# Response memorandum

## Notification of intent and proposal for public participation

## Construction of new nuclear power plants

Date: April 2025

## 1. Introduction

The Netherlands Government Gazette of 22 February 2024 announced that the notification of intent and proposal for public participation relating to the construction of new nuclear power plants was available for inspection and that written or oral views on that document could be submitted between Friday 23 February and Thursday 4 April 2024. During this period, 757 views (and 617 identical views) were received. There were nine views from national administrative authorities and 10 from international administrative authorities. While responding to this public input, it was found that, in addition to the aforementioned 617 identical views, a further 14 were identical. All views have been registered and included in the consultation document 'Responses to the notification of intent and proposal for public participation relating to the construction of new nuclear power plants'.

A number of themes recur in many views, so we have decided to address each theme in turn (see section 2 'Response by theme').

Abbreviations

| | |
|---|---|
| ANVS | Authority for Nuclear Safety and Radiation Protection |
| COVRA | Central Organisation for Radioactive Waste |
| EIA | Environmental impact assessment |
| IIA | Integrated impact assessment |
| MW | Megawatt |
| NPP | Nuclear power plant |
| NRD | Memorandum on Scope and Details |
| PSR | Periodic safety review |
| RVO | Netherlands Enterprise Agency |
| SEA | Strategic environmental assessment |
| SMR | Small modular reactor |
| TPR | Third-party review |
| TWh | Terawatt-hour |

# 2. Response by theme

## 2.1 *Benefit and necessity*

### General

The Dutch government aims for the Netherlands to be climate-neutral by 2050. This means that by 2030, carbon emissions must be reduced by 55-60%. To achieve climate neutrality, the energy system must become more sustainable by making electricity the main energy carrier. The government is aiming to have a carbon-neutral electricity system as early as 2035. Time is running out to achieve this, which is why it is important to take decisive action now.

Various energy sources are available in the Netherlands that can contribute to achieving climate neutrality, as they are virtually carbon-neutral when used to generate electricity. These are wind energy, solar energy, nuclear energy, and biomass and gas-fired power plants equipped with carbon capture technology. Of these, nuclear is important because it provides a stable baseload supply. This refers to a type of power supply where a specific quantity of electricity is generated and delivered to the grid fairly constantly and almost without interruption. Nuclear energy therefore complements wind and solar energy, which will supply most of the Netherlands' electricity needs in the future. It should be emphasised that one energy source does not hinder or compete with another. In view of the urgent need to address climate change, the Netherlands cannot afford to rule out any carbon-neutral energy sources (see also the letter to parliament of 9 December 2022, the National Energy System Plan and the Energy Network Programme).

Electrification is the preferred route to sustainability for many applications. The government aims for domestic electricity production to be high enough by 2050 to meet the vastly grown direct demand for electricity in the various end-user sectors, as well as being available for producing other energy carriers such as hydrogen and carbon, or for exporting to neighbouring countries. To enable a more than fourfold increase in the total electricity supply by 2050, compared with present usage, the government plans to rapidly scale up wind, solar and nuclear power.

Preparations are being made for the possible development and integration of around 70GW of offshore wind power, 3.5−7GW of nuclear power and significant growth in onshore renewable energy generation.

The government's framework coalition agreement opts to extend the operating life of the existing nuclear power plant (NPP) in Borssele and start preparations for building two large new NPPs. There will also be two additional units, as well as the option of a few small modular reactors (SMRs). These two extra units (and optional SMRs) are outside the scope of this project procedure.

Other advantages of nuclear power are as follows:

- As well as producing electricity, NPPs can be used to generate steam, heat and hydrogen.
- It would be in Europe's interest to move towards a more independent energy system that would better enable us to meet our own energy needs.
- NPPs require considerably less land per MW than other energy sources.

### Disadvantages of nuclear power

Besides the advantages mentioned above, nuclear power also has disadvantages, such as concerns about the safety of nuclear facilities. Safety is an essential prerequisite for operating an NPP. Dutch nuclear reactors therefore have to meet stringent national and international safety requirements, significantly reducing the likelihood of an accident. In the unlikely event of an incident, there are many measures in place to minimise its impact.

Generating electricity with nuclear energy produces radioactive waste. In the Netherlands, this waste is managed by the Central Organisation for Radioactive Waste (COVRA), which stores it above ground for at least a hundred years at its facility in the municipality of Borsele in the province of Zeeland. Ultimately, the waste will have to be disposed of deep underground in a final repository, isolating it from the human environment for thousands of years. The safe storage of radioactive waste is a responsibility that will also fall to future generations.

Furthermore, before any new NPP can be built, a lengthy licensing process must be completed. This process entails various technical challenges and financial risks, making it difficult to estimate construction costs and lead times at this stage. Incidents elsewhere in the world could also have a major impact on the project, as was the case in the wake of the Fukushima nuclear accident. This could, for example, result in additional design requirements, with possibly significant financial implications. It could also have a major impact on public perception of and support for nuclear power.

## Scope

The framework coalition agreement of the fourth Rutte government opted to extend the operating life of the existing NPP in Borssele and start preparations for building two large new NPPs. Two new units with a combined capacity of around 3GW and a capacity factor of 90% are being considered, which would generate approximately 24TWh per year. The current Schoof government is going ahead with these plans and is also aiming to build two additional units, including the option of a few SMRs. These two extra units (and optional SMRs) are outside the scope of this project procedure.

This procedure will not seek to answer the question of why nuclear power should be included in the energy mix. In accordance with the advisory opinion of the Netherlands Commission for Environment Assessment, the Ministry of Climate Policy and Green Growth is currently working on the environmental justification for including nuclear power in the energy mix in terms of benefit and necessity. This justification will be ready before the initial formal decision on nuclear power is made, which will be when the Dutch Nuclear Energy Act is amended to extend the operating life of the existing Borssele NPP.

## Dunkelflaute and nuclear power

In the energy sector, 'dunkelflaute' (dark doldrums) is the term used to describe a period of time during which little or no energy can be generated with wind turbines and solar panels due to the simultaneous occurrence of darkness and a lack of wind. The Netherlands is aiming for a broad energy mix that includes nuclear. Although the use of nuclear power is not directly intended to supplement any shortfall in wind and solar power production, it does contribute to a more robust energy system.

## Nuclear power is not zero-carbon

No energy source has zero carbon emissions. This is because developing any energy source requires natural resources. In the case of nuclear power, uranium must be mined and enriched, and this is not a completely zero-carbon process. The generation of electricity using solar, wind or nuclear energy does not produce any carbon emissions, however. Consequently, the carbon footprint per MW for nuclear power is considerably lower than that of many other forms of energy generation, such as fossil fuels.

## Choices made by other countries

Decisions regarding the energy system are a national competence. Some European countries want to reduce their reliance on nuclear power. However, there are also many countries that, like

the Netherlands, have plans to expand nuclear energy generation. These include Poland, Czechia, Finland, Sweden and Slovenia.

## 2.2 *Alternatives*

Investigating alternative (sustainable) energy sources is not part of this project procedure (see also under 'Benefit and necessity' above).

### Zero option: no nuclear power

Many of those who submitted views pointed out that under the Aarhus Convention, the participation process should include consideration of the zero option. Under the Convention the public must have access to information early in the decision-making procedure, be entitled to participate in decision-making and have access to justice in environmental matters . Furthermore, a document containing recommendations was published in 2015 proposing a number of addenda to the Convention. One of these recommendations is that it should always be possible to contribute ideas and take part in discussions about the zero option, which in this case would mean no nuclear power at all. The Ministry of Climate Policy and Green Growth is investigating the environmental implications of nuclear power and the choices involved in a separate procedure.

However, the current focus is on a project to build two new NPPs. The first phase, the exploratory study, involves a public participation process. The environmental impact assessment (EIA) outlines the reference situation, i.e. the situation in 2040 as it would be without the construction of two new NPPs, but with the existing nuclear reactor in Borssele. This option (effectively a zero option) is therefore part of the overall assessment and the public participation process. The decision on extending the operating life of the existing NPP in Borssele is part of another procedure (see the website of the Netherlands Enterprise Agency (RVO)) and falls outside the scope of the present project procedure.

### SMRs

Small modular reactor (SMR) is an umbrella term for a wide variety of nuclear reactor designs. An SMR knowledge module is available. SMRs have a smaller generation capacity than conventional reactors built using currently available technologies. There are more than 80 designs under development around the world, which differ in terms of cooling methods, fuel used and energy applications, amongst other things. SMRs could help make industry more sustainable and provide power to more remote areas of the Netherlands, which would support the energy transition.

No SMRs have yet been built in the West, and it is not known when and at what cost they would be commercially available in the Netherlands. However, we do know that Canada and the UK are implementing concrete plans aimed at delivering the first SMRs in their respective countries by the early 2030s, making them the forerunners in the Western world.

A recent market analysis indicates that the minimum lead time for obtaining planning permission and constructing an SMR is around seven years, provided the design is based on existing technology and has already been tried and tested somewhere in the world. Based on these expectations, it seems feasible that an SMR could be operational in the Netherlands by 2040.

In addition to the ambition to build four conventional NPPs, the programme of government includes the option of a few small reactors (SMRs). In order to assess the potential of SMRs for the Netherlands and accelerate developments in this area, the Ministry of Climate Policy and Green Growth has launched an SMR programme. This approach ensures that various preconditions are identified, and that the necessary know-how is acquired and disseminated. By sharing knowledge, stakeholders will be better informed and able to respond appropriately to developments. Investigating alternative (sustainable) energy sources, such as SMRs, is not part of this project

procedure.

### Other alternatives

To achieve its climate policy objectives, the government intends to use a variety of clean and fossil energy sources to meet energy needs over the next few years. Nuclear energy complements wind and solar energy, which will supply most of the Netherlands' electricity needs in the future. It should be emphasised that one energy source does not hinder or compete with another. In view of the urgent need to address climate change, the Netherlands cannot afford to rule out any carbon-neutral energy sources (see also the letter to parliament of 9 December 2022, the National Energy System Plan and the Energy Network Programme). Large-scale energy storage and green and blue hydrogen will also be used to meet the objectives. Thorium reactors are still under development and are therefore not yet an option.

### Energy conservation

To achieve the objectives set, multiple measures must be taken as part of the energy transition. Energy conservation is a cornerstone of Dutch energy policy, which is why the government is focusing strongly on ways of saving energy. Energy that we do not use does not need to be generated, paid for, imported or transported. Energy conservation therefore contributes directly to affordability, reduces the need for (and hence the scarcity of) sustainable energy during the transition and makes us less dependent on other countries, while also mitigating transmission challenges such as grid congestion. Consequently, energy conservation makes the energy transition more manageable, as well as reducing the impact of the energy system on the Netherlands, for example in terms of how much space it takes up. This aim is also in line with the EU's Energy Efficiency Directive (EED).

In order to manage energy conservation efforts more effectively, the government has launched the National Energy Conservation Programme, which aims to reduce energy consumption and increase energy efficiency in energy-using sectors. As part of this programme, government, businesses, universities, research institutions and non-governmental organisations are working together to transition to an efficient and sustainable energy system. However, studying energy conservation is not part of this project procedure.

## *2.3 Siting*

### General

The site for the proposed two new NPPs has yet to be determined as part of this project procedure. Various factors influence a site's suitability, safety being an important consideration. Other key criteria include:

- The site's location in relation to densely populated areas and the ability to meet the safety requirements for local residents.
- Ease of access (for emergency services, fuel delivery and removal, etc.).
- The availability of cooling water of suitable quantity and quality.
- The suitability of the electricity infrastructure and future prospects for investment in upgrades.
- Potential users/customers for the energy produced (and possibly for by-products).
- The possibilities for spatial integration, including related measures such as earthworks or infrastructure upgrades.

The Netherlands' nuclear site reservation policy has been gradually refined since 1985. Initially, 29 prospective sites were identified. After closer study, this number was reduced to five which

were considered to be the most suitable, based partly on the above criteria. These sites are reserved for future nuclear development. This means that no new 'sensitive objects' (such as hospitals or schools) or housing for more than 5,000 residents may be built in a 1km radius around these sites, even though this would be permitted under environment and land-use plans. In 2008 the latest review of suitable sites was carried out as part of the Electricity Supply Structure Plan (SEV III), partly on the basis of a strategic environmental assessment (SEA). Three prospective sites then remained (Eemshaven, Borssele/Vlissingen and Maasvlakte I). Two of these were reconfirmed in the 2023 Energy Network Programme: Borssele/Vlissingen and Maasvlakte I.

As mentioned in the notification of intent and proposal for public participation, the draft Memorandum on Scope and Details (NRD) explains which sites in the Netherlands will be further investigated as part of this project procedure.

### Borssele/Vlissingen and Maasvlakte I

Borssele/Vlissingen and Maasvlakte I are designated as reserved sites. The notification of intent and proposal for public participation indicates that both of these will be assessed for the construction of two NPPs. Both are adjacent to large bodies of water, which can be used for cooling. The first step is to investigate whether there are any other potentially suitable areas, taking into account the views in this response memorandum. The NRD sets out the specific sites to be studied.

In late 2022 the then Minister for Climate and Energy Policy stated that the existing site in Borssele, operated by Dutch power company EPZ, is the preferred site for the two new nuclear reactors. Announcing this preference allows technical feasibility studies to go ahead, which would normally only begin once a definitive site has been selected. This enables the ministry to quickly and responsibly move forward with the preparatory work for the project. The studies will examine whether it is feasible to build two NPPs at the preferred site in Borssele, how long this would take and what the construction costs would be. Many of the findings will also be applicable to sites other than Borssele.

In order to make a fully informed decision, it is important to carry out the project procedure with due care. Environmental legislation requires that all alternatives deemed reasonable be investigated, which is why sites other than Borssele are also being considered. This will enable a comparison to be made of the impact of building two NPPs, at suitable sites, on people and the environment. The exploratory study will provide important information needed to decide on the best site as part of the project procedure. The final siting decision is expected to be made in 2026.

### Sites other than Borssele/Vlissingen and Maasvlakte I

In principle, an NPP may be built anywhere in the Netherlands, provided it is done safely and complies with environmental and other legislation. The exploratory study requires an assessment of all alternatives deemed reasonable. A couple of areas in the Netherlands have been designated as suitable sites for large-scale NPPs with a capacity of at least 500MW, based on the aforementioned nuclear site reservation policy. These are Maasvlakte I and the Sloe area (Borssele/Vlissingen). The former Spatial Planning (General Rules) Decree designated Borssele/Vlissingen, Eemshaven and Maasvlakte I as reserved sites, but Eemshaven in the province of Groningen will in due course be scrapped at the request of the House of Representatives (motions by MPs Sandra Beckerman and Matthijs Sienot).

This designation has been included in the Physical Environment (Quality) Decree under the Environment and Planning Act. However, this does not mean that the site reservation policy is the only factor to be considered in the project procedure. First, a study will be conducted so that the alternatives deemed reasonable can be described in the next stage of the procedure (the draft NRD). This involves updating the assessments made in connection with the site reservation policy, using the latest knowledge to review the sites previously identified as potential candidates for nuclear reactors. This update has already been done as part of the project procedure for the construction of new NPPs. Additionally, the suggestions received in response to the notification of

intent and proposal for public participation have been evaluated, and a GIS analysis carried out.

The draft NRD explains which sites will be investigated further. This project procedure focuses on three sites in Zeeland (Terneuzen, Borssele and Vlissingen), three in Eemshaven and one on Maasvlakte II.

### Option of building units on different sites

Building two nuclear units next to each other offers considerable financial advantages in terms of cost and construction time. Conversely, building two nuclear units on two different sites entails significant additional costs and takes longer. As such, it is not a financially viable option. This project procedure will therefore only consider the construction of two interconnected units next to each other on a single site.

## *2.4 Safety*

See section 2.5 for information on safety with regard to radioactive waste. Safety, in terms of nuclear safety, security of water supply and environmental safety, is evaluated as part of the EIA.

### General

Safety is an essential prerequisite for building and commissioning an NPP. Dutch nuclear reactors therefore have to meet stringent national and international safety requirements, based on the defence-in-depth principle. This refers to a combination of technical, organisational, procedural and administrative measures, divided into 'levels', which are designed to manage increasingly serious situations, ranging from preventing abnormal operating conditions through to mitigating the consequences of environmental discharges. Each level has its own set of independent measures, which means that in the event of a malfunction, the entire safety system can never be jeopardised. There will always be other layers of safety that provide protection.

NPPs undergo a comprehensive review every 10 years to ensure they meet the latest safety standards and practices. This is known as the periodic safety review (PSR). A PSR reveals possible improvements that will enhance safety, which are then considered and prioritised. The licensee must take all necessary measures to prevent accidents or, if one occurs, to limit its consequences (article 6, paragraphs 1 and 2 of the Nuclear Safety (Nuclear Facilities) Regulations (*Regeling nucleaire veiligheid kerninstallaties*)). Finally, a summary assessment report and an 'implementation plan' are drafted, detailing how the improvement measures will be implemented.

The Authority for Nuclear Safety and Radiation Protection (ANVS) is responsible for conducting and assessing the PSR, as well as overseeing the implementation of improvement measures. The PSR is carried out in consultation with the licensee.

In addition to assessing the PSR, the ANVS also has a supervisory role, ensuring that nuclear safety and radiation protection in the Netherlands meet the highest standards. It sets rules, issues licences, ensures compliance and, if necessary, can take enforcement action. There are also constant safety checks based on set protocols.

NPPs must be able to withstand extreme external events, such as earthquakes or flooding. However, despite stringent regulations and close supervision, an accident in a nuclear reactor can never be completely ruled out. The Minister of Infrastructure and Water Management and other relevant ministers are responsible for having plans in place for an effective response to nuclear accidents.

'Continuous improvement' is another concept on which nuclear safety is based. All licensees of nuclear units are ultimately responsible for their safety. This means that they must examine and evaluate the nuclear safety of their unit and take timely measures to improve safety, giving due

consideration to national and international developments and lessons learned in this area. This significantly reduces the likelihood of an accident. In the unlikely event that an accident does occur, there are a large number of measures in place to limit its effects, from instructing people to stay indoors (take shelter) and take iodine tablets, to organising evacuation and measures aimed at the food supply. The exact measures advised by the government will depend on the situation.

New insights acquired over time, either as a result of developments at NPPs elsewhere in the world or otherwise, lead to new requirements for NPPs. These new requirements must be implemented in order to achieve a level of safety that is consistent with current scientific knowledge. In the interests of nuclear safety, the radiological consequences of both normal operations and accident scenarios are documented in the EIA. External hazards are included in the assessment framework used.

### Sea-level rise and flood risk

Sea-level rise is taken into account in both the project procedure and the design process, and is assessed in the SEA under 'Water'. Dyke stability is the responsibility of the water authorities and Rijkswaterstaat, that are both involved in the planning process. NPPs are designed to prevent water reaching vital systems in the event of flooding, i.e. when the water level rises above the dykes. They are therefore flood-resistant.

### Terrorism

NPPs are well secured against terrorism. Protection measures are designed to prevent human-induced external events at the NPP, as well as cyberattacks. In new units, the core is located underground, and the design takes the possibility of extreme terrorist acts into account. For example, NPPs must be able to withstand an intentional aircraft impact. Based on the set of reference threats, a range of security measures are put in place and assessed by the ANVS. For security reasons, no specific information is provided here about the measures or the reference threats. The NRD and the EIA include assessment criteria for environmental safety, taking into account factors such as hazardous economic activity and military targets in the vicinity.

### Radiation

Every person living in the Netherlands is exposed to radiation on a daily basis, for example indoors and during certain medical procedures, such as X-rays. Incidents involving radioactive substances can result in additional exposure. Overexposure to radiation is hazardous to health. A great deal is known about radiation and its effects on human health.

Policy on nuclear safety and radiation protection is designed to protect people and the environment from the risks of exposure to ionising radiation. To achieve this, exposure to radiation must be justified, as low as reasonably achievable (the ALARA principle) and below limit values. The Dutch National Institute for Public Health and the Environment (RIVM) studies radiation and its impact on health and helps the government protect patients, workers and the general public against the harmful effects of radiation. This includes preventive measures, such as providing iodine tablets. Radiological effects are included in the EIA.

### Escape routes

The assessment of possible escape routes (evacuation routes away from NPPs) is also included in the EIA. This falls under 'environmental safety', which encompasses both people's self-reliance and the group risk. It is also important for the safety region, fire service, other emergency services, workers and local residents to be able to evacuate quickly and safely in the event of a major incident.

### Examples from other countries

Many respondents mentioned disasters that have happened abroad, for instance at Chernobyl and Fukushima. We have already explained above how safety is assessed and safeguarded. What's more, the situations are not entirely comparable: Chernobyl had a very outdated first-generation nuclear reactor, while Fukushima experienced successive natural disasters (a severe earthquake and a tsunami) that could not occur in the Netherlands.

## *2.5 Radioactive waste*

### General

Nuclear power generates radioactive waste, which must be managed carefully and responsibly. The current approach is as follows: first, as much of the waste as possible is recycled. This is done in France. The remaining waste is managed by the Central Organisation for Radioactive Waste (COVRA), which stores it above ground for at least a hundred years at its facility in the municipality of Borssele in the province of Zeeland. Ultimately, the waste will have to be disposed of deep underground in a final repository, isolating it from the human environment for thousands of years. COVRA is currently researching how the Netherlands can achieve this by 2130. The safe storage of radioactive waste is a responsibility that will also fall to future generations.

### Policy

Policy on radioactive waste is part of the policy on nuclear safety and radiation protection, which is designed to protect people and the environment from the risks of exposure to ionising radiation. To achieve this, exposure to radiation must be justified, as low as reasonably achievable (the ALARA principle) and below limit values. Radioactive waste management has been based on the following principles since 1984:

- the generation of radioactive waste is kept to a minimum
- radioactive waste is safely managed
- no undue burden is imposed on future generations
- those who generate radioactive waste bear the cost of managing it.

### Interim storage of radioactive waste at COVRA

In the Netherlands, radioactive waste is stored above ground where it will remain for at least a hundred years in specially designed buildings at the COVRA facility in Zeeland.

The government is currently working on a new policy programme for radioactive waste, which will be finalised by 2025 at the latest. It will include a roadmap for final disposal deep underground, outlining the steps that need to be taken. As well as preparing for final disposal, the Netherlands is exploring the scope for cooperating with other countries on radioactive waste management.

### Final disposal

After being stored for a hundred years, some of the waste will no longer be radioactive. The waste that is still radioactive will then be placed in storage deep underground. This solution is called final disposal, or deep geological disposal. Storing waste in an underground repository would protect people and the environment from radiation exposure, even if no maintenance were to be carried out. This means that future generations would not be burdened with maintaining the storage facility. Multiple geological layers contain the radiation for as long as necessary.

The government will identify what action is required before a decision can be made about final

disposal of radioactive waste. This decision was initially due to be made around 2100, but the government would like to bring it forward. As well as preparing for final disposal, the Netherlands is exploring the scope for cooperating with other countries on radioactive waste management.

The relatively long period of interim storage above ground gives us time to learn from the experience of other countries, conduct research and accumulate knowledge. It also means there is time to accrue a sufficient budget to cover the cost of a final repository. This will enable a well-informed decision to be made in the future about radioactive waste management without imposing an undue burden on future generations.

### Quantity and types of radioactive waste

All radioactive waste emits radiation, but not all waste emits the same amount or for the same length of time. High-level waste is extremely radioactive and remains so for tens of thousands of years. In contrast, some types of short-lived radioactive waste lose their radioactivity after two years and can be processed as normal waste. In between are waste streams that emit relatively little radiation, but remain radioactive for longer. In the Netherlands, current figures show that high-level waste accounts for less than 1% of all radioactive waste.

### Transport to and from a potential nuclear power plant

Radioactive waste is transported by air, sea, road and rail, subject to strict rules. Transport security measures are always in place to protect shipments of nuclear material. A licence from the ANVS is required for each transport movement. Licences are only issued after the ANVS has examined the application to determine whether all the necessary conditions are met.

## *2.6 Nuclear fuel cycle*

### Dependence on uranium

Uranium is an abundant natural resource that is found all over the world. It must be processed before it can be used as fuel in a nuclear reactor. The first step is to mine uranium ore. Worldwide, the main uranium mining countries are Kazakhstan, Canada, Namibia, Australia and Uzbekistan, which together accounted for 85% of the global market in 2022. The economic viability of a mine depends on the price of uranium: the reserves in Kazakhstan, for example, are viable at a price below 40 dollars per kilogram of uranium, while those in Australia are only viable if the price is higher than 80 dollars per kilogram.

Once uranium has been mined, it must be converted into a form suitable for enrichment. This conversion process can be carried out in France, China, Russia, Canada and the US. After conversion, the uranium is enriched. The companies that do this include the partly Dutch-owned Urenco Group, which has facilities in the Netherlands, Germany, the UK and the US, and the French multinational Orano. Other global leaders in uranium enrichment are Russia and China. Western nations wish to stop using Russian enriched uranium, and Urenco and Orano are therefore expanding their capacity to meet demand. The enriched uranium is then fabricated into fuel rods, to be used as fuel in nuclear reactors. This process is carried out in France and Germany, but also in other countries.

### Uranium recycling (spent fuel)

To minimise the quantity of radioactive waste, spent fuel from the Borssele nuclear reactor is recycled wherever possible. EPZ, which operates the Borssele plant, has a contract with a European supplier for this purpose. In order to recycle the uranium, this supplier uses a Russian subcontractor for one part of the process. The Dutch NPP in Borssele does not have any direct

dealings with Russia. The existing fuel contracts are with European parties. Following a review, EPZ has concluded that this step, which involves the use of a Russian company, is the only viable option in the short term. Aiming to end this indirect dependence on Russia, the Ministry of Infrastructure and Water Management and the Ministry of Climate Policy and Green Growth will investigate uranium recycling alternatives. The implications of no longer recycling uranium will also be considered.

### Uranium exports

An export licence for depleted uranium is only granted for civil uses. Licences are issued subject to strict conditions based on the guidelines of the export control regime of the Nuclear Suppliers Group (NSG) and the EU dual-use Regulation. Nuclear material also comes under the system of safeguards administered by the International Atomic Energy Agency (IAEA).

## 2.7 *Costs and planning*

### Economic feasibility

Possible financing models are currently being studied. This involves examining the preconditions set by technology providers and the financial sector, as well as the government's role within a government support package (GSP). The economic feasibility of NPPs will also depend on the final business case and their integration into the energy system. Nuclear power can be cost-effective but has high investment costs and a long design and construction phase. Some form of substantial government support is therefore needed, especially during the early stages. A range of support measures could also be considered for the operational phase, as is already the case with various renewable technologies. It is important to distinguish between the total investment required for an NPP and the Dutch government's contributing share.

### Studies and lessons learned in other countries

A 2022 scenario study estimated the investment cost of a 1,600MW EPR (Generation III+ pressurised water reactor) at €6 billion (excluding finance charges). This study also showed that with this price tag, NPPs could play a valued role in the electricity market of the future. The independent research organisation TNO is currently conducting an in-depth study to compare energy system costs in a scenario with no NPPs and in scenarios with two and four NPPs. The study will also examine possible ways in which nuclear power could benefit the whole system, for instance in terms of flexibility requirements, interconnection, import dependence and security of supply. Specifically, TNO will consider what impact bringing new nuclear units into the energy system will have on demand for hydrogen production and storage (flexibility requirement) and the costs this will entail. Investing in nuclear power could therefore mean that less is invested in other parts of the energy system.

The Slovenian government expects the cost of building one reactor to be between €9.5 billion (the American AP-1000 design with 1,050MW capacity) and €15.4 billion (the French EPR design with 1,650MW capacity). In Czechia, Korea Hydro & Nuclear Power (KHNP) has been selected as technology provider, with expected costs of around €8 billion per reactor (Korean AP-1400MW design). In Poland, the construction of three reactors of the American AP-1000 design is expected to cost €35-45 billion. Construction project costs in different European countries cannot be directly compared with each other or with the Dutch project due to differences in, for example, the owner's scope. The cost of NPPs in the Netherlands is therefore not yet clear and more precise estimates can only be given once the various technology providers have submitted their bids.

### Initial cost indication

The technical feasibility studies provide an initial indication of the construction costs per NPP (capital costs), ranging from €20-30 billion for two. This includes the costs that the owner must bear for the project (the owner's scope), which will not become the responsibility of the technology provider at any point in the future. The range indicated excludes any finance charges (interest). This is an initial estimate, with a large margin of error.

The cost range does, of course, depend on the technology provider and the reactor capacity (1,050 to 1,650MW). The final choice of site will also significantly affect the overall cost. The uncertainty will therefore decrease as the project progresses through the selection process and eventually culminates in a contract with a technology provider. This is typical of major infrastructure projects, where additional technical studies and negotiations between the property developers and their own suppliers are required during the construction preparation phase in order to achieve greater cost certainty. The final cost and the government's contribution will only be confirmed once the final investment decision has been made, after contract negotiations with the preferred bidder.

The sum of €5 billion previously allocated for nuclear power from the Climate Fund was specifically earmarked from the outset for preparatory work and as part of the government's contribution to the construction of two units. The current government has committed a further €9.5 billion as its additional contribution to the development and construction of four NPPs. The cost range that emerged from the third-party review (TPR) shows that the total investment required will be higher than the amount set aside from the Climate Fund. It is a real possibility that the remaining funding needed will exceed what can be raised on the private market on acceptable terms. The use of additional public funding instruments to cover construction costs is therefore being considered. This could include the government debt-financing the project.

### Potential budget overruns

The exact cost of constructing two NPPs is not yet clear, as it is still uncertain where they will be built and what additional costs will be incurred at the selected site. Cost overruns are not unique to NPP construction, but are more likely due to complex technical designs and stringent safety requirements. Needless to say, every effort is being made to keep costs as low as possible without compromising safety or attention to detail. The lessons learned from other countries will inform the Dutch approach to building two NPPs in the Netherlands. An important factor when trying to reduce the risk of cost overruns is to opt for proven technology (conventional Generation III+ reactors). This prevents overruns incurred in the development of a first-of-a-kind reactor.

The TPR devoted a great deal of attention to the 'delivery model' concept. This is the model used by various technology providers to carry out a construction project, including risk allocation and assignment of responsibilities to the owner. The TPR mainly focused on the contractual structure of the delivery model. A key issue for the government to consider over the next few years is how a major role for government in the financing model relates to risk allocation in construction and to how any cost overruns will be absorbed. The technology selection process is a crucial part of this.

### Planning in relation to sustainability objectives

See the 'Benefit and necessity' section for information on how the planning of NPP construction relates to the sustainability objectives.

### Decommissioning costs

The lack of funds to cover the cost of decommissioning Dodewaard NPP is a recurrent theme in the views submitted. This plant was operational until the late 1990s, but since then has been on hold until sufficient funds are available to decommission it. When Dodewaard was built in the late 1960s, there was no provision in the Nuclear Energy Act requiring the operator to accumulate sufficient funds over time to decommission the plant at the end of its useful life. Consequently, it is central government that will have to bear the cost of decommissioning in this case. Since the

Borssele NPP was built, the Nuclear Energy Act has specified that the operator should have sufficient financial resources to cover decommissioning in all cases. This also applies to new NPPs. Such a measure ensures that the operator pays for decommissioning, not the taxpayer.

## 2.8 *Wellbeing*

### Citizen participation initiative

In a letter to parliament dated 9 December 2022, the government named Borssele as the preferred site for two new NPPs. This announcement was made to enable in-depth research to be carried out ahead of the tendering process. It also allowed for a public participation process to be set up early on. Building two new NPPs in Borssele would have a major long-term impact on the area before, during and after construction. In terms of scale, construction time and environmental effects, the expected impact would be greater than that of other energy projects in the region, such as the construction of a high-voltage substation in the Sloe area or the development of the national hydrogen network. In view of the Borssele project's significant and long-term impact, central government and regional authorities are jointly putting together a package of measures known as the 'Central Government-Region Package' ('Rijk-regiopakket') that will mitigate negative consequences where possible, while also responding to shared opportunities and interests affecting the region's future. The aim is to create a win-win situation for all concerned.

The municipality of Borsele has launched its own citizen participation initiative, known as the Borselse Voorwaarden Groep ('Borsele Conditions Group'), comprising 100 local residents. Based on a deep understanding of the region's interests, this group has drawn up a list of conditions, specifying what would be needed in the region if construction work on the new NPPs were to go ahead there. These 39 conditions cover a wide range of issues, including house prices, cooling towers and workers' accommodation, and also apply to other energy projects in the area. Borsele municipal council unanimously adopted these conditions without amendments at its meeting on 11 January 2024. They were then consolidated with the conditions of the province of Zeeland and officially presented to the House of Representatives in April 2024. The Minister of Climate Policy and Green Growth gave her initial response to the conditions in a letter to parliament dated 11 September 2024.

Translating the Borsele and Zeeland conditions into concrete agreements provides key input for the Central Government-Region Package. To determine the extent to which the conditions set by the region can be met, a number of basic principles apply: the measures must be proportional, they must be compatible with the Dutch energy system, they must be legally feasible and they must comply with legal standards. These principles could also be applied in other regions if Borssele is not ultimately chosen as the site for two new NPPs.

The government takes the conditions very seriously. The minister will hold discussions on the subject with local and provincial authorities in the weeks and months ahead. It is important that the people of Zeeland are kept well informed about how the conditions will be implemented. The municipality of Borssele and the province of Zeeland will maintain close contact with residents and businesses in Borsele and with other Zeeland authorities and stakeholders, respectively. Putting together a Central Government-Region Package requires care and attention. The minister, the municipality of Borsele and the province of Zeeland have therefore signed a declaration of intent setting out how they will carry out the process and emphasising the importance of a collaborative approach. The parties apply the following guiding principles: we are working on a positive legacy for people living in Zeeland, we take each other seriously and we tell the true story.

As mentioned in section 3.3 'Siting', other sites besides Borssele are being investigated and it is important to identify local interests there, too. Like the Borsele conditions, this is key information that should be taken into account when making a decision on the preferred site. Discussions will be held with the local and provincial authorities where the sites identified in the draft NRD are located, focusing on the impact of building new NPPs and the best way to organise the public participation

process.

### Area-based approach

At regional and local level, nuclear power is just one of many spatial developments. Others include energy projects such as hydrogen production, landfall of offshore wind power and additional high-voltage capacity. Local residents and other stakeholders may connect these with the developments in nuclear power, mainly because of their spatial impact. This issue is being taken into account as much as possible in the public participation process, procedures and communication. The information to be compiled for the integrated impact assessment (IIA) will also include other developments in the area that could be affected by the decision on the siting of the two NPPs. The RVO website has a summary of all national energy projects coordinated by central government.

### Nuisance during construction

The construction of two new NPPs will take a long time and will be disruptive for the surrounding area, as it means increased road traffic (including lorries), higher noise and vibration levels, air pollution and dust nuisance. Naturally, every effort will be made to minimise these negative environmental effects and, in particular, to ensure that residential areas near the sites suffer as little inconvenience as possible. However, some disruption is inevitable. The SEA will clarify the extent of environmental nuisance likely to occur in the surrounding area and the mitigating measures available to keep it to a minimum. This assessment will also examine the land requirements for the proposed sites, including the space required during construction.

### Social friction

The process of building NPPs can alter the fabric of local communities. For example, there will be some 10,000 workers on site at the peak of construction, and they will need somewhere to live. This means that sufficient temporary housing and amenities must be available locally. We will aim to minimise any negative effects or social friction in the towns and villages concerned. This aspect will be explored in the project procedure.

### Pressure on property prices

The most suitable site for building two NPPs is currently being investigated. How the project will affect local communities – and potentially property prices – will be studied at a later stage once a site is selected.

### Impact on tourism

The most suitable site for building two NPPs is currently being investigated. How the project will affect local communities – and potentially tourism and other economic drivers in the region – will be studied at a later stage. This will not be part of the EIA but will be addressed in other studies focusing on the local impact of the construction and operation of two NPPs.

## *2.9 Impact on the environment*

The environmental impact of building and operating two new NPPs is currently being studied. This includes assessing the effects of cooling water discharges, the consequences for biological diversity

and the extent to which local residents and the surrounding area will be affected during the construction phase, for instance by noise and air pollution, increased road traffic and swirling dust. The consequences of cooling water intake and the impact on cultural and historical heritage, the landscape and recreational activities are also being examined. The environmental impact will, however, depend on where exactly the NPPs are sited, which is why this project procedure includes two EIAs. First, a SEA will be carried out to enable the most suitable site to be selected. This assessment has a broader scope and can be used to compare different sites in terms of environmental and other factors. The SEA will be published together with the draft and final preferred decisions. The exact environmental and other impacts will only become clear when an EIA is done. It will be appended to the project decision. The EIA will also look at the cumulative effects (the combination of several effects).

The extraction of uranium, a critical fuel for nuclear reactors, is outside the scope of the environmental assessment procedure, however, since uranium mining activities take place in other countries, where the Dutch government cannot impose any legal requirements. The potentially significant adverse environmental effects of mining must therefore be studied and mitigated in the country where it is carried out. The transport of fuel by road and rail in the Netherlands will, however, be assessed.

## *2.10 Electricity grid*

### Trends in power demand

Demand for electricity will increase substantially over the next few years. The phasing out of gas and coal means that more energy and heat will have to come from electricity. As a result, electricity demand could more than double by 2050. Population growth and the energy transition could also significantly increase electricity demand from industries, ports and other businesses. This will have implications for the electricity grid and the way energy is generated. Nuclear energy can contribute to this transition as a zero-carbon form of power production.

### Risk of grid congestion

The new NPPs will be connected to the Dutch high-voltage grid. This must be done in conjunction with other developments in the energy system, such as the electricity generated by offshore wind farms and any additional grid capacity that may be needed. This in turn is linked to the decarbonisation of local industry and will be decided in consultation with local stakeholders. TenneT manages the national high-voltage grid. When suitable sites are investigated, TenneT will be asked whether they expect any problems in the high-voltage grid as a result of the addition of the new NPPs.

TenneT has already carried out an initial study, published on 29 February 2024, into the feasibility of NPPs at the Maasvlakte I and Borssele sites for the reference year 2035. The analysis shows that, given the underlying principles and assumptions, siting two large new NPPs on the Maasvlakte or at Borssele would create bottlenecks for the high-voltage grid at both locations. The combination of two new nuclear units and additional offshore wind power capacity (on top of the 21GW target set in the 2030 roadmap) would exacerbate these problems. The system study provides an initial but as yet incomplete picture of the impact on the high-voltage grid. Further research is required. This is taking place in parallel with and is coordinated with the IIA for the Offshore Wind Power Landfall Exploratory Programme 2031-2040 (VAWOZ 2031-2040) and the IIA for the construction of new NPPs. The additional research is looking at ways to stimulate demand in industrial clusters, such as by decarbonising and electrifying industry, as well as the possibility of grid expansion. The period beyond the currently selected reference year 2035 should also be considered. In the ongoing procedures, the information needed for decision-making will be collated from both of the aforementioned IIAs. This will enable a comprehensive assessment of all plans: landfall of offshore wind power, new NPPs, stimulating demand and the possible expansion of grid infrastructure.

### Impact on the landscape

Overhead high-voltage power lines can spoil the landscape. In particular, visual pollution (and how local residents perceive it) may play a role here. The need for additional high-voltage power lines will very much depend on where the new NPPs are built. As explained above, the site selection process will provide an initial overview of the various possible sites.

### System costs

System costs comprise the total costs to supply a reliable and flexible electricity system. In addition to investments in production facilities, the costs for transmission, distribution and storage are an important factor. Renewable energy sources such as wind and solar require additional capabilities, including controllable generation, interconnection, demand management and storage, to accommodate natural variability. In contrast, NPPs provide a stable baseload, potentially reducing the need for expensive flexibility options. Consequently, although the costs per kilowatt-hour may appear higher at unit level, the total system costs may be lower when viewed in a broader context. The government is conducting further research into the most cost-effective deployment of nuclear power in the Netherlands from a system cost perspective; the findings will be available by the end of 2025.

### Flexibility of nuclear power

Although NPPs are often regarded as being 'rigid', modern units could be deployed flexibly in the future energy system. Flexibility is essential to be able to respond to fluctuations in electricity supply and demand, for example during 'dunkelflaute' events when little electricity is generated by wind turbines and solar panels. When properly managed, an NPP can not only provide a continuous baseload power supply, but also modulate it where necessary to ensure grid stability. This flexibility therefore makes it possible to respond to strong fluctuations in energy generation by renewable sources.

## *2.11 Procedure*

### Lead role for climate minister

The proposed nuclear power plants will be part of the critical energy infrastructure and are a project of national interest. Consequently, the Minister of Climate Policy and Green Growth and the Minister of Housing and Spatial Planning serve jointly as the competent authority. The former is also responsible for spearheading efforts during the first phase of the project, the exploratory study. Once this study is complete, a state-owned enterprise that is currently being set up will take over this role.

Due to the care and attention to detail required, responsibilities within the Ministry of Climate Policy and Green Growth are divided. In this project, the Nuclear Power Programme Department will lead efforts during the exploratory study phase. The Energy Transition Implementation Department is mandated to coordinate the entire project on behalf of the Minister of Climate Policy and Green Growth, i.e. during both the exploratory study and the subsequent phase, when a more detailed plan will be developed. The project procedure is concluded as soon as the decisions are final and unappealable. The construction phase will then begin.

### Aarhus Convention

The project procedure set out in section 5.44 ff of the Environment and Planning Act will be followed for this project. It comprises various steps, with all relevant information disclosed at each stage, including research findings, which will be explored in more detail during the procedure.

See section 2.2 'Alternatives' for a discussion on the zero option under the Aarhus Convention.

### Espoo Convention

The UN Convention on Environmental Impact Assessment in a Transboundary Context was signed in Espoo (Finland) on 25 February 1991 and entered into force on 10 September 1997. The Espoo Convention aims to prevent, reduce or control any adverse cross-border environmental consequences for a neighbouring country. Members of the public and the authorities in that country must therefore be involved in the EIA in the same way as members of the public and the authorities in the Netherlands.

The extent to which a project will affect the territory of neighbouring countries is not always clear at the outset. At the start of this procedure (when the notification of intent and proposal for public participation was published), all countries within a radius of 1,000km were informed about the proposed project. They will be updated on the next steps in the project procedure via the Espoo contact points.

## *2.12 Public participation*

The Ministry of Climate Policy and Green Growth is committed to ensuring that stakeholders are properly involved. We know from past projects that engaging with the local community yields valuable information and enables us to accommodate their interests and wishes. In our experience, this approach results in a better spatial integration of projects. During the public participation process, opportunities to add value or create win-win situations may also arise that we could potentially pursue. Furthermore, we attach great importance to providing transparency on interests, tasks, responsibilities and the decision-making process, as this is in everyone's interest. We therefore inform local communities about the procedure at an early stage and give everyone the opportunity to express their views, so that the minister or ministers responsible can reach a well-considered decision. The ways in which we will enable involvement will be set out in the participation plan, to be published on the RVO website. This will be updated regularly during the project procedure to reflect the latest situation.