nitrogen) or oil. For example, the Netherlands' strategic oil reserves are partially stored in salt caverns in Twente. To be suitable for e.g. hydrogen storage, caverns must meet specific requirements as to the size, shape, materials used, etc.

6.2 Stocks, supply and demand

Figure 7 indicates where rock salt is being extracted in the Netherlands and where there is a potential for salt extraction. Production in the Netherlands is fairly consistently around 6 to 7 million tonnes per annum. This production is directly linked to the demand for salt products. Current concessions in Friesland, Groningen and Overijssel are sufficient to meet demand until approximately 2045.

[39] TNO (2024). *De economische en maatschappelijke waarde van zout* (Economic and social value of salt). Report commissioned by the Ministry of Climate Policy and Green Growth.
[40] Ministry of Climate Policy and Green Growth (2025). Letter to Parliament on the national underground hydrogen storage agenda and the importance of salt extraction. Parliamentary paper presented to the House of Representatives on 4 July 2025.
[41] Ministry of Infrastructure and the Environment. (2017). Reply Paper in response to statements of views on the draft Structural Vision for the Underground.
[42] Ministry of Economic Affairs and Climate Policy. (2023). National Energy Network Development Plan.

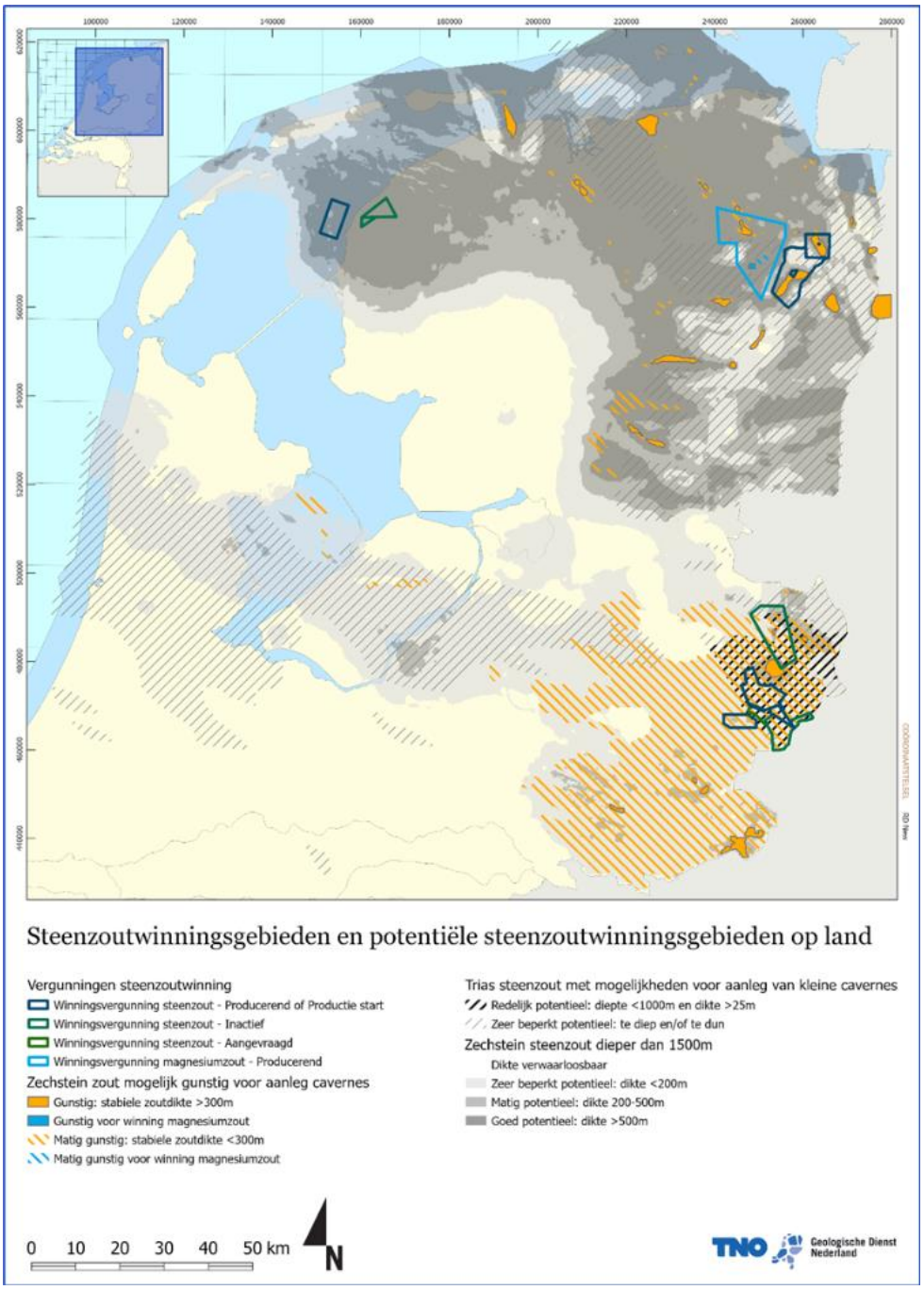

Figure 7: Potential for extraction of rock salt and magnesium salt in the Netherlands (source: TNO, 2025 [43])

6.3 Reference situation

The Netherlands' total estimated demand for rock salt until 2050 is approximately 150 million tonnes. The majority of this extraction has already been licensed and defined in approved extraction plans. Demand for magnesium salt up to 2050 is between 6 and 7 million tonnes. Forecasts do not indicate any substantial changes in the demand for rock salt in the near future. While factors such as macro-economic developments and industrial growth or shrinkage could affect demand, these have not been included in the current forecasts.

[43] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

There is plenty of rock salt present underground in the Netherlands (see also Figure 7). In theory, it is enough to meet demand for thousands of years into the future. Stocks from approved extraction plans will continue generating a supply up to around 2035–2045. To continue meeting demand through 2035–2050 and afterwards, additional extraction will be required. New extraction licences will need to be applied for leading up to 2045. Extraction takes around four years to become fully operational. The existing extraction site for magnesium salt in Veendam is sufficient to meet predicted demand until at least 2045.

No new licences will be granted for salt extraction under the Wadden Sea. Regarding magnesium salt extraction, the European Critical Raw Materials Act could also prove relevant. This regulation aims to secure a safe and sustainable future supply of critical raw materials to EU member states[44]. Developments are being monitored and this will be included in the DGDO programme's review if indicated.

6.4 Objective and scope

The DGDO programme aims to use salt extraction in support of the following goals:

- Ensuring sufficient space underground to be able to meet the Netherlands' demand for salt through 2050.
- Ensuring sufficient space in salt caverns to store the desired quantities of hydrogen based on the National Underground Hydrogen Storage Agenda (NAOW) and the associated policy choices from the DGDO programme. Section 7, which addresses underground hydrogen storage, provides more details.
- Giving regions where the envisioned salt extraction will take place sufficient opportunities to contribute ideas and working out how to approach the spatial and societal embedding of salt extraction in these regions.

Matters the State wants to decide with respect to salt extraction:

- Consolidation of the salt extraction taking place currently, based on existing extraction licences, to be able to meet the demand for salt up to 2045;
- The possible designation of preferred areas to be able to meet the demand for salt after 2045. To that end, the State also wants to determine what the status of this decision will be.
- The possible determination of preferred areas for hydrogen storage in salt caverns, including conditions as to how and where salt extraction should anticipate such use, see also Section 7.
- Defining the associated spatial conditions, while also taking into account the impacts of extraction, such as potential subsidence, on surface land use such as housing, agriculture and nature areas.

The DGDO programme is not expected to include any specific statements on magnesium salt extraction. Magnesium salt extraction is therefore included as part of the reference situation in the SEA report. No alternatives for magnesium salt extraction will be assessed. The current licence for magnesium salt extraction in Veendam remains in effect. Eventually, it will need to be investigated how to continue extracting magnesium salt once this specific extraction has ended. Because magnesium salt may become designated as a 'critical raw material', any decisions to change or continue this extraction will take place at a later stage as part of the National Exploration Programme for Critical Raw Materials.

[44] Letter to Parliament on National Exploration Programme for Critical Raw Materials | Parliamentary Paper | Rijksoverheid.nl

6.5 Alternatives to be assessed

In the **reference** situation, current concessions in Friesland, Groningen and Twente are used to meet predicted demand for rock salt until approximately 2045. Market operators must apply for new exploration and/or extraction licences to be able to meet demand after 2045. The reference situation assumes continued extraction of magnesium salts.

The SEA report will assess the following alternatives assessed for salt extraction:

- **Alternative Z1**: Concentration of additional salt extraction in existing salt extraction areas (Zuidwending, Drenthe, Friesland, Twente), insofar possible. This would align with current concessions (with extraction licences) and make efficient use of existing infrastructure and processing.

- **Alternative Z2**: Deliberate spreading out of additional salt extraction to mitigate salt extraction's impact on the living environment, e.g. subsidence. The SEA report includes a description of suitable areas in the alternative's elaboration.

Both alternatives are linked to the choice of hydrogen storage locations, see also Section 7. Furthermore, both these alternatives must consider existing extraction concessions versus potential new concessions.

The following factors will also be taken into account for these alternatives:
- To what extent future salt caverns should always be designed to enable re-use as storage, e.g. hydrogen storage. This would impose restrictions regarding the salt extraction method and associated operations (infrastructure and salt processing plants). Not all salt layers are suitable for use as storage.
- Potential barriers due to competition between regular salt extraction and extraction that also creates caverns suitable for energy storage.
- The impact of uncertain macro-economic developments and industrial growth or shrinkage affecting the demand for salt.

The SEA report also includes a reflection on the general impact if no additional salt extraction were to occur in the Netherlands after 2045. While this scenario deviates from current policy, which considers salt extraction an important activity, it is included in order to elucidate the potential impact. It provides details regarding the possible effects as a reflection on alternatives' impact. In this scenario, there is no more new salt extraction taking place and salt is imported from abroad. A general description is included of the impact if salt were only extracted in aid of hydrogen storage after 2045. In that case, it would not be used to meet the demand for salt.

7. Alternatives for Underground Hydrogen Storage

7.1 Description of uses of the underground

Underground hydrogen storage is an essential component of the Netherlands' future energy system. It enables the conversion of surplus solar and wind energy into hydrogen so it can be stored for later use. Hydrogen storage contributes to security of supply, proper operation of market forces, a robust energy system and the hydrogen network's functioning. The DGDO programme will consider two alternatives for underground hydrogen storage; in salt caverns and in gas fields.

Storage in salt caverns means the salt must be extracted first. Existing salt caverns in the provinces of Groningen and Friesland are located at depths of over a kilometre underground, while caverns in Twente are shallower, starting at around 500 m. Generally speaking, salt caverns constructed in the past either aren't suitable for hydrogen storage or are already being used to store other substances such as diesel or natural gas. These caverns are not considered as options for hydrogen storage. That means hydrogen storage will require the construction of new caverns by means of the usual salt extraction methods. For these caverns to be suitable for hydrogen storage, the means of extraction and materials used must already take this future use into account. This will also require additional infrastructure, both on the surface and underground.

Gas fields are located at depths of more than a kilometre underground and with sufficient technological advances, could potentially be used for large-scale hydrogen storage as well. Worldwide, there is not much experience regarding hydrogen storage in gas fields yet. Pilot projects are underway in Austria and Germany, and additional pilots are set to launch in other countries including Hungary and Spain in the next two to three years. The Netherlands is currently exploring options to set up an initial pilot as well. This country does have plenty of experience storing natural gas in gas fields.

7.2 Stocks, supply and demand

For salt caverns to be suitable for storage, the salt formations must consist of homogenous rock salt at the correct depth, with the right thickness and stability. The Netherlands has more than enough geological potential to create salt caverns for hydrogen storage. Onshore, there are five suitable areas: Groningen, Drenthe, Overijssel, Gelderland and Friesland[45]. Around 13 sites in Groningen, Friesland and Drenthe have been identified as potentially useful for hydrogen storage in salt caverns, two of which are already being used to store natural gas and nitrogen.

All the energy scenarios assessed[46] predict an increasing demand for large-scale hydrogen storage after 2030. To be able to meet this demand, there is a focus on storage in salt caverns and, eventually, in depleted gas fields as well. This storage will require the use of at least one salt cavern in 2030, increasing to 17–20 caverns in 2050 (lower limit) and possibly up to 40 caverns with additional gas field storage (upper limit), see Figure 8. Demand is strongly dependent on developments in the hydrogen sector, the type of use, the amounts of electricity produced using solar and wind power and policy choices in aid of a more sustainable industry and energy supply. Based on predicted future demand from the National Underground Hydrogen Storage Agenda (NAOW), Dutch storage capacity may need to be supplemented by storage in Germany or offshore. These supplementary options are not included for consideration in the DGDO programme.

[45] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.
[46] Scenarios described in TNO; Spatial Planning Assessment for Sustainable Use of the Underground. Module 1: The Deep Underground (2025) and the National Underground Hydrogen Storage Agenda for 2025.

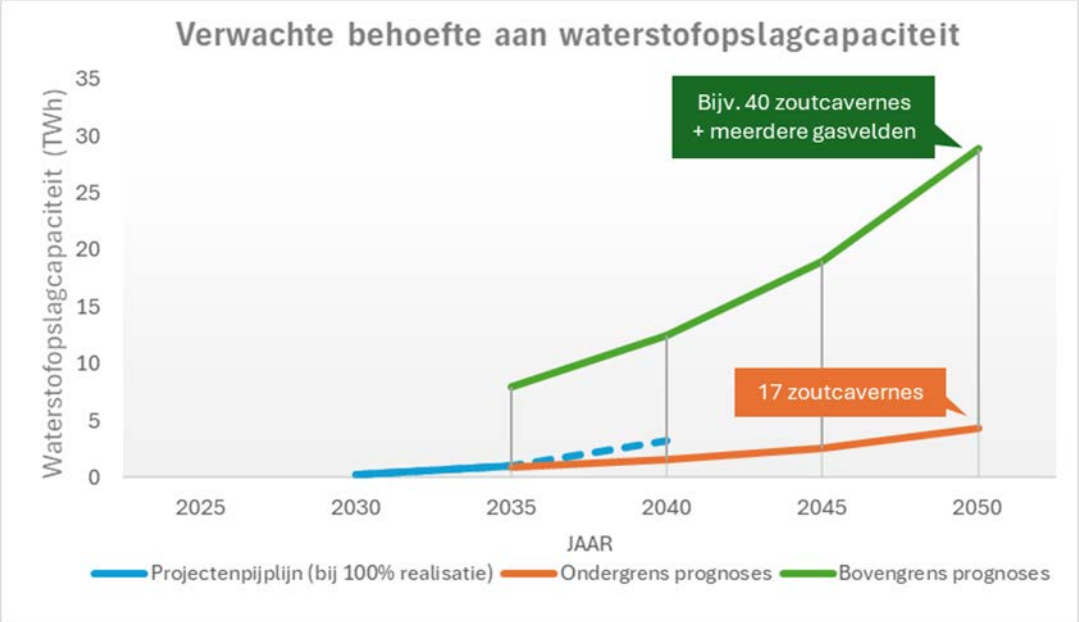

Figure 8: Predicted trends in demand for hydrogen storage capacity (TNO, 2025, source: National Vision on Underground Hydrogen Storage, 2025)

If all the plans for Zuidwending are implemented, this would result in up to 24 storage caverns being ready by 2050 with a total storage capacity of 6 TWh (21.6 PJ). This is sufficient to accommodate the lower limit of the predicted demand for storage, but far below the upper limit. For the upper limit to be achievable, around 40 caverns and multiple gas fields will be needed, see Figure 8.

7.3 Reference situation

Four hydrogen caverns are currently being constructed as part of the HyStock project in Zuidwending, Groningen. The first cavern is expected to be operational by 2031, the others by 2037. The reference situation for hydrogen storage is based on these caverns.

7.4 Objective and scope

The DGDO programme's objective with regard to hydrogen storage is to ensure sufficient space for the desired storage in line with the Underground Hydrogen Storage Agenda. The required storage capacity derives from the policy for a transition to renewable energy laid down in the National Energy Network Development Plan. This spatial requirement anticipates the envisioned increasing demand for energy storage. This demand is specified in the Underground Hydrogen Storage Agenda, along with predicted lower and upper limits.

To that end, the State wants to use this programme to make the following decisions:

- The designation of preferred areas with which to meet the national demand for underground hydrogen storage in salt caverns. It also wants to determine the status of this designation.
- Providing a framework for areas where regional storage could become valuable in supporting national demand. It also wants to determine how to provide a framework that fits the regions' needs in this respect.
- Indicating which steps the State will be taking to enable eventual storage of hydrogen in gas fields. The programme will not designate preferred areas for such use.
- Defining the spatial conditions for hydrogen storage in salt caverns and further development of the associated policy framework and standards.

Storage of gases other than hydrogen and storage under the North Sea fall outside the scope of the DGDO programme and the SEA report.

7.5 Alternatives to be assessed

In the **reference** situation, four salt caverns for hydrogen storage are constructed in Zuidwending as planned.

The State is using the SEA report to assess the following alternatives for hydrogen storage:

- **Alternative O1**: Achievement of the predicted *lower limit* for hydrogen storage demand until 2050 through the construction of nine new caverns in Zuidwending. These nine new caverns are in addition to the four planned caverns for Zuidwending included in the reference situation, creating a total of thirteen caverns. The question is whether this number will be sufficient to achieve the predicted lower limit for the storage required or if even more caverns will be needed.

- **Alternative O2**: Achievement of the predicted upper limit for hydrogen storage demand until 2050 through the construction of nine new caverns in Zuidwending (as in alternative 1), supplemented by new storage *in salt caverns* (up to approx. 40 caverns). This alternative is basically supplementary to alternative 1, should demand prove greater than the predicted lower limit or this lower limit fail to be achieved. For the new salt caverns, two alternatives are assessed:
  - ***Alternative O2a:*** Concentration of new salt caverns in two clusters, including one in Zuidwending;
  - ***Alternative O2b:*** New salt caverns spread across multiple clusters, for example in Zuidwending, Drenthe and/or Twente.

- **Alternative O3**: Achievement of the predicted upper limit for hydrogen storage demand until 2050 through the construction of nine new caverns in Zuidwending (as in alternative 1), supplemented by new storage in *gas fields*. These alternatives are basically supplementary to alternative 1, should demand prove greater than the predicted lower limit or this lower limit fail to be achieved, with supplementation through gas fields. This is not expected to involve investigation of any specific gas field locations as yet.

The SEA report considers the following factors:
- Whether prioritising potentially suitable locations for hydrogen storage over other uses (such as compressed air) is already desirable at this stage;
- Whether not using the salt extracted during cavern construction is desirable or necessary to achieve sufficient storage capacity in time, and what could be done with the extracted salt;
- The influence of uncertainty on alternatives being assessed regarding the use and type of hydrogen, carbon-free adjustable capacity, strategic reserves, import/export, types of consumers, security of supply, flexibility options and storage elsewhere, e.g. on the surface or offshore;
- Based on the Underground Hydrogen Storage Agenda, a demonstration project in an empty gas field and strengthening of European cooperation have also been included;
- The hydrogen storage choices interact with the choices from the National Energy Network Development Plan (PEH) and choices and developmental trajectories from the PEH II, including the location of a 'hydrogen backbone'[47]. The links between hydrogen storage and salt extraction are addressed in the elaboration on alternatives for salt extraction, see Section 6.

As a **reflection**, the impact will also be described if no more new underground storage were added after creating the four storage locations in Zuidwending. Further storage would take place on the surface. This does not appear very realistic for now and is only included to enable comparison of the impact in case of underground storage. This reflection is a general outline based on national quantities. It does not include any site-specific elaboration for the surface storage.

[47] This is the planned hydrogen pipeline that will be used to provide hydrogen to five large industrial clusters, see also TNO: Spatial Planning Assessment for Sustainable Use of the Underground. Module 1: The Deep Underground (2025)

8. Relations between Underground Activities

The four activities in the deep underground are not independent of each other. The activities' stocks and supplies overlap in various areas, either spatially or in time and both on the surface and underground. In many cases the extraction concerns multiple soil layers. Additionally, salt extraction and hydrogen storage in salt caverns are inherently linked. Accumulation of activities deep underground can create conflict between these activities and intensify the impact in a certain area.

These relationships are assessed using the following approach. First, the impact assessments per activity are used to determine the cumulative impact in both space (3D) and time (4D) of combining geothermal energy, natural gas, petroleum and/or salt extraction and/or hydrogen storage in areas where these activities could potentially coincide.

Subsequent research determines which combinations are already possible under current policy and which alternatives could be used to guide smart, desirable combinations of activities deep underground and their prioritisation. Those alternatives are then worked out in greater detail. As an example of prioritisation, natural gas may be extracted first, followed by geothermal energy. Setting such priorities is only useful if the research shows that combining these activities deep underground is not permitted under current policy or would be unsafe.

The combination of hydrogen storage and salt extraction deserves special attention, as these activities are inextricably linked. To that end, two alternatives are used to assess the most relevant factors and associated choices for this combination:

- **Alternative S1**: Hydrogen storage is definitive, determining the salt extraction locations. Key choices:
  - Use of Zuidwending to achieve the predicted lower limit for hydrogen storage in 2050;
  - Use of freely chosen, concentrated or spread-out hydrogen storage locations if preparing to meet the envisioned upper limit for such storage in 2050 through the use of salt caverns. The extracted salt may be sold or disposed of;
  - Same as the previous alternative, excepting the decision not to create any further storage in salt caverns besides the 13 caverns in Zuidwending.

- **Alternative S2**: Salt extraction is definitive, determining the hydrogen storage locations.
  - For both salt caverns currently under development and new caverns added after 2045, the development is not subject to any specific restrictions. Mining companies can determine the most desirable location based on their own considerations. The choice of location and whether to enable future hydrogen storage during extraction are left up to the company;
  - Newly constructed salt caverns won't be available before 2045, with the State controlling the locations (concentration vs spread). There are two options: either the mining company is free to decide whether to enable future hydrogen storage during extraction, or the State compels it;
  - This alternative is only feasible in areas potentially suitable for both underground salt extraction and hydrogen storage (see TNO spatial planning assessment, 2025[48]).

Both alternatives can then be used to derive general and area-specific choices and conditions for linked salt extraction and hydrogen storage for the DGDO programme.

[48] TNO (2025). Spatial Planning Assessment for Sustainable Use of the Underground: DGDO.

Relations with assessments for BOG programme

Finally, the relationships between the alternatives and their impacts are described, including the assessed alternatives from the SEA report for the Programme for Soil, the Underground and Groundwater (BOG). The assessed alternatives from the BOG programme are those that concern the deep underground or interact with the impacts from the DGDO programme. One factor that will definitely be explored is the relationship between geothermal energy extraction and groundwater protection, including for the designated National Strategic Groundwater Reserves from the BOG programme. We will also look at the alternatives' impact with regard to subsidence and subsidence-related choices in the BOG programme. This provides a comprehensive picture of the relations between underground uses and their impacts.

9. Impacts for Assessment

9.1 Impact Assessment using the Wheel of the Living Environment

The Wheel of the Living Environment was introduced in 2019, in the context of the National Strategy on Spatial Planning and the Environment, as a comprehensive tool with which to describe the impact on all themes relating to the physical living environment. The Wheel of the Living Environment aligns with the Environment and Planning Act. The objective of this legislation is defined as follows [49]: *with an eye to sustainable development, the liveability of the land and the protection and improvement of the living environment, (..) to, in conjunction with one another, (a) achieve and maintain a safe and healthy physical living environment and high environmental quality, also considering the intrinsic value of nature, and (b) purposefully manage, use and develop the physical living environment to meet social needs*.

The Wheel elaborates this objective into four core themes:
1. Safe and healthy physical living environment
2. Good environmental quality
3. Living environment
4. Economic environment

The assessment framework used in the DGDO programme's SEA report is based on these categories. The SEA report uses the assessment framework in creating the snapshot of the living environment and to describe and assess the alternatives. In principle, the impact is assessed at the level of the four core themes, taking all the indicators for each theme into consideration. A closer look is taken at the most relevant and distinguishing impacts, opportunities and risks in the context of the DGDO. If themes or indicators do not have any relevant or noteworthy impacts, opportunities or risks, these are not explicitly addressed.

Tables 3, 4 and 5 follow the Wheel's division into core themes, themes and indicators. These categories may be adjusted in the SEA report if necessary. That can be applicable to specific underground impacts such as soil vibration and subsidence, for example, or in case of relevant impacts occurring elsewhere.

Table 3 Themes and indicators for the 'Safe and healthy living environment' core theme from the Wheel of the Living Environment (source: *Environmental impact assessment report for National Strategy on Spatial Planning and the Environment*, Ministry of the Interior and Kingdom Relations, 2020)

Main theme	Theme	Indicator	Elaboration for impact assessment
Safe and healthy living environment	Environmental Quality & Health	Environmental health risk	Changed extent of environmental health risk due to factors including air quality, environmental safety risks and noise nuisance
		Healthy behaviour	Changed extent of journeys being made on foot or by bicycle and a healthy lifestyle
	Safety risks	Floods	Changed likelihood and effects of river or coastal flooding and the associated flood risk
		Earthquakes	Changed likelihood and effects of earthquakes in the Netherlands
		Environmental disasters	Changed likelihood and effects of economic disasters due to risks from economic activities
		Road safety	Changed numbers of road traffic victims, behaviour by road users and mobility trends
	Climate	Greenhouse gas emissions and sequestration	Changed greenhouse gas emissions and sequestration
		Heat and drought	Changed intensity and timing of periods of heat and drought
		Flooding	Changed prevalence and effects of waterlogging

Table 4 Themes and indicators for the 'Good environmental quality' core theme from the Wheel of the Living Environment

Main theme	Theme	Indicator	Elaboration for impact assessment

[49] Environment and Planning Act, Article 1.3

Good environmental quality	Natural systems	Soil & the underground	Changed quality of and natural systems in the soil and underground
		Groundwater	Changed groundwater quality and natural systems
		Surface water	Changed surface water quality and natural systems
	Nature	Quiet & darkness	Changed land area of dark, quiet and peaceful areas
		Biodiversity	Changed biodiversity
		Land area of nature conservation areas	Changed land area of nature conservation areas
		Connections between nature conservation areas	Spatial cohesion of nature conservation areas
		Species & habitats	Correct environmental conditions for sustainable conservation of species and habitats
	Landscape & public spaces	Landscapes of value	Changed land area and quality of valuable landscapes
		Public space	Changed quality of public spaces
		Heritage & archaeology	Changed preservation and development of archaeological sites, built heritage (monuments, historic townscapes and villages), cultural landscapes and world heritage

Table 5 Themes and indicators for the 'Economic Environment' core theme from the Wheel of the Living Environment (source: Environmental impact assessment report for National Strategy on Spatial Planning and the Environment, Ministry of the Interior and Kingdom Relations, 2020)

Main theme	Theme	Indicator	Elaboration for impact assessment
Economic environment	Natural resources	Drinking water	Changed quantity and quality of drinking water sources
		Mineral & fossil resources	Changed quantity and quality of mineral and fossil resources
		Circularity	Changed prospects for closed-loop raw material cycles
		Sustainable land use	Changed extent of sustainable land management, including soil health and fertility
	Economic capital	Employment opportunities	Changed availability of jobs in sectors
		Earning potential	Changed earning potential in sectors
		Knowledge and innovation	Changed extent of knowledge development and innovation
		National security	Changed assurance of national safety
	Spatial economic structure	Accessibility	Changed availability of jobs with commutes under an hour
		Energy networks	Changed connections between energy supply and demand due to energy infrastructure
		Digital network	Changed digital connectivity due to digital infrastructure
		Establishment locations	Changed land area and quality of establishment locations for specific sectors

Table 6 Themes and indicators for the 'Economic Environment' core theme from the Wheel of the Living Environment (source: Environmental impact assessment report for National Strategy on Spatial Planning and the Environment, Ministry of the Interior and Kingdom Relations, 2020)

Main theme	Theme	Indicator	Elaboration for impact assessment
Living environment	Living & living environment	Housing locations	Changed land area and quality of housing locations
		Facilities	Changed availability, quality and proximity of facilities
		Recreation	Changed availability, quality and proximity of recreational opportunities
	Wellbeing	Social cohesion	Changed (spatial) social cohesion
		Inclusion	Changed equality of opportunities for participation in society

9.2 Impact assessment in four dimensions

In the visualisation of the living environment, impact descriptions and assessments, the SEA report considers both the various elements of the system (soil layers) and the impact at various times (phases), see Table 7. The SEA report explores four dimensions; the three layers of soil and the phase in time. The SEA report includes an overview of all activities required to enable use of the deep underground. For each of the activities, it describes the relations between intervention and impact. This overview is linked to the alternatives to be assessed.

Table 7 Assessment of layers and phases

Part of physical system	Part of use (function)	Construction phase	Impact of use phase	Dismantling phase/ Long term
Layer 1: Surface	Temporary and permanent facilities for use of the underground, e.g. heat exchanger, pumps, boreholes	• Land take (nature, etc.) • Environmental impact (noise, etc.) • Impact on soil, surface water or groundwater	• Environmental impact (noise, nature, landscape, soil, water) • Effects of soil motion (subsidence, vibration)	• Waste disposal, injection of waste • Likelihood of functional recovery after dismantling • Cessation of impact (e.g. noise) • Long-term impact of subsidence • Risk due to failure of permanent seal
Layer 2: Intermediate soil	There are no activities in this layer, except to drill through it[50]	• Drilling through barrier layers • Reduced effectiveness of barrier • Leaks	• Mixing/reduced barrier effect • Contamination • Temperature change	• Continued risk of impact
Layer 3: Underground	Functional uses, e.g. storage or extraction		• Soil motion • Pressure change • Contamination • Temperature change	• Soil motion • Contaminant transport

[50] When actually tunnelling through the intermediate soil, penetration of barrier layers is the most relevant issue. Drilling under intermediate soil at an angle enables resources to be extracted from under a protected area even if drilling through that area is not permitted.

Assessment by layer
The descriptions and assessments in the SEA report distinguish three layers:

- The **surface** is basically the layer of the immediate living environment in which an impact may occur due to permanent or temporary facilities for use of the underground; the soil and the first few metres underground[51]. Impact in this layer can relate to the soil quality, air quality, noise, light, water quality, landscape, ecology, and social and economic factors such as health, safety and perceptions. Impact in this layer can also be due to subsidence and soil motion.
- **Intermediate soil** is the layer between the surface and the (deep) underground, where impacts will be mainly due to drilling. This concerns all soil layers between the previously mentioned surface and the underground. The extent of these intermediate layers depends on the actual depth of the extraction or storage.
- The **underground** is the layer where the actual extraction or storage takes place. Examples of impact include soil motion, contamination and temperature changes.

The descriptions and assessments focus mainly on the areas in which an impact may occur. In addition, where relevant, the SEA report includes a general, qualitative evaluation of possible impacts occurring elsewhere, e.g. the impact of mineral imports.

Assessment of different phases
The SEA report considers the impact on the three layers at various phases. It distinguishes a construction phase, a use phase and a dismantling phase/long-term use.

For the construction phase, it addresses the impact of activities in the deep underground. Examples include noise nuisance, air pollution due to construction traffic, disturbance to plants and wildlife, soil disturbance and safety. For the use phase, the SEA report addresses the impact of ongoing use of the deep underground. Examples include emissions, energy consumption, water consumption, waste production and effects on the landscape and living environment.

Terminating an activity can also have a (lasting) impact. That impact may relate to abandonment[52], e.g. residual waste, soil and water risks or redevelopment of the area in question, but also to knock-on effects due to minerals being removed. Aftercare may be necessary in this phase. Various factors can influence an impact's duration and thus, the length of this phase. The SEA report explores these factors.

Impact assessment based on expert judgement
Impact assessments in the SEA report are generally qualitative in nature and are accomplished based on expert judgement, existing information and analyses. The SEA report also addresses the existence of uncertainty and gaps in knowledge and information.

9.3 Impact assessment method

The SEA report assesses the impact of the alternatives compared to a reference situation. This is the future situation expected to come about as a result of current policy and autonomous developments, that is to say without the DGDO programme's influence. To be able to describe this reference situation, the SEA report must first define which developments are considered autonomous. Reference situations in an SEA report are commonly defined based on both established policy and planned policy changes with a high likelihood of implementation. They also take into account autonomous developments such as climate change, demographic trends and developments due to established government policies (e.g. the Climate Agreement, spatial planning and legislative changes). For each use of the underground under consideration, the alternatives in Sections 4 through 8 are accompanied by descriptions of the associated reference situations.

The SEA report aligns with the DGDO programme's planning horizon of 2050. The SEA report also provides insight into the future after 2050.

[51] 'Soil' refers to the uppermost layer of the surface of the Earth and the gases, liquids and organisms contained therein. In a more practical sense, it refers to parts of the underground used for living and working, infrastructure, agriculture and nature, and also for cabling and pipelines.
[52] This is the term commonly used to describe the closing of production wells after extraction has ended. Permanent decommissioning of wells is subject to specific conditions

The intention is for the SEA report to follow the same approach used to create environmental impact assessment reports for the NOVI, the National Spatial Strategy and the 2020 and 2022 Monitors, while also making use of the environmental data contained in these reports. Descriptions of existing and reference situations in the DGDO's SEA report draw on this data wherever possible. The SEA report includes a brief explanation of any refinements in the reference situation's assessment for each theme. Where feasible, it also looks at anticipated trends and impacts in the reference situation leading up to 2070.

The intention is for the SEA report to follow the same approach used to assess environmental impacts in the National Spatial Strategy's recent SEA report. This involves an assessment of the current and reference situations for the environmental factors under consideration, followed by a description of whether and to what extent the alternatives would affect these situations in a positive or negative sense. These findings are then used to assess the future situation. A chart provides a visual representation of the assessment, including degrees of uncertainty.

9.4 Accounting for differences between regions and areas in the impact assessment

When creating an impact assessment for all of the Netherlands, regional differences and differences between specific areas should not be ignored. While this SEA report has a national scope, insight into such variations in impact is important. For this reason, the SEA report also considers the impact on different areas, particularly areas where the applications deep underground will actually take place for the alternatives being assessed.

10. Comprehensive Assessment of DGDO Policy Choices

The DGDO programme is intended to provide a coherent collection of national policy directions and choices for activities deep underground. The SEA report describes the environmental impacts of various alternatives, as well as their impact on the living environment. The various alternatives to be assessed represent the boundaries of the policy field. Based partially on the information from the SEA report, a strategic trajectory for development of the deep underground can be defined; this is the so-called preferred alternative that will be included in the (draft) DGDO programme. For the preferred alternative, too, the SEA report will assess its environmental impact and determine the suitability. As the activities deep underground are weighed individually, the preferred alternative can vary by activity, and may in fact deviate from the assessed alternatives.

10.1 Policy choices

The SEA report identifies the impact on the living environment for the various alternatives assessed, including the alternatives' relationships and interactions with each other. This is done for all three layers and their use phases. Intersections with the BOG programme and its SEA report are also taken into account. The impact offers insight into:

- Impact of individual activities deep underground and their assessed alternatives, for the areas in which these activities may take place;
- Correlations between these deep underground activities and their assessed alternatives for areas in which the activities may take place in combination, including their potential cumulative impact;
- Correlations between these deep underground activities and their assessed alternatives for areas with potential policy choices relating to the BOG programme, including their potential cumulative impact.

Partially based on these insights, the Ministry of CGG will make its policy choices for the (draft) DGDO programme. These policy choices are expected to concern, in conjunction:

- Choices regarding the extraction and/or storage quantities of substances;
- Choices regarding the areas where and under which conditions these activities can or are permitted to take place;
- Choices regarding prioritisation where different uses could cause conflict (spatial or timewise);
- Choices regarding the associated spatial and societal conditions for different types of exploitation and areas.

These are also used to generate insights for possible inclusion in the DGDO programme's spatial assessment framework. Further distinction may be made between general insights and insights only applicable to a specific use. Procedural considerations can play a role as well.

10.2 Impact of policy choices in assessed alternatives

In aid of the impact assessments for the alternatives, the SEA report distinguishes between several types of impact assessment. A distinction is made between alternatives for policy choices regarding the continuation of existing policy, alternatives for specific decisions leading to implementation, alternatives establishing principles to guide the policy implementation and alternatives concerning procedural decisions; see Table 8.

Table 8 Classification of alternatives for assessment of preferred alternative

Category	Explanatory notes	Method
1. Continuation of existing policy	Policy choice that is a consolidation and continuation of existing policy.	No impact assessment; no change compared to reference situation by definition, as the reference situation is based on a continuation of existing policy.
2. Specific decision	New policy choice that has been worked out in enough detail to provide insight into the implementation method.	Impact assessment; based on extent to which choices may already affect the achievability of targets for indicators from the Wheel of the Living Environment (5-point scale).
3. Decision in principle	New policy choice that is still undefined enough that insight into the implementation requires further weighing of choices in follow-up decisions. A framework for these follow-up decisions is imminent.	Impact assessment; based on investigating opportunities and risks relevant to follow-up decisions, insofar as future choices may affect the achievement of targets for the indicators from the Wheel of the Living Environment.
4. Procedural decision	New policy choice concerning an intention to make progress on a process that could lead to new policy. Frameworks for any follow-up decisions are not yet apparent.	No impact assessment; the impact cannot be determined as the nature of any follow-up decisions is still unclear.

10.3 Reflection on the impact

The SEA report assesses the reference situation and describes and assesses the impacts of the various alternatives under consideration. The chosen starting points can affect these assessments. The impact assessments may also be affected by various trends and developments. The most relevant are trends in demand, governance by the State and correlations with other policy programmes. Where pertinent, the snapshot of the living environment and impact assessment will include reflections on such developments.

Reflection on Mining Act revision

Due to the delay in the Mining Act, the description of the reference situation does not take this Act's planned update into account, nor do the assessed alternatives. The SEA report includes an explanation of how and to what extent the Mining Act revision affects the reference situation and the alternatives' assessment.

Reflection on trends in demand for the various areas

For natural gas extraction, salt extraction, hydrogen storage and geothermal energy, external developments and trends in demand can affect the snapshot of the living environment and the assessed alternatives' impact. Where pertinent, the impact assessment will address these effects.

Reflection on innovations

With respect to geothermal energy, innovations and research into ultra-deep geothermal energy extraction are currently ongoing. The reflection in the SEA report explores these developments' relevance to the impacts and their assessment.

Reflection on governance

In making these policy choices, it is also important to consider which tools are available to the State to support their actual implementation in the policy field. This is an important factor in the extent of the actual impact. This is even more relevant because the legal framework (Mining Act and Environment and Planning Act, see Section 3) is primarily aimed at safely and responsibly enabling the envisioned use of the deep underground. The Ministry of CGG is working on revising the Mining Act to create a future-oriented legal framework for safe and responsible use of the deep underground with greater government control and consideration of surface impacts. A programme based on the Environment and Planning Act is a self-binding instrument and does not directly affect other public bodies or their environmental policies. This means that besides the legal framework, implementing the envisioned policy choices will also depend on 'softer' policy instruments such as agreements with other government bodies, civic organisations and market operators (management agreements, covenants, sector agreements, etc.), communications and financial instruments. The State's choices regarding governance are partly dependent on the costs and loss of income for the State.

The reflection in the SEA report explores the ways in which various forms of governance could affect the impact positively or negatively.

Intersections with other national programmes

Section 3.4 describes the correlations with other national programmes. This Memorandum indicates how the policy ambitions for the DGDO programme represented in the SEA report could influence other national programmes and their environmental effects, and what this means for the policy choices in the DGDO programme. This is done using a sensitivity analysis as part of the SEA report.

Addressing impacts by and on other countries

The Netherlands and its underground do not stand alone when it comes to challenges and the impact of global trends. Impacts by and on other countries (mainly neighbouring countries such as Belgium and Germany) are likely. The SEA report will briefly consider the developments in these countries and describe the risks and opportunities for other countries. In addition, where relevant, the SEA report includes a qualitative evaluation of impacts occurring elsewhere, e.g. due to imports of primary raw materials.

10.4 Knowledge gaps and monitoring

The impact descriptions in the SEA report suffer from knowledge and information gaps in various areas. The SEA report identifies these gaps and to what extent they may affect the assessments.

Based on the impact assessments, the SEA report will also include recommendations on monitoring of the intended DGDO programme's impact.

11. Suitability assessment method

The DGDO programme will include new policy choices. The possibility of these choices having a significant negative impact on the conservation objectives for Natura 2000 sites, either individually or in combination, cannot be ruled out in advance. In accordance with Article 6(3) of the European Habitats Directive, a suitability assessment is therefore required[53]. This requirement is implemented in the Netherlands by means of the Environment and Planning Act, which replaced the Nature Conservation Act in 2024. Purpose of the suitability assessment:

- Identifying the risks of a significant negative impact on the natural characteristics of Natura 2000 sites due to new policies.
- Insight into possible mitigation measures or policy changes to prevent this significant impact.
- Likelihood of positive impact on Natura 2000 sites

The suitability assessment's level of detail corresponds to the level of detail in this SEA report. Considering the policy statements' level of abstraction, the assessment is limited to broad outlines. This mainly concerns the estimated likelihood of a negative impact on the conservation objectives for Natura 2000 sites.

The suitability assessment focuses on the 'preferred alternatives' included in the DGDO programme as policy choices. In aid of public consultation, the suitability assessment will be added to the SEA report and published along with the draft programme and SEA report.

[53] European Commission. (1992). Council Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora (Habitats Directive), Article 6(3). Implemented in the Netherlands by means of the Environment and Planning Act.

12. Glossary

Term	Definition
Groundwater and drinking water protection zones	Areas designated for protection of groundwater or drinking water supplies by provinces or the State. Within these zones, restrictions apply for any activities that could affect groundwater quality or availability.
Subsidence	Land subsidence as a result of natural factors or human activities such as mining or groundwater abstraction.
Cavern	Underground cavity resulting from salt extraction (solution mining) that can be used to store substances such as hydrogen, natural gas or oil.
The deep underground	The deep underground refers to the portion of the underground covered by the Mining Act; deeper than 100 metres, or deeper than 500 metres for geothermal energy.
DGDO	National Programme for Sustainable Use of the Deep Underground; an overarching state programme aimed at sustainable and safe use of the deep underground for e.g. energy extraction, storage and as a source of raw materials.
Minerals	Natural minerals or organic substances in a solid, liquid or gaseous state (e.g. natural gas, oil, salt) that are extracted from underground.
EBN B.V.	Energie Beheer Nederland; a fully State-owned company involved in the extraction of minerals and geothermal energy.
Geothermal energy	Extraction of geothermal energy from underground for sustainable heating in, for example, greenhouse horticulture, industry and the built environment.
SEA	Strategic Environmental Assessment (procedure) at the programme level.
Mining Act (Mbw)	Dutch legislation governing the exploration and extraction of minerals, geothermal energy extraction and the storage of substances in the deep underground below 100 metres; below 500 metres for geothermal energy.
Mining agreement	Agreement between the State and a licence holder on the extraction of a specific mineral resource, with provisions on yields and conditions.
National Strategy on Spatial Planning and the Environment (NOVI)	National policy document describing the main tenets of national environmental policy, including guiding principles for use of the underground.
Environment and Planning Act	Law that provides a legal framework for the physical living environment, including the aboveground aspects of mining operations and the obligation to apply for an environment and planning permit for environmentally harmful activities.
Alternative	A possible policy choice being assessed through the programme to gain insight into the impact of different options for use of the deep underground. The alternatives to be assessed represent the boundaries of the 'playing field' within which the State can make its choices.
Operators	Market operators involved in the extraction of raw materials or energy underground, e.g. petroleum, natural gas, salt or geothermal energy.
Exploration licence	Licence that entitles the licence holder to explore a specific area for supplies of natural gas, petroleum or salt.
Suitability assessment	Assessment in the context of the Nature Conservation Act (now Environment and Planning Act) to determine whether policy choices could have a significant negative impact on Natura 2000 sites.
SEA report	Environmental impact assessment report (document) used to evaluate the impact of policy choices and alternatives for the National Programme for Sustainable Use of the Deep Underground
Wheel of the Living Environment	Comprehensive assessment framework for the physical living environment, with main themes such as a safe and healthy living environment, good environmental quality, the economic environment and the living environment.
Start-up licence	Licence required to search for geothermal resources and extract the energy for a limited initial period, including the drilling of wells.
Reference situation	The future situation (for example in 2050) expected to come about due to autonomous developments, without the DGDO's influence.
Follow-up licence for geothermal energy	Licence required to extract geothermal energy in a designated area for an extended period, as a follow-up to the start-up licence.
Extraction plan	Plan in which the licence holder describes how minerals or geothermal energy will be extracted. The minister must have approved the extraction plan before the extraction can take place.
Production licence	Licence that grants the right to actually extract previously identified minerals or geothermal energy.
Geothermal search area	Area that may be explored for geothermal resources, where a search area allocation grants the exclusive right to apply for a start-up licence for this area.
Salt cavern	See 'cavern'. Underground cavity resulting from salt extraction, suitable for the storage of gases or liquids.

About Antea Group

Antea Group proudly boasts 1800 engineers and advisors. Every day, we work to create a safe, healthy and future-proof living environment together with you. We have some of the best subject matter experts in the Netherlands, as well as offering innovative data, sensoring and IT solutions. We contribute to new infrastructure, housing developments and watercourse management. We can help with issues such as climate change adaptation, the sustainable energy transition and infrastructure rehabilitation. From research to design and implementation to management, we have the knowledge available to meet all your challenges. We think along and provide criticism, always with the goal of achieving the best possible results together. In this way, we anticipate both current demands and future solutions. This has been our approach for 70 years now.

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