RIKSGÄLDEN
SWEDISH NATIONAL DEBT OFFICE

2023-09-29

Nuclear waste fees and collateral amounts

Proposed nuclear waste fees, credit risk amounts and risk margins for reactor owners 2024–2026

Ref. RG 2022/814

The Debt Office's assignment

In September 2018, the Swedish National Debt Office took over the responsibility within financing nuclear waste management that was previously held by the Swedish Radiation Safety Authority. These duties are regulated by Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities and Ordinance (2017:1179) on the Financing of the Residual Products of Nuclear Power.

The Debt Office's role as supervisory authority is to ensure that the nuclear power industry allocates sufficient financial resources to fund the management and disposal of nuclear waste and spent nuclear fuel, the decommissioning and dismantling of the facilities and the research necessary to enable this. It is the nuclear industry that is to pay – not future taxpayers.

The Debt Office decides on disbursements from the nuclear waste fund to various recipients and audits the use of fund assets. The agency also presents assessments to the Government on the collateral to be pledged by the industry for the decided credit risk amounts and risk margins.

Table of contents

1. Summary

1.1. Financing of the nuclear waste programme

According to section 8 of Ordinance (2017:1179) on the Financing of the Residual Products of Nuclear Power (the Financing Ordinance), a reactor owner shall – in consultation with other reactor owners – prepare a cost estimate of the remaining costs for the nuclear waste programme and submit it to the Debt Office once every three years. In September 2022, the Swedish Nuclear Fuel and Waste Management Company (SKB) submitted this documentation (Plan 2022) on behalf of the reactor owners.

According to section 14 of the Financing Ordinance, the Debt Office shall submit proposals to the Government on nuclear waste fees, credit risk amounts and risk margins (collateral amounts) for reactor owners for the next three-year period. The proposals are to be submitted within 12 months of the reactor owners' deadline for submitting their cost estimate, which means by September 2023 at the latest. According to section 15 of the same Ordinance, the Debt Office shall grant the permit holder the opportunity to comment on the proposal. If the proposal concerns a reactor owner, the relevant agencies, municipalities and organisations shall also be given the opportunity to comment. The Debt Office referred its proposal to the parties concerned for consultation from 28 June 2023 to 31 August 2023.

In this report, the Debt Office submits its final proposal to the Government on nuclear waste fees and collateral amounts for reactor owners for the 2024–2026 period. The report also summarises the Debt Office's audit and opinion on the cost estimate.

1.2. A need for higher fees and collateral amounts

The Debt Office has calculated nuclear waste fees, credit risk amounts and risk margins based on the reactor companies' latest cost estimate, Plan 2022. The amounts are based on market data and information available as at 30 June 2023.

Table 1 shows the Debt Office's proposal for nuclear waste fees, credit risk amounts and risk margins for the period 2024–2026.

Table 1: The Debt Office's proposal for nuclear waste fees and collateral amounts for 2024–2026

Different units, see table

Reactor owner	Nuclear waste fee	Credit risk amount (SEK million)	Risk margin (SEK million)
Forsmark	4.5 öre/kWh	5,934	19,144
Oskarshamn	7.5 öre/kWh	6,112	10,356
Ringhals	8.6 öre/kWh	8,150	17,049
Barsebäck	SEK 264m/year	772	4,145

Source: Swedish National Debt Office

Nuclear waste fees and collateral increase for all reactor owners compared with current levels. Barsebäck, which has had a fee of zero since 2021, now has a positive financing need and is therefore proposed to pay the nuclear waste fee and pledge collateral for the credit risk amount once more.

The need for nuclear waste fees and collateral amounts is explained partly by the development of a reactor owner’s financing need (the difference between liabilities and assets) and partly by the expected remaining electricity generation over which the credit risk amount is distributed. These components are in turn affected by both programme-specific factors and the macroeconomic development and its impact on prices and return on the financial instruments in which the nuclear waste fund invests.

As a result of rising inflation globally, the world’s central banks have tightened monetary policy over the past year, leading to higher market rates and falling asset prices. For the full year 2022, the nuclear waste fund had the worst full-year return since its inception, with a nominal return of -11 per cent for the portfolio as a whole (corresponding to a real return of -23 per cent).

However, the financing need is determined by the development of liability and asset values in relation to each other. The higher interest rates also have a curbing effect on liability valuation; that is, the present value of a reactor owner’s remaining expected costs, because the discount rate curve used in the calculation is (partly) based on market rates.

Developments in the fee and collateral need have, in the past year, been reported in the Debt Office’s quarterly reports on reactor owners. The reports show that a relatively modest increase in current fees would suffice to balance the reactor owners’ assets and liabilities, given the cost development calculated by SKB in Plan 2019.

The main reason for the need for increased nuclear waste fees and collateral amounts is a sharp upward revision in the reactor owners’ assessment of future remaining costs. A comparison between the base calculations in Plan 2019 and Plan 2022 shows that remaining costs have increased by 24 per cent. SKB estimates that costs have increased in most parts of the nuclear waste programme, with the spent fuel repository (SFK) accounting for the largest increase in absolute numbers. The need for increased fees and collateral amounts is thus mainly explained by factors specific to the nuclear waste programme and not by the macroeconomic trend.

The need for increased fees varies between the different reactor owners. For reactor owners with reactors in operation, Ringhals’ financing need increases most, which is largely because the rise in remaining costs is greater for Ringhals than for the other reactor owners. In addition, there is a long period of reduced electricity generation due to an unforeseen shutdown of reactor 4. Other factors influencing the relative differences in the increases are duration of the reactor owners’ liabilities, balance sheet totals and remaining expected electricity generation of the different reactor owners.

The credit risk amounts, which reflect the financing need for residual products that already exist, need to be increased for the same reasons as the nuclear waste fees (not for Oskarshamn, for which the amount is essentially unchanged). However, in percentage terms the increases are lower than for fees because the credit risk amounts naturally decrease as fees are paid into the nuclear waste fund.

The risk margins need to be increased to a similar degree for all reactor owners. The increase is due to the higher cost estimate, a lower fund value of the nuclear waste fund and somewhat higher expectation and volatility of the future inflation.

Fees and collateral amounts are somewhat lower than in the proposal that the Debt Office referred for consultation in June. The discrepancies in these levels are due to the final proposal taking output and market data through 30 June 2023 into account, whereas the proposal for consultation used a valuation date of 31 March 2023. In the second quarter of 2023, market interest rates rose while at the same time inflation expectations, measured as break-even inflation, fell. Both of these changes have a curbing effect on fees and collateral.

1.3. The Debt Office’s comments on the estimated costs

According to section 18 of the Financing Ordinance, the Debt Office shall assess the cost estimate and submit detailed reasons for its assessment and the factors that it considers particularly critical to cost development.

Over time, SKB has gradually revised up the remaining expected costs in the nuclear waste programme. These costs have in part evolved as a result of the estimation assumptions changing with time, mainly because of increased operating-time assumptions. However, even after adjusting for such differences, the conclusion remains that, measured in constant prices, overall costs for the nuclear waste programme are on an upward trend. Moreover, the risk of the cost escalation that is now transpiring has been underestimated in SKB’s previous uncertainty analyses.

In our audit of Plan 2022, we identify a number of areas in which SKB’s analysis and reporting can be improved, both in terms of the expected costs and their related uncertainties. We note that several of these areas have already been identified in previous audits but that SKB has applied these views only to a limited extent. The Debt Office has therefore further clarified what is expected of the analysis and reporting in Plan 2025.

The most important overall conclusion from our audit is the need for a more data-driven approach. The Debt Office ascertains that SKB’s assessments have so far not been supported by output data. Prior to the work on Plan 2025, it may be reasonable to attempt to map out, analyse and report evaluations from previous projects within the nuclear waste programme and how these are weighed into the assessment of future cost estimates.

2. Introduction

This report presents the Debt Office's proposals on nuclear waste fees, credit risk amounts and risk margins for reactor owners for 2024–2026.

The report is structured as follows:

- Section 3 provides a background to the financing system and the process for setting nuclear waste fees, credit risk amounts and risk margins.
- Section 4 presents a summary of the Debt Office's views on the reactor owners' cost estimate.
- Section 5 describes the principles for the Debt Office's calculation of nuclear waste fees, credit risk amounts and risk margins.
- Section 6 presents proposals for nuclear waste fees and credit risk amounts. The section also presents:
  - a comparison with the balance sheet forecast at the time of the previous fee calculation,
  - stage-by-stage explanations that translate the most important changes into impact on fees for each reactor owner,
  - the change in nuclear waste fees from the amounts in the proposal referred for consultation, using updated market data, and
  - sensitivity analyses for some of the most important parameters in the fee calculation.
- Section 7 presents proposals for risk margins. The section also presents:
  - a comparison with decided levels,
  - a stage-by-stage explanation of the aggregated risk margins,
  - the change in risk margins from the referred amounts, resulting from updated market information, and
  - sensitivity analyses for some of the most important parameters for the risk margin.

The Debt Office's summarised audit opinions are based on three underlying explanatory appendices, which are presented in:

- explanatory appendix 1: basic costs,

- explanatory appendix 2: external economic factors and
- explanatory appendix 3: skb’s uncertainty analysis.

The proposal is also to include the agencies’ and, in some cases, the municipalities’ and regions’ expected costs (additional government costs). The Debt Office's calculation of additional costs is presented in explanatory appendix 4: additional costs.

On 26 June 2023, the Debt Office referred its proposal on nuclear waste fees and collateral amounts to relevant parties for consultation. A summary of the comments received, and the Debt Office’s counter-comments, are presented in explanatory appendix 5: consultation response.

These appendices are published, in Swedish, on the Debt Office’s website.

The individual consultation responses (which are summarised in Explanatory appendix 5) can be requested from the Debt Office’s registrar’s office: registratur@riksgalden.se.

The Debt Office has also received three external reports, these are presented in:

- Annex 1: Ortec Finance – ALM study report – June 2023, which contains a further analysis of the risk margins.
- Annex 2: Oxford Global Projects – Reference Class Forecast for The Swedish National Debt Office, which contains a reference class forecast for the Swedish nuclear waste programme.
- Annex 3: National Institute of Economic Research – Calculation of benchmarks for EEF1 and EEF2, which contains an analysis of EEF 1 and 2. (only available in Swedish)

The external reports can be requested from the Debt Office’s registrar’s office: registratur@riksgalden.se.

3. Background

The nuclear waste programme is one of Sweden's largest infrastructure projects of all time. The programme covers the decommissioning of all nuclear power plants and final disposal of nuclear waste and spent nuclear fuel. The development of a method for the final disposal of spent nuclear fuel has been ongoing since the 1970s. The method that has been developed involves placing the spent nuclear fuel in copper canisters that are deposited 500 metres down into the bedrock, surrounded by bentonite clay. The nuclear fuel must be isolated for at least 100,000 years. The industry is responsible for the execution of the programme.

The industry must set aside funds to secure financing. To this end, every three years the industry must submit a cost estimate to the Debt Office. The Debt Office shall, in turn, assess the cost estimate and propose nuclear waste fees and collateral amounts to the Government.

3.1. The Swedish nuclear waste programme

The Swedish nuclear waste programme (the programme) encompasses the decommissioning and dismantling of the Swedish nuclear power plants. The programme also encompasses the management and final disposal of nuclear waste and spent nuclear fuel from the nuclear power plants. There are a total of twelve nuclear reactors in Sweden, located at four nuclear power plants:

- Forsmark (three reactors, all in operation),
- Oskarshamn (three reactors, one in operation),
- Ringhals (four reactors, two in operation), and
- Barsebäck (two reactors, all shut down).

The reactors' planned operating time is an important factor in the execution of the nuclear waste programme. The reactors' operating times govern the forecasts for the amounts of nuclear waste and spent nuclear fuel that will require disposal, as well as when the need for different types of storage will arise. The reactors' operational status is essentially unlimited in time and the reactor owners may operate the reactors as long as they fulfil the safety requirements and hold a permit. The Swedish Radiation Safety Authority (SSM) is responsible for operational supervision at the nuclear power plants. The owners have made investments to enable maintaining a total of 60 years of operation (until 2045 at the latest) for the six reactors remaining in operation. The planning basis for the nuclear waste programme thus comprises 60 years of operation.

It is the Swedish Nuclear Fuel and Waste Management Company (SKB) that, on behalf of its owners, is responsible for the execution of the management and final disposal of nuclear waste and spent nuclear fuel. The reactor companies are themselves responsible for executing the decommissioning and dismantling of the nuclear power plants. The plan for execution, continued research and technological development is presented once every three years in an RD&D programme (research, development and demonstration). In September, the latest RD&D programme was submitted to the Swedish Radiation Safety Authority [1], which finds that the submitted RD&D programme fulfils the legal requirements [2].

The waste can be divided into nuclear waste (low- and medium-level waste) and spent nuclear fuel (high-level waste). Nuclear waste can in turn be divided into short-lived and long-lived waste. Short-lived waste consists mainly of components from the nuclear power plants. The parts will chiefly be deposited in the final repository for short-lived waste (SFR). SFR is located at Forsmark’s nuclear power plant by the Baltic Sea. At present, only operational waste is finally deposited in SFR, and the repository is therefore soon to be expanded to accommodate future decommissioning waste. Long-lived waste consists mainly of reactor core components (such as control rods). Disposal of long-lived waste is planned to be done in the final repository for long-lived waste (SFL). The development of SFL is in the early stages, but the concept consists of a smaller but deeper repository compared with SFR. Until then, interim storage is needed for the long-lived waste, which is partly done at the nuclear power plants.

The disposal of the spent nuclear fuel consists of numerous elements that interact with one another. Pending final disposal, storage takes place in a central interim storage facility for spent nuclear fuel (Clab). Storage in Clab is done in storage pools at a depth of about 30 metres below the surface. Before final disposal of spent nuclear fuel can take place, it must be encapsulated in copper canisters. To this end, SKB needs to construct an encapsulation facility. Once the encapsulation facility is connected to Clab, the two facilities will be operated as one single integral facility and be known as the central facility for interim storage and encapsulation of spent nuclear fuel (Clink).

Research to develop a method for final disposal of spent nuclear fuel has been ongoing since the 1970s. The canister that will encapsulate the nuclear fuel will consist of a copper shell and a ductile iron insert. In the planning, around 5,600 canisters of spent nuclear fuel will need final disposal. Final disposal of the copper canisters will be done in the final disposal facility for spent nuclear fuel (SFK). The plan is to build SFK around 470 metres below the rock surface at Forsmark in the municipality of Östhammar. SFK’s storage facilities will consist of a large number of depositing tunnels with drilled disposal shafts at the bottom of the tunnels. Once the canisters have been deposited, the tunnels will be filled with bentonite (a type of swelling clay). The copper canister, the clay and the rock together constitute the three main protective barriers for the spent nuclear fuel.

Nuclear waste is transported from the nuclear power plants by sea on the vessel m/s Sigrid. This ship has double hulls and double shell plating to protect the cargo in the event of grounding or collision. Custom-built vehicles are used for loading.

3.2. The financing system for residual products from nuclear power

Entities with a permit under the Act on Nuclear Activities (1984:3) (the Nuclear Activities Act) are, according to section 13, obliged to finance the safe management and final disposal of residual products from nuclear power, decommissioning and dismantling the facilities when operations are no longer to be conducted, as well as the research required to enable the measures. Under section 14 of the Nuclear Activities Act, these obligations remain in place until they have been completed, even if the permit ends. In order to ensure the financing of the obligations arising from the Nuclear Activities Act, the Financing Act is in force. The purpose of the legislation is for the costs of final disposal of spent nuclear fuel and nuclear waste to be borne by those that generated the waste; the state shall pay neither for decommissioning nor final disposal.

A company that has a permit to own or operate one or more nuclear power reactors that have not been permanently shut down before 1 January 1975 are defined as reactor owners. In Sweden, there are four reactor owners (listed below) that are subject to the obligations of the Financing Act:

- Forsmarks Kraftgrupp AB (Forsmark),
- OKG Aktiebolag (Oskarshamn),
- Ringhals AB (Ringhals) and
- Barsebäck Kraft AB (Barsebäck).

Detailed rules on financing and cost reporting are set out in the Financing Ordinance. According to the Financing Ordinance, once every three years reactor owners are required to jointly present a cost estimate detailing the remaining costs of the nuclear waste programme. The cost estimate shall describe, among other aspects, the joint costs for the reactor owners and those that each has for its own reactors. Section 9 of the Financing Ordinance stipulates that the costs shall refer to the probability-weighted average. In practice, the work is coordinated through the jointly owned Swedish Nuclear Fuel and Waste Management Company (SKB). The cost estimate shall reflect the execution of the nuclear waste programme as described in the RD&D programme, although with account taken of certain specific conditions pursuant to the financing legislation. The cost estimate shall be submitted to the Debt Office no later than in September.

According to the Financing Ordinance, the Debt Office has the task of assessing the cost estimate and submitting proposals to the Government on nuclear waste fees for the next three-year period. The nuclear waste fees shall, together with previously funded assets, cover the expected remaining costs of the programme, as well as the costs that may arise for the central government for supervision and management of fee proceeds (in the legislation, these are defined as additional government costs). For reactor owners with one or more nuclear reactors that are not permanently shut down (i.e. Forsmark, Oskarshamn and Ringhals), the fee shall be expressed in Swedish kronor per kilowatt hour of delivered electricity. For reactor owners with all their reactors permanently shut down (i.e. Barsebäck), the nuclear waste fee shall be expressed as a fixed annual amount in Swedish kronor. The Debt Office's calculation of nuclear waste fees is based on expected values of all input data.

After the Government has decided on levels for nuclear waste fees, the reactor owners pay the fees into the nuclear waste fund. Fund assets are managed by a government agency of the same name – the Nuclear Waste Fund. According to section 13 of the Financing Act, fund assets shall be managed prudently to secure the financing of the future costs for which the fees are intended. More detailed rules on the management of the fund, such as permitted asset classes, are set out in Ordinance (2017:1180) on the Management of the Assets of the Nuclear Waste Fund (the Asset Management Ordinance).

Besides paying fees, reactor owners shall also pledge eligible collateral equalling the credit risk amount and the risk margin to the nuclear waste fund. The credit risk amount is an amount equalling the difference between a reactor owner's remaining costs for residual products that have already emerged, and the assets already included in the nuclear waste fund. The risk margin is an amount which, together with the credit risk amount and the reactor owners' share in the nuclear waste fund, implies that the reactor owner will, with a high degree of probability, fulfil their obligations. The Debt Office also submits to the Government, together with proposals on nuclear waste fees, proposals on the size of these collateral amounts for the reactor owners. The Government decides whether the collateral proposed by the reactor owners is eligible, after the Debt Office has assessed the reactor owners' proposals on collateral.

On 27 January 2022, the Government decided on nuclear waste fees, credit risk amounts and risk margins for reactor owners for 2022 and 2023 [3]. Table 2 shows decided amounts.

Table 2: Nuclear waste fees, credit risk amounts and risk margins for 2022 and 2023

Different units (see table)

Reactor owner	Nuclear waste fee	Credit risk amount (SEK million)	Risk margin (SEK million)
Forsmark	3.0 öre/kWh	5,485	15,834
Oskarshamn	5.6 öre/kWh	6,113	8,628
Ringhals	4.5 öre/kWh	5,846	14,219
Barsebäck	SEK 0 million	0	3,052

Source: The Government [3].

On 30 September 2022, the reactor owners jointly submitted their cost estimate through SKB [4]. On 26 June 2023, the Debt Office referred its proposal on nuclear waste fees and collateral amounts to relevant parties for consultation [5].

4. The Debt Office's assessment of the cost estimate

In September 2022 SKB submitted Plan 2022, which is a report on the remaining costs for decommissioning and dismantling the nuclear power plants, and the management and final disposal of nuclear waste and spent nuclear fuel from the nuclear power plants. SKB's estimate extends until the 2090s, and the expected remaining costs from 2024 are estimated at SEK 133 billion (undiscounted at the December 2021 price level).

According to section 18 of the Financing Ordinance, the Debt Office shall comment on the cost estimate and present the detailed reasons for the agency's assessment, and the factors that Debt Office considers particularly critical to cost development.

4.1. Cost development in the nuclear waste programme

SKB's cost estimates are the most important basis for the Debt Office's calculations of nuclear waste fees and collateral amounts.

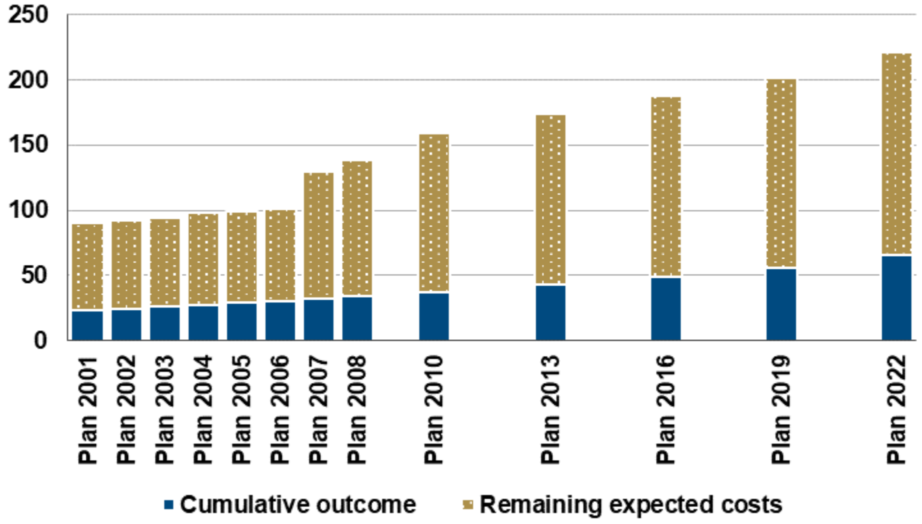
First, the annual expected costs used to estimate nuclear waste fees are based on the mean of the cost outputs obtained from the uncertainty analysis. Second, SKB's uncertainty analysis might potentially constitute valuable information for the Debt Office's modelling of the risks on the liability side in the calculation of risk margins.

SKB has been tasked with producing cost estimates for the nuclear waste programme since the 1980s, which enables analyses of the cost development over a lengthy horizon. Chart 1 shows the progression of SKB's assessment of the total cost of the nuclear waste programme at the time of presenting the cost estimate. The total cost is a sum of the historical costs incurred (cumulative outcomes) and the assessment of future costs (remaining expected costs).

Before Plan 2001, there were no historical outcomes reported per year, and running comparisons can therefore not be made further back. However, the expected costs from the first cost estimate, Plan 1982, equal approximately SEK 100 billion at today's price level. It therefore appears that the assessment of the total costs was relatively constant in the cost estimates of the first 20 years.

Chart 1: Development of the estimated total cost of the nuclear waste programme

SEK billion, constant prices (price level December 2022)



Note. Regulated operating time varies during the period. Cumulative outcomes also include costs not financed by the fund.

Source: SKB and own calculations.

If the expected costs from Plan 2022 are realised as forecast, the nuclear waste programme will cost a total of SEK 221 billion from start to finish. This can be compared with the assessment made in Plan 2001 just over 20 years ago, which was less than half of the current forecast. The increase corresponds to an average annual real growth rate of 4.3 per cent in expected costs during the reported period.

Over the period, the operating-time assumption, which is regulated in the Financing Ordinance, has changed, affecting the volume of nuclear fuel included in the estimates and therefore the assessment of remaining costs. The operating-time assumption was 25 years before Plan 2007, 40 years between Plan 2007 and 2013, and 50 years from Plan 2016 onwards. However, as can be seen in 0, costs have increased sharply in periods of a constant operating-time assumption[1].

Compared with the previous Plan report, costs from 2024 onwards for the most probable cost scenario according to SKB have increased by 24 per cent in Plan 2022. The increase, which is considerably larger than before, is explained by a number of factors analysed in more detail in section 3.3 and Explanatory appendix 1.

Forecasts for a programme that spans several decades inevitably carry great uncertainties, and substantial forecasting errors are not surprising. However, a

[1] Corresponding to an average annual real increase of 5.0 per cent between Plan 2007 and Plan 2013, and 2.8 per cent between Plan 2016 and Plan 2022.

concern in terms of sustainable financing design over time is that the costs have been systematically underestimated for a long time.

The Debt Office's audit areas therefore have the common denominator of attempting to identify the causes of systematic misestimates and allowing for the considerable uncertainties surrounding SKB's cost assessments.

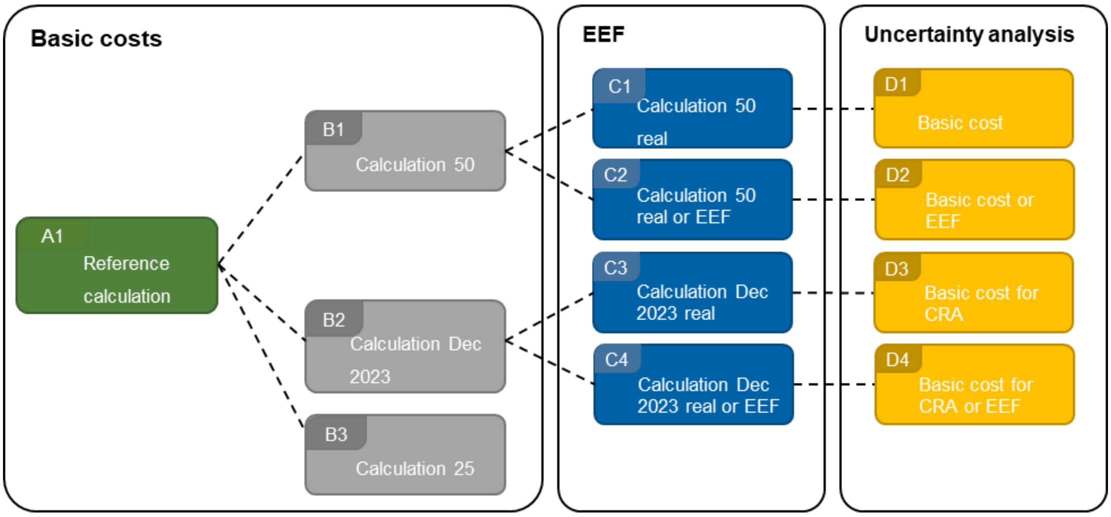
4.2. The cost report (Plan 2022) and the Debt Office's audit

Our audit can be broken down into three areas that correspond to the main stages of SKB's work on producing the remaining expected costs that form the basis for calculating nuclear waste fees and collateral amounts.

Pursuant to section 8 of the Financing Ordinance, the reactor owners are obliged to estimate the of remaining costs for the disposal of residual products from nuclear activities and submit it to the Debt Office once every three years. The cost estimate shall describe, among other aspects, the joint costs for the reactor owners and those that each has for its own reactors. Section 9 of the same ordinance sets out that the costs shall refer to the probability-weighted average.

Work on producing cost estimates is delegated by the reactor owners to SKB. On 30 September 2022, SKB submitted a common cost base, called Plan 2022. Plan 2022 consists of several calculations with different assumptions The calculations are based on each other and produced by a process with stages. Figure 1 shows how the different calculations are connected and in which area they are addressed in the audit.

Figure 1: The Debt Office's audit areas in relation to calculations in Plan 2022



Source: SKB and the Debt Office

In the first step, the so-called reference costs (A1) are calculated, which are based on the current planning conditions of the reactor owners in terms of the reactors' operating times and expected volumes of radioactive waste as well as spent nuclear fuel. Calculation of the reference cost is based on a deterministic method; that is, conditions for the calculation are constant. The reference costs are obtained by compiling a large volume of underlying calculations – which SKB calls base calculations – for the different parts of the nuclear waste programme. SKB is responsible for producing the base calculations, often with the support of various consultants, for the elements that are common to the reactor owners (joint waste management costs). This may include, for example, construction of the final repository for spent nuclear fuel and the encapsulation plant. Calculating the costs that are unique to each reactor owner (specific costs) – mainly decommissioning of the reactors – is the responsibility of the reactor owners themselves.

The Financing Ordinance sets out that the remaining total operating time of reactors as a basis for calculating nuclear waste fees shall be 50 years, although not less than six years from the beginning of the next fee period, unless there is reason to assume earlier shutdown. To this end, SKB scales down the reference cost estimate in the next step to obtain calculation 50 (B1), which thus corresponds to a total operating time for each reactor of 50 years. Since the operating time in calculation 50 has been reduced by 10 years per reactor, SKB also reduces the number of spent fuel canisters that require disposal. However, it should be noted that the dates for dismantling the reactors are based on 60 years of operation in calculation 50 as well.

SKB also produces calculation Dec 2020 (B2), which includes operation of the reactors until December 2020. The purpose of calculation Dec 2020 is to provide a basis for calculating the credit risk amount, which is calculated on the assumption that no additional electricity generation takes place, and thus that no further fees are contributed. In addition, calculation 25 (B3) is also performed, which corresponds to operating the reactors for a total of 25 years. SKB uses calculation 25 to allocate costs to the four reactor owners at a later stage. The distribution is based on agreements between the reactor companies.

In the next step, the base estimate is adjusted for changes in real costs to obtain calculation 50 real (C1). The adjustment is made using a method called external economic factors (EEF). Using the method, a forecast is made, based on historical data, of the real progression of economic factors that SKB considers to be representative for the nuclear waste programme. In Plan 2022, SKB also performs an alternative calculation, calculation 50 real or EEF (C2), which is based on calculation 50 but adjusted for EEF according to the guidelines of the Swedish Radiation Safety Authority. An equivalent adjustment is made to calculation Dec 2020 in order to obtain calculation Dec 2020 real (C3) and calculation Dec 2020 real or EEF (C4).

Finally, SKB adds a mark-up for “unforeseen and risk”, known as the uncertainty mark-up, onto all four calculations. That way, the remaining cost (D1), remaining cost or EEF (D2), remaining cost for CRA (D3) and remaining cost for CRA or EEF (D4) are obtained. The mark-up is calculated using an uncertainty model consisting partly of an application of the *successive principle* and partly of a stochastic calculation model. The actual uncertainty mark-up is the difference between the mean of the stochastic simulation in the uncertainty analysis and Calculation 50 real, and Calculation 50 real or EEF. In calculating the mark-up for the calculations as a basis for the credit risk amount, no new simulation is performed. Instead, a standardised mark-up assumption is made based on the relationship between the size of the costs in the two calculations. Using calculation 25 in step B, the costs are also distributed among the four reactor owners.

4.3. Basic costs (Explanatory appendix 1)

The Debt Office's audit of the basic costs in Plan 2022 has been more thorough than in previous audits, for several reasons.

SKB's assessment of the remaining basic costs has increased significantly in more recent cost estimates, particularly between Plan 2019 and Plan 2022. We consider it important to better understand which parts of the nuclear waste programme have been most affected by the revisions and their underlying causes. This is valuable in order to better predict the progression of the future financing need, and also to enable giving recommendations to SKB as to how the basis can be improved.

The basic costs lay the foundation for all subsequent calculations. If the basic costs contain systematic errors – that is to say they are, in their entirety, under- or overestimated – this means that subsequent mark-ups for price changes and uncertainties will be made around an incorrect cost level. This is particularly the case for the uncertainty analysis, in which the basic costs constitute the "most likely" value for the probability distributions for the risk factors in the model.

The basic costs are also used as a foundation for the comparative analyses performed by the Debt Office using *reference class forecasts*, in which the projects in the nuclear waste programme are compared with previously executed nuclear projects (see section 3.5 and explanatory appendix 3). If SKB's basic cost estimates systematically deviate from those performed for the projects of the reference class, there will be an adverse impact on comparability.

The audit of basic costs has been divided into three areas, corresponding to chapters in Explanatory appendix 1:

Chapter 1 compares Sweden's cost estimate for decommissioning in an international perspective through collecting data from publicly available sources. In comparison with the countries examined, Sweden has significantly lower estimated costs for decommissioning. While a number of factors impede comparability between countries, at the same time the differences (a factor of 2 to 3) are so large that we consider that they cannot be explained solely by country-specific factors and differences in the scope of decommissioning projects. From a risk perspective for the central government and taxpayers, this is problematic. The Debt Office considers that SKB and the reactor owners need to analyse the issue further and report the results of their work more transparently.

Chapter 2 compares the estimated costs reported in SKB's Plan reports since 2010. The aim is to identify trends and cost drivers. We arrive at the conclusion that delays lead to cost increases and that delays in one sub-project appear to have significant effects on other projects too within the nuclear waste programme. Furthermore, there is a pattern over time of the cost estimates firstly being revised down as a result of expected efficiency measures, to subsequently be revised up again. In our opinion, such revisions should be avoided and cost reductions from any efficiency improvements should be treated conservatively.

Chapter 3 analyses sub-projects within the ongoing decommissioning, and also SKB's own project evaluations for completed projects. Regarding the ongoing decommissioning of reactors, the overall picture is that sub-projects completed so far have been within budget. However, much work remains to be done for reactor owners in areas where uncertainty in estimated costs is considered to be high. SKB's forecast evaluations, which we have looked at, provide some insight into the individual projects. However, we consider that SKB needs to report evaluations in a more complete and transparent way. In light of the fact that the nuclear waste programme is entering a more operational stage in the coming years, there is a great need for more comprehensive reporting of forecast evaluations in order to enable monitoring and drawing conclusions on cost development.

4.4. External economic factors (Explanatory appendix 2)

SKB's work on forecasting the future price trend for input factors in the nuclear waste programme has been subject to auditing by the Debt Office (and, prior to that, by the Swedish Radiation Safety Authority) for a long time.

The focus for the audit of external economic factors (EEF) in Plan 2022 has been a more thorough analysis of the expected progression of productivity in the nuclear waste programme, in which small variations in assumptions have significant implications for the estimation of future expected costs due to the long duration of the nuclear waste programme.

First, the matter of productivity is analysed from a theoretical perspective through a study of relevant research literature. Numerous potential factors are identified as to why the progression of productivity in the nuclear waste programme likely differs from that in the service and construction sector. We consider that there is a risk of overestimating productivity using SKB's current approach, although it is difficult to quantify the size of the overestimation. SKB should analyse the matter in more detail based on the analysis performed by the Debt Office.

A more empirically oriented analysis then follows that shows that the expected remaining costs are highly sensitive to changes in methodology and choice of historical data. The National Institute of Economic Research's review of the data series used by SKB points to several areas in which the dataset can be refined to make it more comparable with the projects in the nuclear waste programme. SKB should investigate the possibilities of extending and supplementing the data series for EEF1 (labour costs in the service sector) and EEF2 (labour costs in the construction sector) based on the National Institute of Economic Research's recommendations.

Finally, the correlation between how SKB addresses productivity in EEF and the variations in the uncertainty analysis that are intended to take account of efficiency improvements is studied. Our opinion is that SKB's approach probably leads to overestimations of productivity growth and should therefore be reviewed.

An overall conclusion from the EEF audit is that SKB has only taken limited account of the recommendations and opinions expressed by the Debt Office for Plan 2019. Therefore, in explanatory appendix 2, the Debt Office has further clarified what is expected of the reporting and analysis of EEF in Plan 2025.

4.5. SKB's uncertainty analysis (Explanatory appendix 3)

The results from SKB's uncertainty analysis provide an important basis for the Debt Office's calculations of nuclear waste fees and collateral. First, the annual expected costs used to estimate nuclear waste fees are based on the mean of the cost outputs obtained from the uncertainty analysis. Second, SKB's uncertainty analysis might potentially constitute valuable information for the Debt Office's modelling of the risks on the liability side in the calculation of risk margins.

The Debt Office's audit is divided into three sections that address the outcome, method and model of the uncertainty analysis.

In the first section, the results obtained from SKB's uncertainty analysis are evaluated by comparing them over time and in relation to previously executed nuclear power projects around the world. We draw the conclusion that SKB has systematically underestimated the uncertainties in the future progression of costs over a long period of time. Comparisons with output data from reference classes of previously executed nuclear power projects also indicate underestimations, especially in terms of the risk of substantial cost overruns.

We find that these deviations can be explained by differences in the method and calculation model used to identify and quantify uncertainties. The second section describes how SKB works with uncertainty analyses according to the successive principle and how it fits in with the more data-driven approach advocated by the Debt Office.

The Debt Office finds that SKB's method is based, to an excessive extent, on subjective judgements and that it is therefore inappropriate to use as the sole basis for decision-making. Furthermore, a number of deviations made by SKB from the successive principle are identified, which in our view partly explains the perceived underestimation of the uncertainties.

The third and final section examines SKB's calculation model which, based on the analysis group's assessments, simulates cost scenarios, which results in the probability distribution of total costs used in the calculation of nuclear waste fees and collateral amounts.

Our audit of SKB’s calculation model shows that deficiencies previously pointed out have not been sufficiently addressed. In particular, problems persist regarding addressing schedule risk, the use of far too many risk factors and an overly complex modelling approach.

The Debt Office considers there to be a need for continuing work to develop the estimation model with regard to several points ahead of Plan 2025. However, as regards one specific risk factor, which concerns the modelling of temporal uncertainties due to a longer operating time, we find that the basis must be adjusted before it can be used as a foundation for calculating fees and collateral. The Debt Office therefore bases the calculation of nuclear waste fees and collateral on an adjusted cost estimate that excludes this.

We find that one of the most important areas for SKB’s future work with the uncertainty analysis is to compare and calibrate the results from the uncertainty analysis in relation to output data. It would be particularly valuable to report more comprehensively and transparently internal forecast follow-ups from previously executed projects. The nuclear waste programme has been in progress for over 40 years and incurred costs are at almost SEK 70 billion. Highly useful material should therefore exist for drawing valuable conclusions on developments so far that can supplement the external comparative data identified by the Debt Office.

4.6. The Debt Office’s overall assessment

Over time, SKB has gradually revised up the remaining expected costs in the nuclear waste programme. These costs have in part evolved as a result of changed estimation conditions regarding operating-time assumptions, which is a fixed condition in both SKB’s and the Debt Office's calculations. However, even when controlling for changes in operating time, the conclusion remains that, measured in constant prices, overall costs for the nuclear waste programme are increasing over time.

As the reactors age, the remaining contribution period to finance the reactor owners’ obligations is reduced. In addition, early decommissioning of reactors in Oskarshamn and Ringhals has caused the remaining financing need to be distributed over a lower volume of electricity generation. The combination of historical underestimations of remaining costs and the decline in the volume of remaining electricity generation leads to higher and more volatile nuclear waste fees. If the trend of underestimation of the future financing need continues, this may compromise the stability of the nuclear waste financing system in the long run.

Attempting to better predict future cost development is therefore paramount. Forecasts for a programme that spans several decades inevitably carry great uncertainties. However, the endeavour can and should be to avoid systematic forecasting errors (bias) and to allow for uncertainties that exist.

The Debt Office's audit points to a number of areas in which SKB's analysis and reporting can be improved, both in terms of the expected costs and uncertainties in the nuclear waste programme. We note that several of these areas have already been identified in previous audits but that SKB has only taken our views into consideration to a limited extent. The Debt Office has further clarified what is expected of the analysis and reporting in Plan 2025.

The most important overall conclusion from our audit is the need for a more data-driven approach. The Debt Office ascertains that SKB's assessments have so far not been supported by output data. The Debt Office's purpose in producing reference classes for the costs in the nuclear waste programme is to help attain a situation in which SKB's assessments and models can be compared and calibrated in relation to output data from previously executed projects. Ahead of the continuing work, it may be reasonable to attempt to map out, analyse and report evaluations from previous projects within the nuclear waste programme.

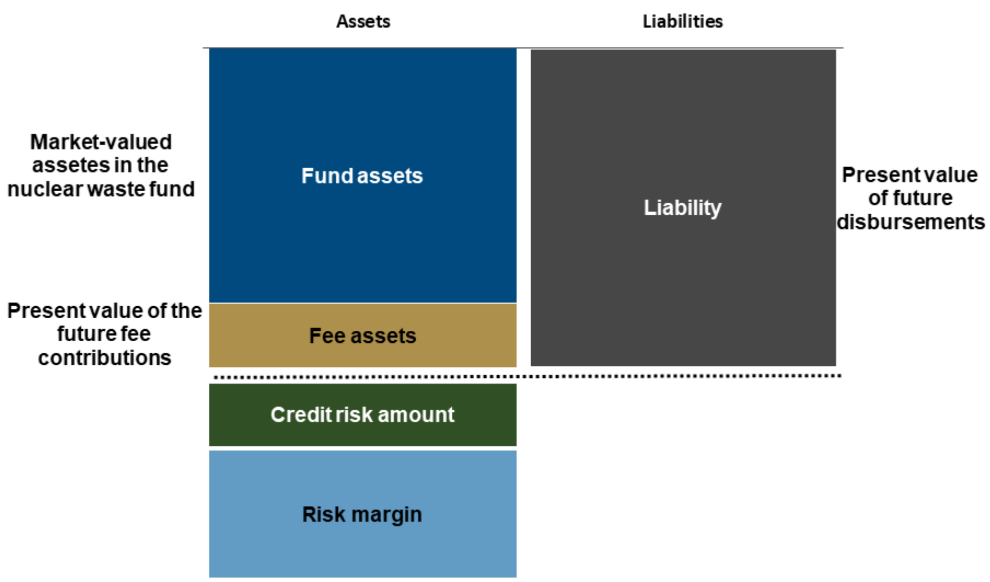
5. Calculation principles

The starting point for calculating nuclear waste fees is to strike a balance between a reactor owner's liabilities and assets. The collateral complements the funding mechanism and aims to secure financing even in a scenario in which a reactor owner does not contribute any additional nuclear waste fees. This section describes how calculating nuclear waste fees, credit risk amounts and risk margins is done and describes the main assumptions for the calculations.

5.1. Balance sheet

The overarching principle in calculating nuclear waste fees and collateral amounts is that a reactor owner's assets shall, at the beginning of the next fee period, be equal to the costs, measured at present value, for its future obligations under the nuclear waste programme. The main components in the calculations can therefore be illustrated in a balance sheet, see figure 2.

Figure 2: Illustrative balance sheet of a reactor owner



A reactor owner's liability is the present value of the disbursements expected for the reactor owner's obligations for the nuclear waste programme and its share of the additional government costs. A reactor owner's assets consist of a fund asset and a fee asset. The fund asset is the assets, measured at market value, in the reactor owner's share of the nuclear waste fund, and the fee asset is the present value of the reactor owner's future fee contributions into the nuclear waste fund. The present value calculation is performed using a discount curve that is to correspond to the expected return of the nuclear waste fund. The starting point in the Debt Office's calculations of nuclear waste fees is that a reactor owner's liability shall be balanced by its assets at the beginning of the next fee period.

The credit risk amount is the difference between the expected remaining costs for the residual products that have emerged at the time of the calculation, and the reactor owner's share in the nuclear waste fund. Somewhat simplified, it can be said that the credit risk amount corresponds to the present value of remaining fee contributions. The risk margin is an amount that is to supplement the credit risk amount should it prove insufficient. Together, the risk margin and the credit risk amount shall, with a high degree of probability, be sufficient to finance future costs, even if no further fees are contributed or no further collateral is pledged.

Nuclear waste fees, credit risk amounts and risk margins are closely interlinked, while calculation methods differ considerably. Nuclear waste fees and credit risk amounts are decided according to a deterministic calculation in Microsoft Excel[2]. The risk margin is calculated using stochastic simulations of a reactor owner's liability and asset side in an ALM system provided by Ortec Finance. A more detailed description of the two different methods for calculating fees and credit risk amounts on the one hand, and risk margins on the other, is provided below in this section.

5.2. Calculation of nuclear waste fees and credit risk amounts

According to section 7 of the Financing Act, the nuclear waste fee shall be calculated such that the discounted value of expected contributions, together with the reactor owner's share of the nuclear waste fund, corresponds to the discounted value of the reactor owner's costs and additional government costs.

Thus, the fee is calculated that is required so that the fee asset, together with the market-valued assets in the nuclear waste fund, to balance future expected disbursements out of the fund. For a reactor owner that has a permit for one or several nuclear reactors that are not permanently shut down, the fee shall be expressed in Swedish kronor per kilowatt hour of electricity delivered and be determined based on the volume of electricity that the reactor owner can be expected to deliver over remaining operating time. The remaining financing need is thus distributed across the remaining expected electricity generation of all the reactor owner's reactors. For reactor owners that do not have reactors in operation, the fee shall be stated as an annual amount in Swedish kronor, with a contribution period of three years.

The credit risk amount shall, according to section 5c of the Financing Act, be calculated as the difference between, on the one hand, the expected remaining basic costs and the additional costs for the residual products that have emerged at

[2] Calculation of fees is deterministic. However, the calculation is founded on basic costs obtained from SKB's stochastic simulation model.

the time of the estimation and, on the other hand, the reactor owner's share in the nuclear waste fund. The credit risk amount is therefore calculated as the difference between expected remaining costs provided that no further electricity is generated, and the market-valued assets in the nuclear waste fund. The liability that forms the basis for calculating the credit risk amount is, as a result of a lower volume of residual products from nuclear activities, slightly lower than the liability used as a basis for calculating nuclear waste fees.

This section provides a more detailed description of the components in the calculation of nuclear waste fees and credit risk amounts.

5.2.1. Valuation date

The valuation date is 30 June 2023. The Debt Office uses the end of the latest quarter as a rule for the valuation date to be used in the calculations. This means that the latest available quarterly data is used at the time of calculation. The ALM system used by the Debt Office to obtain discount and inflation curves is also updated quarterly.

Since the valuation date differs from when the new nuclear waste fees and credit risk amounts are to take effect[3] (31 December 2023), the current year is calculated using current nuclear waste fees.

Some changes have been made compared with the previous proposal with respect to inflation adjustment and discounting for the current year. Previously, the inflation and discount rate curve were assumed to be unchanged until the start of the fee period, which was a simplified assumption without any notable practical consequence in an environment with stable inflation and low interest rates.

In the current situation of sharp fluctuations in interest-rate and inflation expectations, even in the short term, this simplification is no longer considered appropriate. Using the new calculation principle, the inflation and discount rate curve is instead shifted forward from the valuation date to the start of the fee period[4]. This provides better consistency between implicit future inflation and the forward return from the inflation curve and the discount rate curve than previously.

5.2.2. Fund asset

The fund asset consists of the assets, measured at market value, in the reactor owner's share of the nuclear waste fund at the valuation date. The nuclear waste fund's capital is managed in two portfolios – a base portfolio and a long-term portfolio. The base portfolio contains an interest-bearing account, debt instruments issued by the central government (government bonds or treasury bills), covered bonds and derivative instruments (the underlying assets of which are debt instruments issued by the central government, covered bonds or that derive from

[3] The starting point is that the assets and liabilities of a reactor owner shall be in balance at the beginning of the next fee period when estimating nuclear waste fees and credit risk amounts.

[4] That is, by 0.5 years in that the valuation date is the end of the second quarter of 2023, but with the fee period starting on 1 January 2024.

interest rates in Swedish kronor). The base portfolio is the continuation of the previous total portfolio before the investment mandate of the nuclear waste fund was broadened. The long-term portfolio contains other riskier asset classes than those included in the base portfolio. This means that the portfolio contains Swedish and global equities, corporate bonds and derivative instruments to manage, for example, interest rate risks.

Table 3 shows the market value in the nuclear waste fund as at 30 June 2021 (the market value on which the previous fee decision was based) and as at 30 June 2023 (the market value on which this proposal is based). The fund's performance is affected by contributions, disbursements and return on the fund's holdings. The decline in market value since the previous fee calculation is explained by negative return[5].

Table 3: Market value in the nuclear waste fund

SEK million

Reactor owner	31 June 2021	31 June 2023
Forsmark	23,613	23,220
Oskarshamn	14,732	13,574
Ringhals	26,961	25,405
Barsebäck	13,370	11,119
Total	**78,675**	**73,318**

Note: Adjustments for accruals of contributions and disbursements have not been made, and thus the table shows pure market values at given dates.

Source: The Legal, Financial and Administrative Services Agency and own calculations

5.2.3. Future expected costs

A reactor owner's future expected costs (disbursements out of the nuclear waste fund) can be divided into three main components.

The first component consists of costs for activities that SKB has been commissioned by the reactor owners to perform; that is, dealing with and final disposal of residual products from nuclear activities. SKB refers to these as "*joint costs"* because the costs are shared among the different reactor owners.

The second component consists of costs associated with activities for the dismantling and decommissioning of the reactor owner's nuclear power plant. The reactor owner plans and executes these activities on their own, and in the underlying documentation they are referred to as "*specific costs*". Through its role of drawing up a common cost basis, SKB compiles the two components in Plan 2022, in what is referred to as the *"basic cost*". The basic costs together represent around 96 per cent of total costs.

The third component of future disbursements consists of "*additional costs*". "Additional costs" means the agencies' (and some municipalities' and regions')

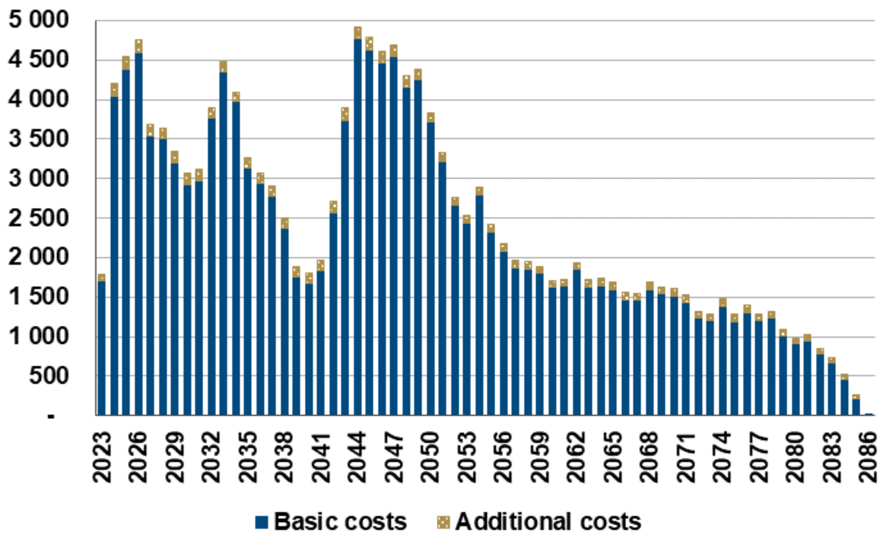
[5] Total nominal return of the nuclear waste fund (which also includes other permit holders) for the 2022 calendar year was -10.7 per cent.

annual expected costs for the operations they are commissioned to perform pursuant to section 4, points 4–9 of the Financing Act. For the Swedish Radiation Safety Authority, this refers to costs for decommissioning supervision in the dismantling of nuclear facilities, monitoring and control of final repositories, working and communicating with the general public regarding final repository-related matters, and the research and development efforts required to perform these tasks. For the nuclear waste fund, this refers to asset management costs. For the Debt Office, this refers to costs for examining matters pursuant to the Financing Act. For municipalities and regions, this refers to the costs of reviewing final repository applications that are examined by the Land and Environment Court, as well as information for the general public regarding final repository-related matters. The Debt Office has estimated total additional costs based on estimates of expected costs from each agency. The assumptions and methods are described in more detail in explanatory appendix 4: additional costs. The additional costs represent the remaining 4 per cent of total costs.

Chart 2 shows the annual costs broken down into basic and additional costs. The basic costs also include a reduction because the Debt Office assumes lower electricity generation than the reactor owners (giving fewer radioactive residual products, read more about this adjustment in section 5.2.3).

Chart 2: Annual future expected total costs per reactor owner

SEK million, price level 31/06/2023, including EEF



Note: The costs for 2023 are not for the full year but for the remaining six months.

Source: SKB, the Swedish Radiation Safety Authority, the Legal, Financial and Administrative Services Agency and the Debt Office

5.2.4. Future contributions

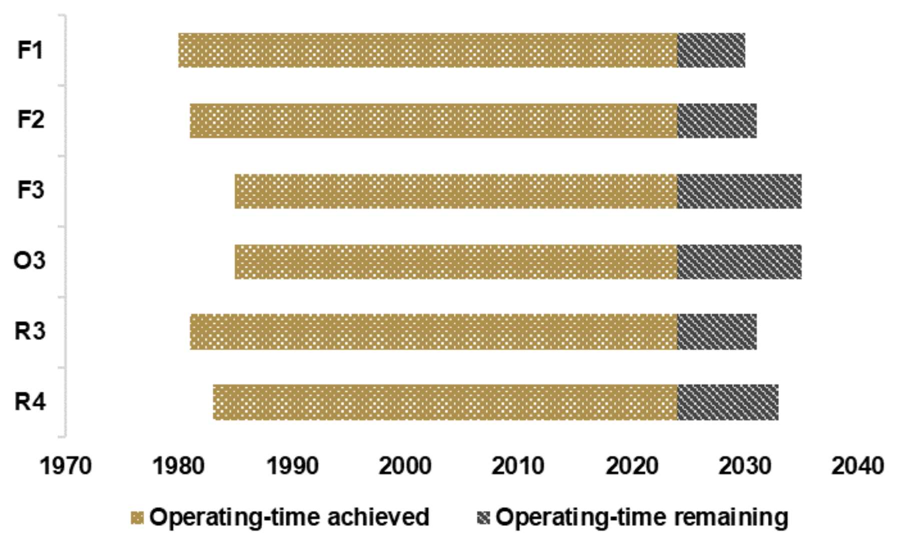
A reactor owner's expected future contributions, at present value, into the nuclear waste fund (the financing need) is provided by the difference between the present value of the reactor owner's future disbursements and the reactor owner's share of the market-valued assets in the nuclear waste fund.

For a reactor owner with shut-down reactors (currently Barsebäck), the fee asset is converted into an annual amount distributed over three years. For reactor owners with one or more reactors in operation, the fee asset is distributed over remaining expected electricity generation for their reactors. There are a total of twelve nuclear reactors in Sweden, located at four nuclear power plants: Forsmark, Oskarshamn, Ringhals and Barsebäck. Forsmark has three reactors in operation (F1, F2 and F3), Ringhals two (R3 and R4) and Oskarshamn one (O3). Oskarshamn shut down two reactors in 2015 and 2017 and Ringhals shut down R2 at the turn of 2019 and R1 at the turn of 2020. Barsebäck shut down its two reactors (B1 and B2) in 1999 and 2005, respectively.

The calculation assumptions for the operating times of the reactors are regulated in section 4 of the Financing Ordinance, which stipulates that each nuclear reactor that is not permanently shut down shall be assumed to have a total operating time of 50 years or at minimum a remaining operating time of six years. If there are special grounds for assuming that operation may cease at an earlier date, the expected operating time shall instead be determined based on that date. Chart 3 below shows operating time achieved from commercial start-up and remaining operating time for the six reactors remaining in operation (based on a total operating time of 50 years).

Chart 3: Operating times of the reactors

Year

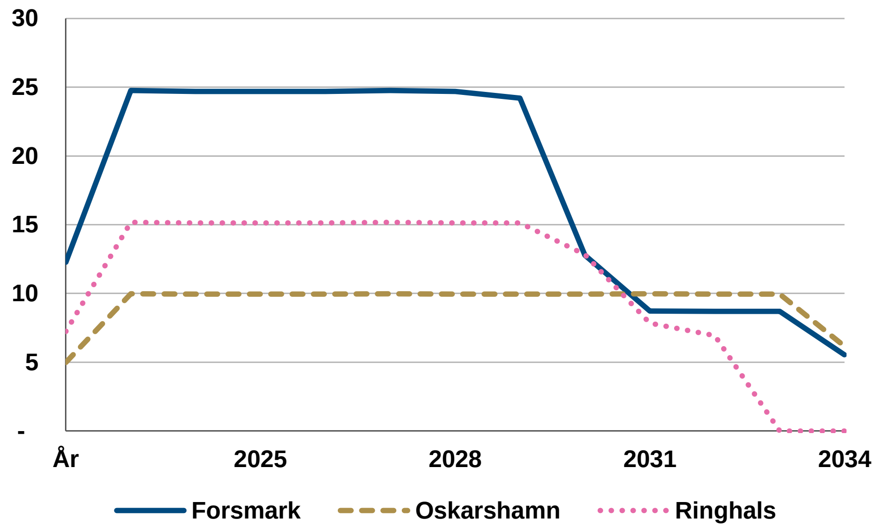


Source: SKB

Future electricity generation is calculated using the Debt Office’s forecast model, which was used in the Debt Office’s proposal for nuclear waste fees and collateral amounts for 2021 [6] and 2022–2023 [7]. The same forecasting model was also used in the Swedish Radiation Safety Authority’s proposal for 2018–2020 [8]. The method is based on estimating each reactor’s future electricity generation using a combination of historical availability factor and an expert opinion of future installed power. Using the method, total remaining electricity production of 491 TWh from the end of June 2023 is obtained (the current year's forecast has been scaled with respect to the valuation date; that is, 50 per cent of the full-year forecast is assumed for the rest of the calendar year). Chart 4 below is the Debt Office's forecast for each reactor owner's total annual expected remaining electricity production.

Chart 4: Remaining electricity production per reactor owner

TWh



Note: Production for 2023 has been reduced by 50 per cent of the full-year forecast with respect to the valuation date being 30 June 2023. The Ringhals 3 forecast for 2023 has been adjusted in light of an extended audit at the beginning of July.

Source: Own calculations

The Debt Office's assessment of expected electricity generation is lower than that reported by the reactor owners in Plan 2022. Lower electricity generation means fewer radioactive residual products as a basis for the cost estimates. Therefore, the basic costs are adjusted by a cost equalling the difference in expected residual products. To this end, SKB has provided an estimate of the reduction in the basic cost expected in the event of a decrease in electricity generation of one TWh. The Debt Office uses this data to calculate the reduction in the basic costs for each reactor owner, which totals SEK 611 million (price level at 30 June 2023).

5.2.5. The inflation curve

Future expected cash flows for disbursements are expressed in constant prices with respect to consumer price index (CPI)[6], while the discount rate curve is nominal. The real cash flows are therefore converted into nominal cash flows with an inflation curve.

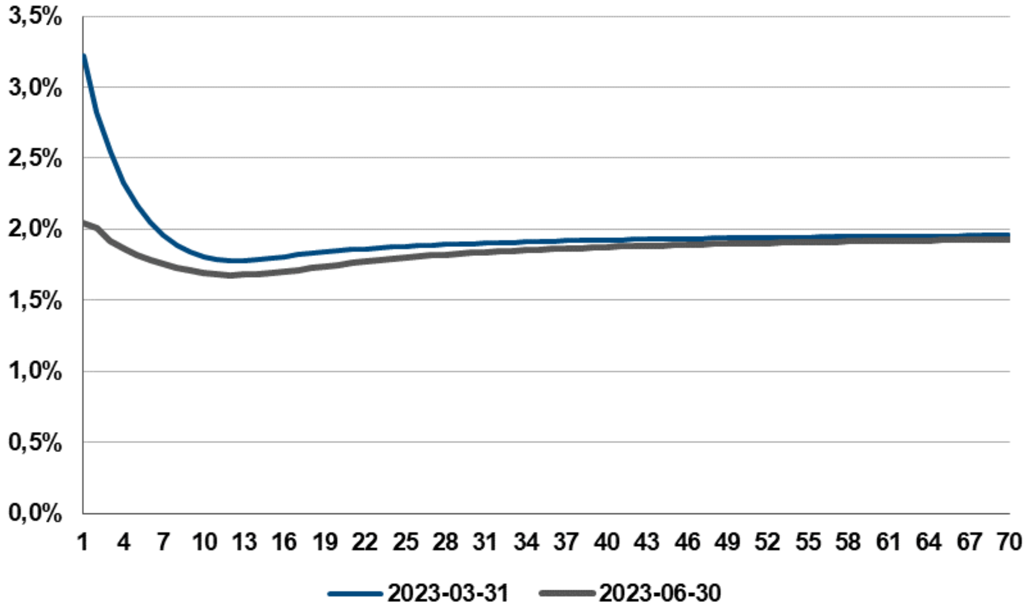
The method for determining an inflation curve based on market data and a long-term assumption follows the same principles as for the nominal risk-free discount

[6] However, they are already increased by SKB to take into account relative price changes in input factors for the nuclear waste programme (EEF).

curve. Inflation for maturities of up to 10 years consists of the difference in expected return for nominal and real government bonds, known as "*break-even inflation*" (BEI). Long-term annual inflation (forward inflation) is expected to be 2.0 per cent (according to the Riksbank's inflation target) and is used for maturities over 20 years. For maturities ranging from 11 to 20 years, expected forward inflation is estimated by aggregating forward inflation according to BEI and long-term forward inflation in the same way as when calculating the risk-free discount rate curve. Chart 5 shows the inflation curve as at 31 March 2023 (the curve used in the proposal for consultation) and as at 30 June 2023 (the curve currently used).

Chart 5: Inflation curves as at 31 March 2023 and 30 June 2023

Per cent



Source: Ortec GLASS

As shown by chart 5, the inflation expectations used in this proposal for fees and collateral, measured as break-even inflation, mean that CPI inflation in Sweden during the twelve-month period July 2023 to July 2024 will be just above the Riksbank's target of 2 per cent. Thereafter, inflation is expected to fall below 2 per cent for a number of years, to return to the target in the longer run.

It is worth noting that break-even inflation, especially in the short term, is significantly lower than many survey-based measures and forecasts performed for expected inflation. For example, Prospera's survey of inflation expectations from July shows an expected average inflation rate on a one-year horizon of 4.1 per cent (with a 75 per cent confidence interval between 2.3 per cent and 4.4 per cent) [9]. Also, consensus forecasts for CPI inflation from banks and major forecasting institutions are above break-even inflation, at least in the short term.

As noted in paragraph 5.2.1, the Debt Office has made some changes to the calculation principles as a result of the current situation with high volatility in interest rates and inflation expectations. Certain simplified assumptions that did not have any notable impact in an environment of low and stable inflation now need to be reviewed. It cannot be ruled out that changes also need to be made to the method for producing the inflation curve if the current situation persists. However, we do not consider it appropriate to make methodological changes to the structure of the discount rate or inflation curve in the current fee proposal. Instead, a review will be performed ahead of the next fee proposal so that any changes can be included in the consultation process.

5.2.6. Discount rate curve

The discount rate curve is used to calculate the present value of a reactor owner's assets and liabilities when estimating fees and credit risk amounts. The Debt Office's discount rate and inflation curve is retrieved from the ALM system GLASS, provided by Ortec Finance.

Section 7 of the Financing Act stipulates that the discount rate shall correspond to expected return in the nuclear waste fund. The Financing Ordinance specifies this in detail, setting out that discounting shall be performed using a risk-free discount rate curve increased by 0.75 percentage points.

The risk-free discount rate curve is calculated in accordance with the rules for occupational pension companies set out in Finansinspektionen's regulations FFFS 2019:21. For maturities of up to ten years, the curve consists of zero-coupon rates for interest rate swaps, less 0.15 percentage points. For maturities over 20 years, the discount rate curve is based on a long-term forward rate (Ultimate Forward Rate, UFR). For maturities ranging from 11 to 20 years, an aggregation of forward rates for interest rate swaps and UFR is used with a progressively higher weight for UFR.

UFR is calculated by the European Insurance and Occupational Pensions Authority (EIOPA) as expected inflation plus the average of annual short real interest rates since 1961. When the Debt Office calculates a risk margin that is proposed to apply for a certain fee period, the UFR that is valid for the first year of that period is used. The UFR for 2024 is set at 3.30 percent [10].

According to Finansinspektionen's (the Swedish Financial Supervisory Authority) regulations (section 26 of FFFS 2019:21), Swedish occupational pension companies may, during a transitional period, use a method in which the long-term forward rate is gradually phased in towards EIOPA's UFR in order avoid an excessively sharp sudden change in the discount curve as a result of the new regulations. The Debt Office applies the same phase-in when calculating the risk margins. According to the method, UFR shall be calculated as a weighted mean between EIOPA's UFR and the value 4.2 per cent, in which the weighting gradually increases towards EIOPA's decided level to be fully implemented by 2026, see table 4 below. According to the method, the UFR for 2024 is 3.66 per cent.

Table 4: Applied phase-in of EIOPA's UFR

Weight (0–1)

Year	Weight for the value calculated by EIOPA	Weight for the value 4.2 per cent
2021	0	1
2022	0.2	0.8
2023	0.4	0.6
2024	**0.6**	**0.4**
2025	0.8	0.2
2026 and later	1	0

Note: Current weighting in bold.

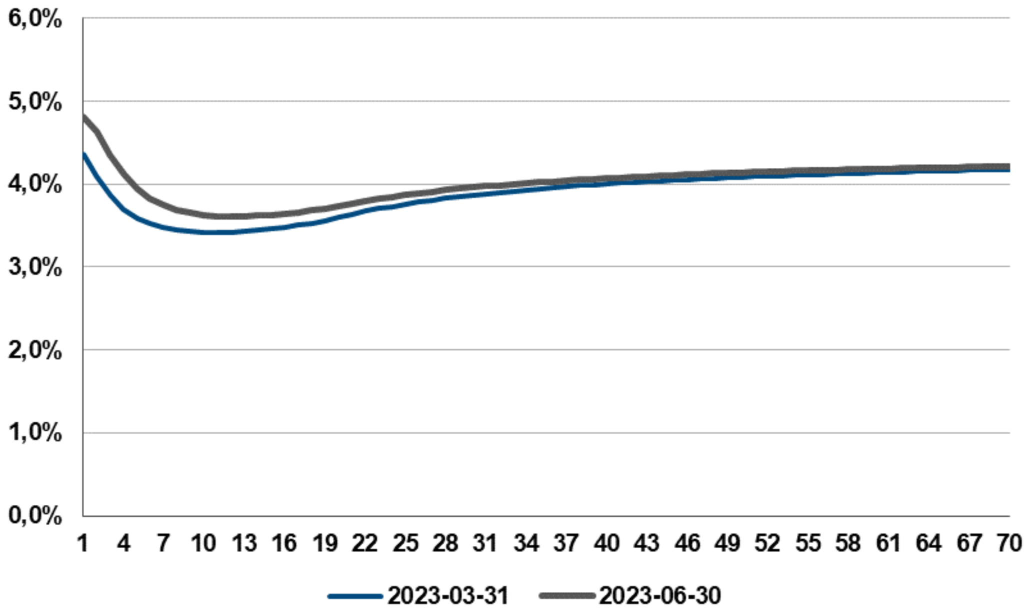
Source: Finansinspektionen's regulations (section 26 of FFFS 2019:21)

Finally, a mark-up of 0.75 percentage points is added to all maturities to reflect the ability of the nuclear waste fund to invest in riskier assets such as covered bonds and equities. This risk premium is regulated in section 3 of the Financing Ordinance.

The risk premium is based on the assumption that the nuclear waste fund uses on average half of its investment mandate for equities, and that remaining investments consist of Swedish government securities (half) and covered bonds (half). The assumed average allocation in the portfolio will therefore be 40 per cent government securities, 40 per cent covered bonds and 20 per cent equities. The long-term risk premiums for the asset class are assumed to be 0 per cent for government securities, 0.50 per cent for covered bonds and 2.75 per cent for equities, thus giving a total mark-up of 0.75 per cent. Chart 6 shows the nominal discount curve with this addition as at 31 March 2023 (the curve used in the proposal for consultation) and as at 30 June 2023 (the curve used now).

Chart 6: Nominal discount rate curves as at 31 March 2023 and 30 June 2023

Per cent



Source: Ortec GLASS

5.3. Calculation of risk margins

The calculation of the risk margins for reactor owners is performed using an ALM model[7] developed by the Debt Office to meet the requirements according to the changes made in financing legislation in 2017. Decided risk margins for 2022–2023 are calculated using this model [3] [7]. This proposal applies the same model as before, but with updated data. This section briefly describes the ALM system and the model that forms the basis for calculating risk margins. The ALM model is described in detail in the model report previously published by the Debt Office [11]. The main results from the ALM analysis, which calculates the proposed risk margins, are shown in section 7 and the ALM analysis is described in Annex 1.

5.3.1. The ALM system

Calculating the risk margin is performed in an IT system provided by Ortec Finance (Ortec). The system is called the Global Asset & Liability Simulation System (GLASS) and is used by insurance companies, pension funds, fund managers and so on. Common to these and the Debt Office is a need to generate scenarios for the performance of financial and economic variables. The scenarios are used together with the ALM analysis as a basis for decisions on, for example, investment strategies, capital requirements, portfolio risks or – as is the case for the Debt Office – to estimate the amount needed to ensure that a reactor owner's

[7] ALM stands for Asset Liability Management and means that a reactor owner's assets and liabilities are modelled together to generate scenarios for the nuclear waste fund's performance.

share of the nuclear waste fund does not turn negative, with a certain degree of probability, over time.

The core of GLASS is a Dynamic Scenario Generator (DSG), which is used for generating scenarios for what might happen with economic and financial variables, such as bond prices, currencies or inflation. In total, scenarios for over 600 variables are generated by default in GLASS, known as “Core” variables. It is also possible to use GLASS to generate scenarios for variables that are not included as Core variables, but that need to be modelled in a consistent manner. We use this functionality, known as “Satellite” variables, to model relative price changes for input factors in the nuclear waste programme (EEF).

The starting point for simulating scenarios is the current market status (updated quarterly), which provides the latest known value of financial and economic variables. Based on the current state of the market, scenarios are simulated that converge towards a long-term equilibrium.

In practice, scenarios are generated in the DSG by proceeding on the basis of a handful of underlying factors broken down into investment horizons. On a long horizon (typically 25–40 years and which Ortec calls “trend”), three variables are used consisting of global interest rates, global growth and global inflation. On the medium-term horizon (which Ortec calls “business cycle”), nine economic and financial factors are used, such as global equities. In the short term (which Ortec calls “monthly”) there are a further ten factors. Together, the base variables interact to create all scenarios for Core and Satellite variables generated in the DSG for the requested investment horizon.

Based on the scenarios generated in the DSG, relevant variables are used to simulate the development of possible return outcomes in the reactor owners’ share of the nuclear waste fund and future costs. These scenarios form the basis for calculating risk margins for each reactor owner.

5.3.2. Risk margin modelling

The definition in terms of calculating the risk margin in the ALM model is:
“The amount which, if together with the credit risk amount is added to the reactor owner’s share in the nuclear waste fund at the start of the next fee period, leads to 90 per cent of a high number of simulated scenarios having a positive fund value in the final year of the nuclear waste programme, even if no additional nuclear waste fees are contributed and no additional collateral is provided.”

In other words, the risk margin is calculated on the assumption that the three-year cycle for adjusting fees has stopped functioning and the balance between a reactor owner’s assets and liabilities is not considered possible to restore by raising the nuclear waste fee or by taking other measures.

The ALM model simulates a great number of scenarios for the progression on the liability and asset side of a reactor owner’s balance sheet. The model calculates the amounts that lead the sum of the two collateral amounts (the credit risk amount and the risk margin) to cause 90 per cent of the simulated scenarios to have a positive fund value in the final year. The credit risk amount is then subtracted from the total amount to obtain the risk margin.

The principles for the risk margin calculations are unchanged compared to the previous proposal for fees and collateral, and are described in detail in the Debt Office's model report [9]. The following section provides a brief description of the modelling of the asset side and liability side of the model. For current input data, results and analysis see Appendix 1: "Ortec Finance – ALM study report – June 2023" (the most important results and analyses are also presented in section 7 of this report).

Modelling of the asset side

In contrast to the calculation of nuclear waste fees, the calculation of the risk margin assumes that no additional fee contributions will be made by reactor owners as of the beginning of the next fee period. When calculating the risk margin, the assets of a reactor owner therefore consist of its share of the nuclear waste fund's assets, the contributions extending up to the beginning of the next fee period and the expected return on these assets.

The nuclear waste fund is divided into two portfolios, the base portfolio (government securities and covered bonds) and the long-term portfolio (corporate bonds and equities). Each reactor owner holds participations in each portfolio.

In order to model the fund's investment strategy, the Debt Office follows the Investment Policy of the Nuclear Waste Fund. The policy stipulates rules governing how the capital of the nuclear waste fund may be invested, how various risks are to be measured and mitigated, and how investment activities are to be reported and monitored. The policy is adopted annually by the board of the fund within the framework of the provisions set out in the Ordinance (2017:1180) on the Management of the Assets of the Nuclear Waste Fund (the Asset Management Ordinance).

The Debt Office has retrieved information from the Legal, Financial and Administrative Services Agency regarding the current investment policy. Proceeding on the basis of the Asset Management Ordinance and the investment policy, the following regulations and strategies are modelled in the ALM model.

- An amount equal to the sum of the discounted value of expected net disbursements of fund assets in the current calendar year and the immediately subsequent nineteen calendar years, although not less than 60 per cent, shall be allocated to the base portfolio (the "20-year rule").
- The strategic weights in the investment policy are assumed to be the composition of assets that apply to the reactor owners. The strategic weights in the investment policy are used as a basis for the size of the participations each reactor owner shall hold in the base portfolio and the long-term portfolio, respectively.

- Rebalancing is performed once at the end of each time stage (which is one year). First, the holdings for each instrument are rebalanced according to the strategic weights. Thereafter, each reactor owner's fund holding is rebalanced to the strategic portfolio weights. Finally, checking is performed to ensure that the allocation of assets for each reactor owner in the base portfolio is not overshot according to the 20-year rule. If the rule is not met, the assets are reallocated between the base portfolio and the long-term portfolio.

- The model defines currency positions in USD, EUR, JPY and GBP in the long-term portfolio, based on data from the Legal, Financial and Administrative Services Agency, which estimates the exposure in costs based on cost data obtained by SKB.

- In the simulation, both transaction costs and management costs are assumed to be zero. This is because the costs are already included in the additional costs. The additional costs include the Legal, Financial and Administrative Services Agency's costs for asset management (together with costs of external mandates).

Scenarios for the asset classes in which the nuclear waste fund is permitted to invest are created through interaction between different components in the DSG. Long-term return assumptions are built up as a risk-free rate that is common to several asset classes and a risk premium unique to the asset class.

The rules in the Financing Act set out that the risk margins shall be discounted by the expected return on the nuclear waste fund's market investments. The return scenarios generated by GLASS are unlikely to be consistent with the return assumed in the structure of the nominal discount rate curve and the premium for the risk assets' return under the Financing Ordinance. Both methods and long-term assumptions differ between those used by Ortec to generate return scenarios in GLASS and those used in the structure of the regulated discount rate curve.

In order to comply with the regulation, the returns in GLASS are therefore calibrated to correspond to the returns implicitly given by the regulated discount rate curve. This means that the same discount rate curve is used for both calculating nuclear waste fees and credit risk amounts, as well as for calculating risk margins.

Modelling of the liability side

A reactor owner's liability comprises future costs of decommissioning the reactors and final disposal of nuclear residual products (basic costs) and the costs of the central government (additional costs). When calculating the risk margin, annual scenarios for the reactor owner's future liability are generated, in order to reflect the risk of basic and additional costs deviating from the expected costs included in SKB's and the agencies' cost assessments.

The risk factors used in the model can be divided into two categories:

- **Volume risk**, defined as programme-specific risks that cause the costs in the nuclear waste programme to be higher or lower than the expected costs in the cost estimate. The assumption concerning volume risk is based on an appraisal of the total uncertainty in the cost volume over the entire nuclear waste programme. As in the previous calculation, volatility is calculated to be 25 per cent for basic costs and 20 per cent for additional costs, measured as standard deviation relative to the mean (more on this in *explanatory appendix 3*). Since uncertainty in costs is modelled over time, the Debt Office has calibrated the annual volatility parameters that correspond to this assumption. The annual volume risk factors are then linked together over time to upwardly adjust the expected costs based on their exposure to given volume risks.

- **Price risk**, which addresses uncertainty in the future price progression of input factors in the nuclear waste programme. The price risk can in turn be broken down into relative prices (EEF) and CPI. The price risk for CPI is modelled as a "core" variable in Ortec GLASS. The price risk for relative price development is modelled as "satellite" variables that take into account (any) covariance with other variables in Ortec GLASS. The regression analysis is based on the same historical relative price data used in estimating nuclear waste fees. The total price risk (for CPI and EEF) is, like the volume risk, linked together in an index, which is used to upwardly adjust the expected costs based on SKB's assessment of the extent to which cash flows are exposed to price risks.

6. Nuclear waste fees and credit risk amounts

This section presents the Debt Office's proposal for nuclear waste fees and credit risk amounts for 2024–2026. The total balance sheet of the financing system is compared with the previous fee estimate. This is followed by a stage-by-stage explanation of how the nuclear waste fees of each reactor owner have changed. The change in fees due to updated market information since the proposal for consultation was presented. Finally, sensitivity analyses are performed for some of the parameters in the fee calculation.

6.1. Proposals for nuclear waste fees and credit risk amounts

Table 5 shows the Debt Office's proposed nuclear waste fees and credit risk amounts for 2024–2026. In accordance with the provisions of the Financing Ordinance, fees in öre per delivered kilowatt hour of electricity (öre/kWh) are proposed for Forsmark, Oskarshamn and Ringhals as they have reactors in operation. Barsebäck, which does not have a reactor in operation, will instead pay an annual nuclear waste fee as a fixed amount.

Table 5: Nuclear waste fees and credit risk amounts for 2024–2026

Different units (see table)

Reactor owner	Nuclear waste fee	Credit risk amount
Forsmark	4.5 öre/kWh	SEK 5,934 million
Oskarshamn	7.5 öre/kWh	SEK 6,112 million
Ringhals	8.6 öre/kWh	SEK 8,150 million
Barsebäck	SEK 264 million per year	SEK 772 million

Source: Swedish National Debt Office

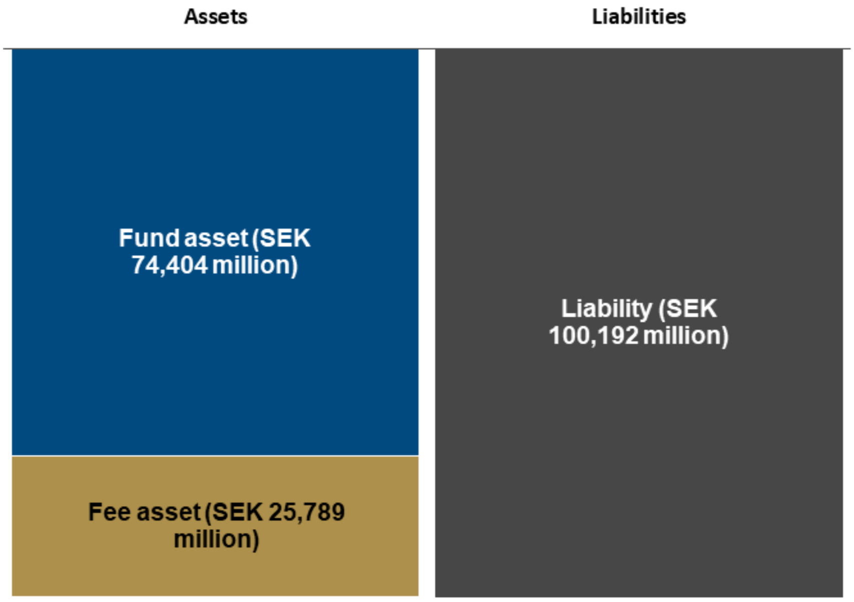
Chart 7 shows the aggregated balance sheet for all reactor owners as at 30 June 2023. It should be noted here that each reactor owner is responsible for its costs and that there is no mutual solidarity. The present value of the remaining expected costs for the obligations of all permit holders is estimated at SEK 100.2 billion. The fund's market value is SEK 74.4 billion. The difference between these results in a remaining financing need of SEK 25.8 billion, which must be covered by nuclear waste fees.

The credit risk amount is calculated on a liability that is SEK 4.4 billion lower than that forming the basis for nuclear waste fees (present value as at 30 June 2023).

This is because fewer nuclear fuel canisters are taken into account, as production in this case is assumed to end at the beginning of the fee period.

Chart 7: Aggregated balance sheets for all reactor owners as at 30 June 2023

SEK million



Source: Swedish National Debt Office

Furthermore, this section provides an explanation of the changes from current nuclear waste fees. We limit the analyses to nuclear waste fees because the explanatory factors affecting the fee and credit risk amount need can essentially stem from the same reasons.

6.2. Explanation of changes in fees

6.2.1. Changes in the financing need

The comparisons between the current financing need and that forming the basis of the previous proposal are done at the aggregate level because the reactor owners are largely affected by common factors. The aggregated balance sheet thus provides an overall picture of events since the previous proposal and how this affects the financing system for nuclear waste at large.

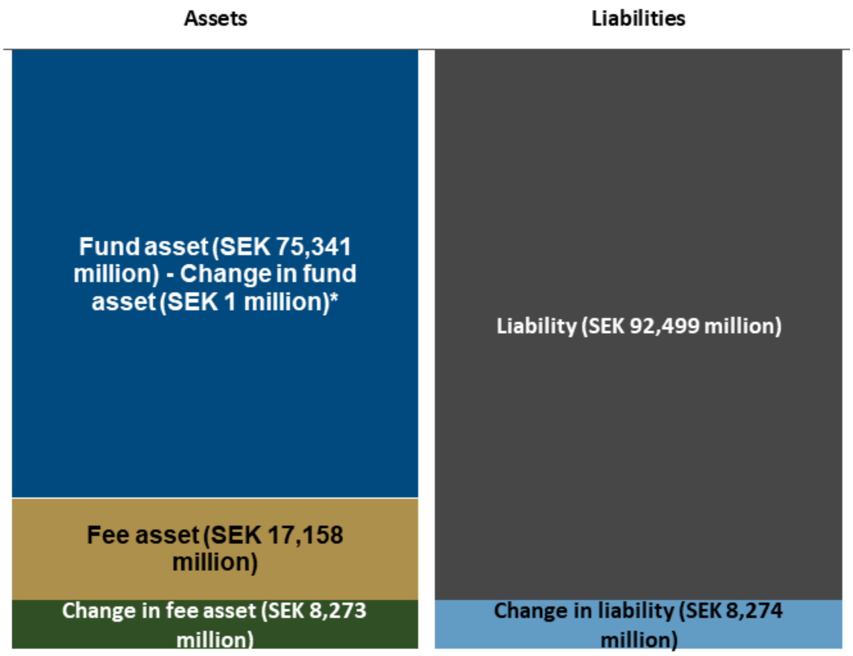
The Debt Office's fee calculations contain a forecast of how a reactor owner's liabilities and assets will progress over time, given the assumptions made about payments into and out of the nuclear waste fund and the expected return given by the discount curve.

By comparing the expected future balance sheet at the previous fee calculation, with the currently expected balance sheet, we can analyse how the components (liabilities and assets) are assumed to progress over time.

Chart 8 shows how outlook for the balance sheet at the start of the next fee period, 31 December 2023, has changed compared with the assessment made at the time of the previous fee proposal.

Chart 8: Aggregated balance sheets in this fee proposal compared with expected balance sheet at the time of the previous fee proposal (at 31/12/2023)

SEK million



Note: *The fund asset (rounded off to the nearest million) has increased by SEK 1 million.

Source: Swedish National Debt Office

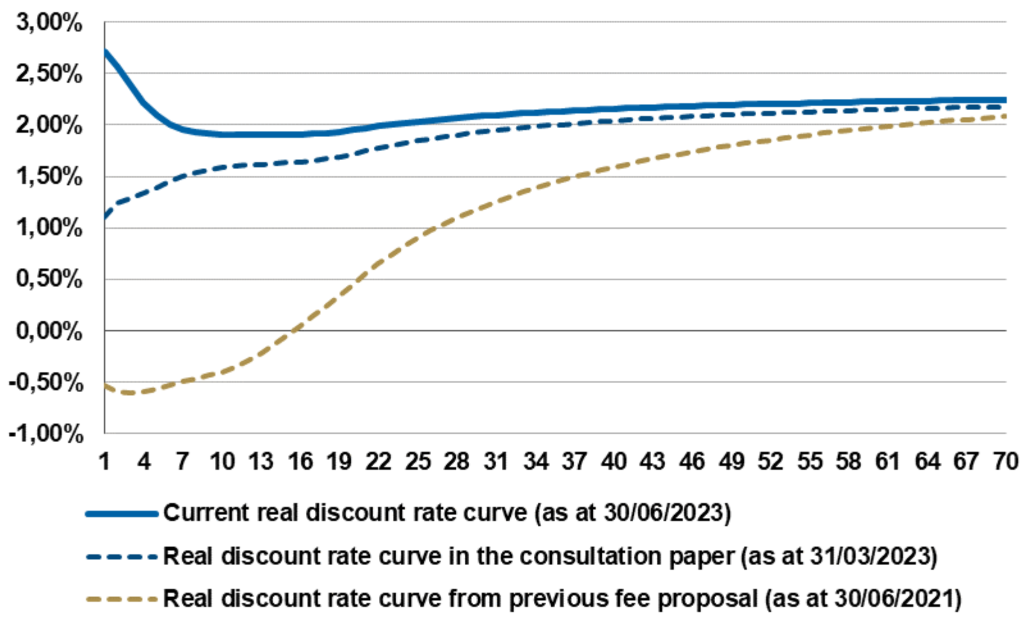
Chart 8 shows that the liability has increased by approximately SEK 8.3 billion (8.9 per cent) compared with the forecast in the previous fee proposal. As the forecast for the assets of the nuclear waste fund has not changed, the financing need (the fee asset) increases in order to attain balance between assets and liabilities.

It can be noted that the change in the fund asset is a net change in realised cash flows (contributions, disbursements and return) up to 30 June 2023 and the expected development for the current year. The net change up to 30 June 2023 has been lower than the forecast in the previous fee proposal due to a negative return for the nuclear waste fund during the period, which has been somewhat curbed by lower disbursements out of the fund. At the same time, the expected return in the nuclear waste fund for the remainder of 2023 is significantly higher than that expected for 2023 in the previous fee proposal (which was based on a discount curve as at 30 June 2021). Expected disbursements for 2023, which are based on the reactor owners' latest applications, have also declined somewhat compared to the previous fee proposal. All in all, this leads to a fund value at the end of 2023 that is unchanged from the value expected in the previous fee proposal.

The change in the liability is the result of how real costs, and the real discount rate curve, have changed. Real basic and additional costs have increased by 13.8 per cent (if costs as of 2024 are compared at the same price level). Real basic costs have increased by 16.8 per cent and real additional costs (costs for supervision, fund management, etc.) have risen by 0.8 per cent[8]. The present value of the liability has not increased as much as the real liability because the real discount rate curve has shifted upwards compared with the previous fee proposal, see chart 9. This results in a lower present value for the liability and thus also a lower financing need, all else equal. The difference between the real discount rate curves is greatest at the start and decreases over time[9].

Chart 9: Real discount rate curves

Per cent



Source: Ortec Finance

The nuclear waste fees are not paid in as a lump sum, but are distributed across expected remaining electricity generation of each reactor owner over 50 years of operation according to the Financing Ordinance. This means that the discount rate curve also affects the level of nuclear waste fees.

The discounting effect is, in this case, the opposite of that for the liability side. Since the real discount rate curve has been shifted upwards, this therefore implies

[8] The increase is lower than the cost increase in the basic costs (24 per cent), which has not been adjusted for EEF and an uncertainty mark-up.

[9] This is because, for longer maturities, we use a constant return assumption that is not affected by changes on fixed-income markets.

higher fees, all else equal. The fact that the real discount rate curve has changed relatively substantially in immediate years is therefore highly significant to the present value calculation of future contributions (which are expected within the next eight to twelve years). However, interest rate sensitivity in the fee asset because of this is considerably lower than in the liability, as the duration of future electricity generation is shorter.

6.2.2. Change in nuclear waste fees

Table 6 compares proposed fees (for 2024–2026) with current fees (for 2022–2023). The table shows the changes for each reactor owner expressed as a percentage. To explain how the fees have changed for each reactor owner, a stage-by-stage explanation follows of how the fees go from the current levels to those proposed by the Debt Office.

Table 6: Change in nuclear waste fees (proposed levels for 2024–2026 compared with decided levels for 2022–2023)

Different units, see table

Reactor owner	2024–2026	2022–2023	Increase	Increase (per cent)
Forsmark	4.5 öre/kWh	3.0 öre/kWh	1.5 öre/kWh	50.00%
Oskarshamn	7.5 öre/kWh	5.6 öre/kWh	1.9 öre/kWh	33.93%
Ringhals	8.6 öre/kWh	4.5 öre/kWh	4.1 öre/kWh	91.11%
Barsebäck	SEK 316 million	SEK 0 million	SEK 264 million	n/a

Source: Swedish National Debt Office

The changes in nuclear waste fees are divided into four stages. This is done in waterfall charts which, at each stage, show the level of the nuclear waste fee in grey bars and the effect of the previous stage in blue (increases) or golden (decreases) bars.

It is important to remember that the charts can only be interpreted incrementally; that is, read in the given order (either from the right or the left). Below we describe each stage (the heading for each stage is the same as in the charts).

<u>Stage 1: Current</u>

The starting point for the comparison is the current levels of nuclear waste fees (applying for 2022 and 2023).

<u>Stage 2: Plan 2019</u>

This stage takes into account the new state of the market as at 30 June 2023, but not the reactor owners' new cost estimate. That is, the calculation is performed on the basis of the current value of the fund (which includes the realised contributions and disbursements), updated electricity generation forecast and current inflation and discount rate curves. This change shows how the fee changes due to what has been realised until 30 June 2023 and the new market state.

Stage 3: Plan 2022
In this stage, we update the calculations with the reactor owners' new cost estimate. This stage also updates the additional cost estimate (for more information see the additional cost estimate in Explanatory appendix 4: Additional costs). This change shows how the fee changes due to the new cost estimations.

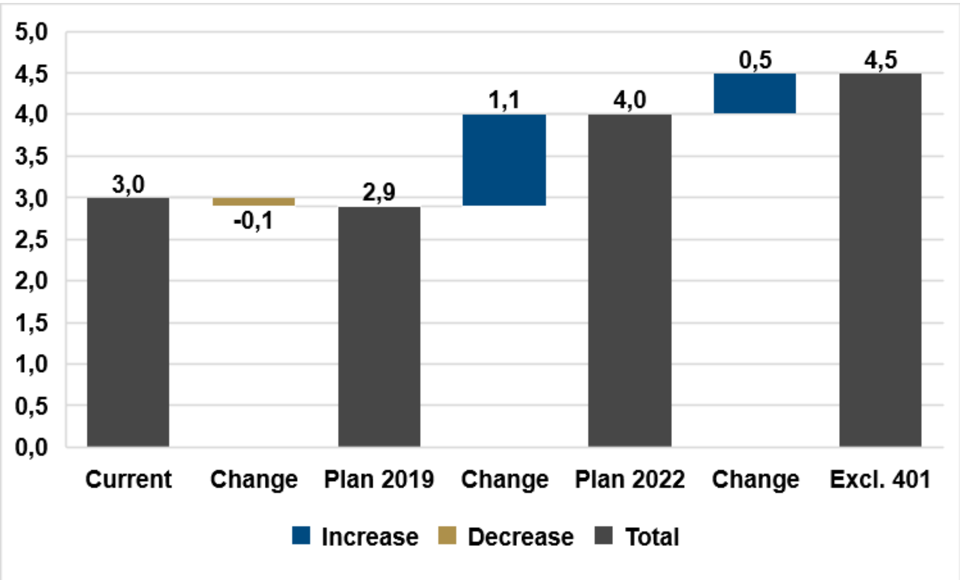
Stage 4: Excl. 401
In this stage, we update the calculations with the reactor owners' new cost estimate excluding variation 401 (read more about why we do this in section 4). The additional cost estimate is also adjusted somewhat (read more about the adjustment in Explanatory appendix 4: Additional costs). This shows how the fee changes when variation 401 is excluded from the cost estimations.

Forsmark
Chart 10 shows how Forsmark's nuclear waste fee has changed at every stage. The chart shows:

- a small decrease when the new market state is taken into account.
- a large increase when Forsmark's new cost estimate is taken into account and
- an increase when variation 401 is excluded. The reason why the fee needs to increase when variation 401 is excluded is that future disbursements are expected to be made earlier, which causes Forsmark's liability to be discounted less and the present value of the liability increases.

Chart 10: Stage-by-stage explanation of the change in Forsmark's nuclear waste fee

Öre per delivered kilowatt hour of electricity



Source: Swedish National Debt Office

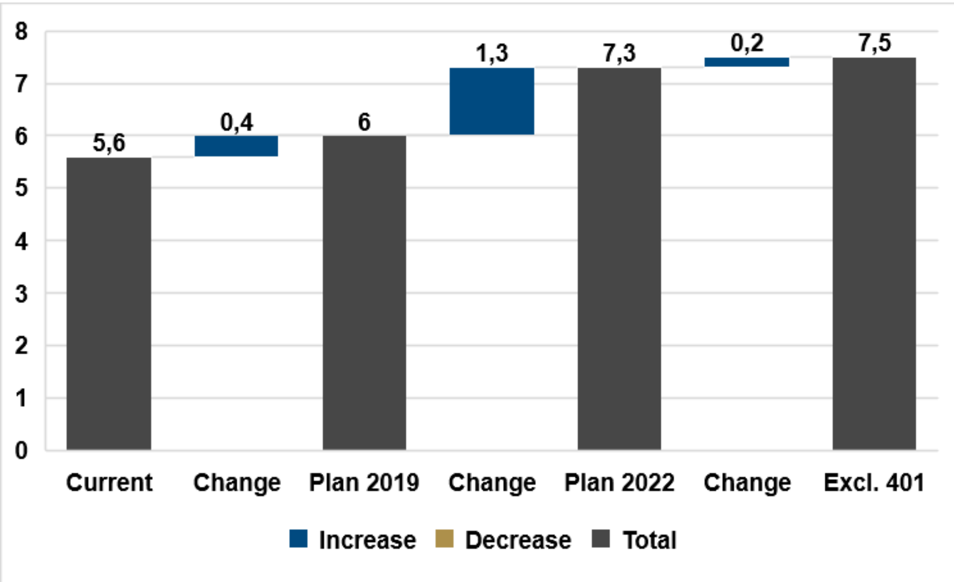
Oskarshamn

Chart 11 shows how Oskarshamn's nuclear waste fee has changed at every stage. The chart shows:

- an increase when the new market state is taken into account. The increase is due to a reduced present value of future electricity generation (resulting from the upward shift in the real discount rate curve),
- a large increase when Oskarshamn's new cost estimate is taken into account, and
- a small increase when variation 401 is excluded, which follows from the expectation that future disbursements will be made earlier. Since the change only affects decommissioning costs for reactors in operation, this means a relatively small change for Oskarshamn, which only has one of three reactors remaining in operation. Besides, Oskarshamn's liability is lower than that of Forsmark and Ringhals which, all else equal, increases the absolute fee requirement (and thus also the nuclear waste fee) less for Oskarshamn in the event of similar cost increases expressed as a percentage.

Chart 11: Stage-by-stage explanation of the change in Oskarshamn's nuclear waste fee

Öre per delivered kilowatt hour of electricity



Source: Swedish National Debt Office

Ringhals

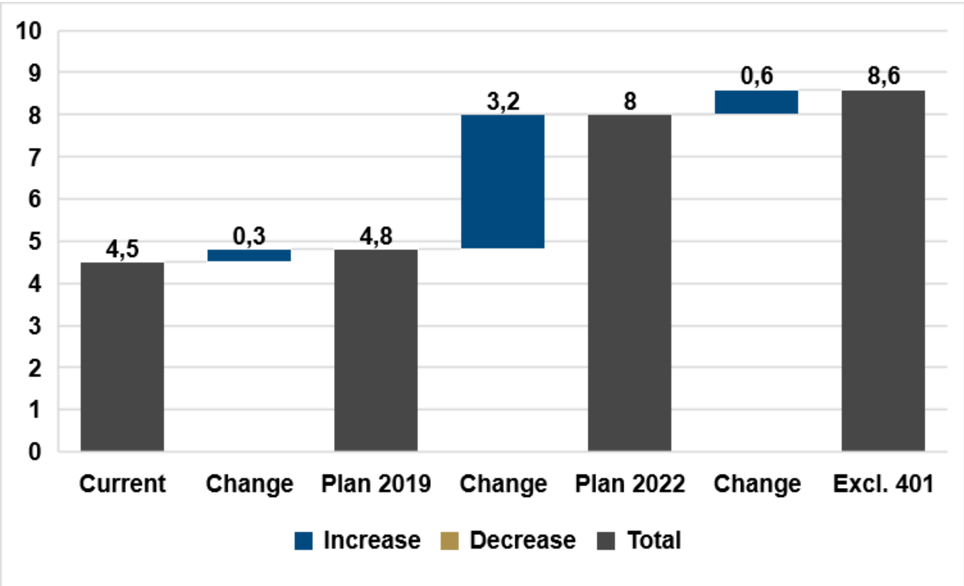
Chart 12 shows how Ringhals' nuclear waste fee has changed at every stage. The chart shows:

- an increase when the new market state is taken into account. The increase is due partly to a reduced present value of future electricity generation (resulting from the upward shift in the real discount rate curve) and partly due to Ringhals' realised contributions into the fund being lower than expected (because reactor four was down during repairs that lasted from August 2022 to March 2023).

- a large increase when Ringhals' new cost estimate is taken into account. The relatively large increase is due to future costs having increased most for Ringhals from Plan 2019 to Plan 2022 compared with other reactor owners. Since the increased costs are also closer in time than for the other reactor owners, the cost increases are discounted less. Also, Ringhals' liability is also the largest in relative terms which, all else equal, increases the absolute fee requirement (and thus also the nuclear waste fee) more for Ringhals in the event of similar cost increases expressed as a percentage.
- an increase when variation 401 is excluded, which follows from the expectation that future disbursements will be made earlier.

Chart 12: Stage-by-stage explanation of the change in Ringhals' nuclear waste fee

Öre per delivered kilowatt hour of electricity



Source: Swedish National Debt Office

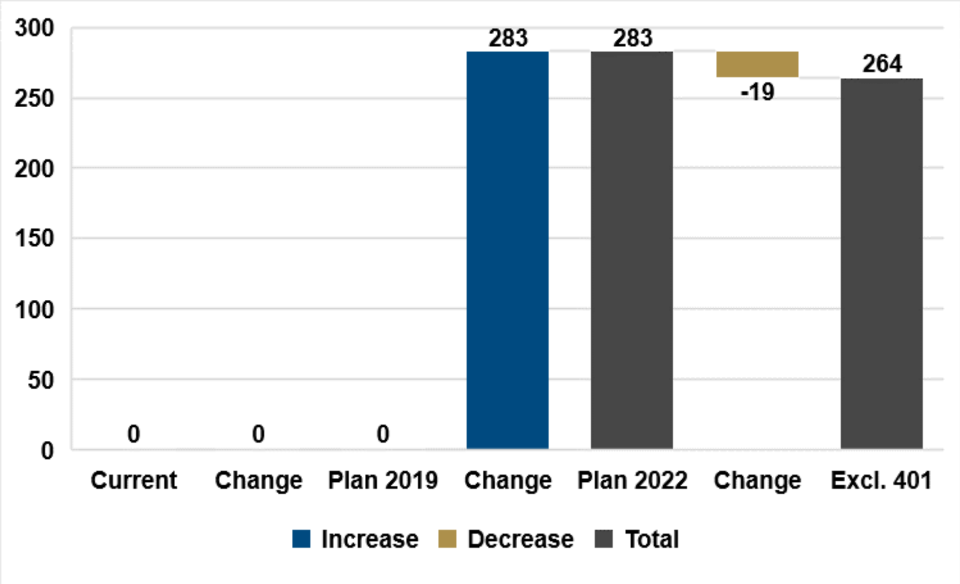
Barsebäck

Chart 13 shows how Barsebäck's nuclear waste fee has changed at every stage. The chart shows:

- an unchanged fee when the new market state is taken into account,
- an increase when Barsebäck's new cost estimate is taken into account, and
- a relatively small decrease when variation 401 is excluded, which follows from Barsebäck not being notably affected by the adjustment in the cost base.

Chart 13: Stage-by-stage explanation of the change in Barsebäck's nuclear waste fee

SEK million per year



Source: Swedish National Debt Office

6.2.3. Explanation of change compared with the nuclear waste fees in the consultation paper

The nuclear waste fees have been updated since the proposal referred for consultation, to take new market data and information into account. The nuclear waste fees in the consultation paper were based on market data and information as at 31 March 2023; whereas this proposal takes into account market data as at 30 June 2023. In the second quarter of 2023, inflation expectations decreased and market rates increased which means that the nuclear waste fees now proposed are lower than those referred for consultation.

0 presents the effect of the update on the reactor owners' aggregated expected balance sheet (as of 31 December 2023); that is, how the outlook concerning the balance sheet at the start of the next fee period has changed compared with the assessment made at the time of the consultation. Finally, the effect on the nuclear waste fees of the respective reactor owners is shown in table 8. The absolute and percentage changes vary between the reactor owners, which is to be expected and is due, among other factors, to variations in the size of, and ratio between, reactor owners' liabilities and assets.

Table 7: Changes in the aggregated expected balance sheets (as at 31 December 2023) compared with the consultation paper

Different units, see table

Component in fee calculation	Proposal	Consult-ation	Change	Main reason for change
Expected fund value	SEK 75,342m	SEK 75,464m	SEK -122m	Slight decrease due to lower electricity generation compared with expectations.
Expected costs (price level 31/12/2021)	SEK 135,311 m	SEK 135,311m	SEK 0 m	No change in basic and additional costs.
Expected costs (current prices)	SEK 241,240 m	SEK 255,412m	SEK -14,172m	A lower inflation curve reduces the value of the liability in current prices.
Discounted expected costs	SEK 100,773 m	SEK 103,258m	SEK -2,485m	A higher real discount rate curve reduces the level of the present value of the liability.
Financing need	SEK 25,432m	SEK 27,794m	SEK -2,363m	The net effect of a marginal decrease in the value of the fund and the present value of the liability causes the financing need to decrease.
Expected electricity generation*	466 TWh	466 TWh	0 TWh	No change in the Debt Office's assessment of remaining electricity generation.
Discounted expected electricity generation*	384 TWh	391 TWh	-6 TWh	Higher nominal discount rate curve reduces the present value of electricity generation.

Note: *Barsebäck is excluded from these items, as it does not have any reactors in operation.

Source: Swedish National Debt Office

Table 8: Change in the nuclear waste fee, from levels referred for consultation to ultimately proposed levels

Different units, see table

Reactor owner	Proposal	Consultation	Change	Change
Forsmark	4.5 öre/kWh	4.9 öre/kWh	-0.4 öre/kWh	-8.16%
Oskarshamn	7.5 öre/kWh	7.8 öre/kWh	-0.3 öre/kWh	-3.85%
Ringhals	8.6 öre/kWh	9.3 öre/kWh	-0.7 öre/kWh	-7.53%
Barsebäck	SEK 264m/year	SEK 316m/year	SEK -52m/year	-16.46%

Source: Swedish National Debt Office

6.2.4. Sensitivity analysis

Finally, we calculate the fees' sensitivity when two of the most important parameters in the fee calculation change – the size of the basic costs and expected return (provided by the discount rate curve).

Basic costs

In table 9 expected basic costs change by -10, +10, +20 and +30 per cent in all years relative to the basic costs underlying this proposal. The fact that the sensitivity analysis is asymmetrical reflects the skewness to the right in the cost distribution (that is, it is considered more probable that the cost outcome will be higher than lower versus expectations). Additional costs do not change.

Table 9: Fees in the event of change in basic costs by -10, +10, +20 and +30 per cent

Different units, see table

Reactor owners	-10 per cent	0 per cent	+10 per cent	+20 per cent	+30 per cent
Forsmark (öre/kWh)	2.8	4.5	6.3	8	9.7
Oskarshamn (öre/kWh)	5.3	7.5	9.7	11.9	14.2
Ringhals (öre/kWh)	5.5	8.6	11.7	14.9	18
Barsebäck (SEK million)	-	264	695	1,127	1,558

Source: Swedish National Debt Office

Expected return

Table 10 shows fees when expected return changes ±25 and ±50 basis points (±0.25 and ±0.5 percentage points). This is done by changing the return equally for all maturities (that is, a parallel shift of the entire discount rate curve).

Table 10: Fees in the event of a change to the discount rate curve by ±0.25 and ±0.5 percentage points (p.p.)

Different units, see table

Reactor owner	-0.5 p.p.	-0.25 p.p.	0 p.p.	+0.25 p.p.	+0.5 p.p.
Forsmark (öre/kWh)	6.4	5.4	4.5	3.7	2.8
Oskarshamn (öre/kWh)	9.5	8.5	7.5	6.6	5.7
Ringhals (öre/kWh)	11.5	10	8.6	7.3	6
Barsebäck (SEK million)	571	414	264	121	0

Source: Swedish National Debt Office

7. Risk margins

In this section, the Debt Office's proposals for risk margins for 2024–2026 for each reactor owner are presented. A comparison with decided levels is presented and a stage-by-stage explanation is provided for the aggregated risk margins. We also present a comparison with the amounts in the consultation paper. Finally, sensitivity analyses are performed for some of the parameters in the calculation of the risk margin.

Table 11 shows the Debt Office's risk margin proposals for 2024–2026.

Table 11: Risk margins for 2024–2026

SEK million

Reactor owner	Risk margins
Forsmark	19,144
Oskarshamn	10,356
Ringhals	17,049
Barsebäck	4,145

Source: The Debt Office and Ortec Finance

In table 12 proposed risk margins for 2024–2026 are compared with the currently decided risk margins for 2022–2023.

The electricity-generating reactor owners have similar percentage increases, and Barsebäck has a larger percentage increase. Barsebäck's liability side differs from that of the other reactor owners with a shorter duration of the liability. Barsebäck's liability is also much lower than that of the other reactor owners. This means that Barsebäck is assigned a lower risk margin than other reactor owners (because the shorter forecast horizon is associated with less uncertainty in the development of the liability and asset side). However, the relatively short duration makes Barsebäck's risk margin more sensitive to changes in the cost estimate, which explains the relatively higher change expressed as a percentage[10].

[10] Among other factors, the final year in the cost estimate for Barsebäck has changed from 2066 (Plan 2019) to 2073 (Plan 2022). To read more about the risk margin specifically for Barsebäck, see: Appendix 1: "Ortec Finance – ALM study report – June 2023".

Table 12: Change in risk margins (proposed levels for 2024–2026 compared with decided levels for 2022–2023)

Different units, see table

Reactor owner	2024–2026 (SEK million)	2022–2023 (SEK million)	Increase (SEK million)	Increase (per cent)
Forsmark	19,144	15,834	3,310	20.90%
Oskarshamn	10,356	8,628	1,728	20.03%
Ringhals	17,049	14,219	2,830	19.90%
Barsebäck	4,145	3,052	1,093	35.81%

Source: The Debt Office and Ortec Finance

7.1. Stage-by-stage explanation of the change compared to current levels

As in the above for nuclear waste fees, we explain the change in risk margins in four stages[11]. We use the same stages as above (see section 6.2.2 for a description of each stage). For further analysis and a presentation by reactor owner see Appendix 1. Chart 14 shows the impact of each stage on the aggregated risk margin. The chart shows:

- An increase when the new market state is taken into account. The reason for the increase is a higher realised CPI than forecast in the previous calculation, which has increased costs. Fund value at the beginning of the period is lower than in the previous calculation. The current forecast entails both higher CPI growth rates and higher volatility. The increase is curbed by an expectation of higher future returns.

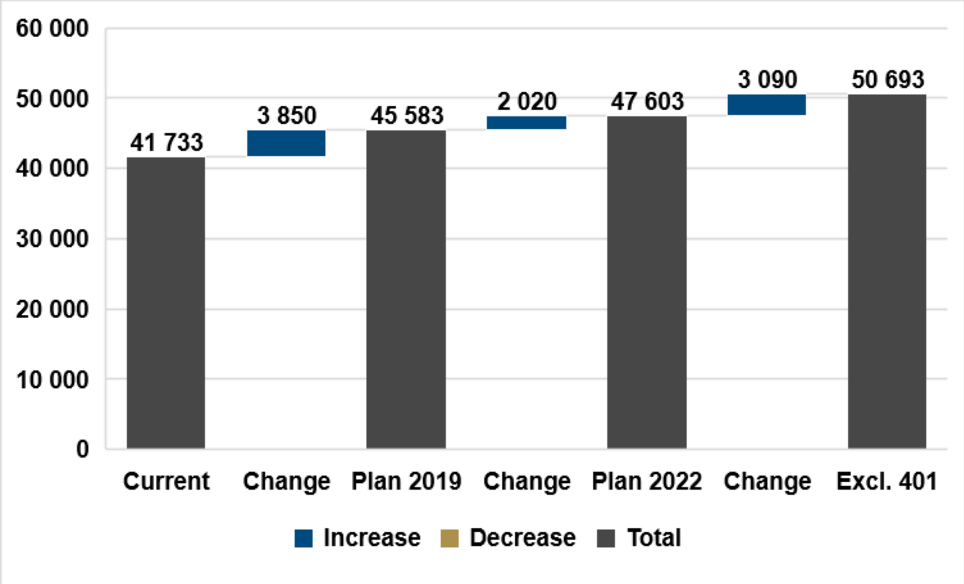
- An increase when the new and higher cost estimate is taken into account. The reason why the increase in expected costs between Plan 2019 and Plan 2022 does not cause a substantial increase in the risk margin is that they are largely captured by the increase in the credit risk amount. The distribution of costs over time also has an impact, with delays in the programme leading to costs being incurred later than previously expected. On the one hand, this means that the fund asset has longer to generate returns in the simulations, which has a curbing effect on the risk margin. On the other hand, this means that the price risk factors on the liability side have a greater impact (as uncertainty in these factors grows over time).

- An increase when variation 401 is excluded. The reason for this is that the duration of the cost estimate is reduced. This increases the risk margin as earlier disbursements cause the fund asset to decrease earlier on, thus generating a lower return over time.

[11] In the analysis, the credit risk amount is also updated in each stage.

Chart 14: Stage-by-stage explanation of the change in aggregated risk margins

SEK million



Note: Differs slightly from Annex 1: Ortec Finance – ALM study report – June 2023" due to rounding effects.

Source: The Debt Office and Ortec Finance

7.2. Explanation of change compared with risk margins in the consultation paper

Table 13 shows how the risk margins for 2024–2026 have changed from those in the consultation paper to the currently proposed levels. The consultation was based on market data as at 31 March 2023, while proposed levels have been updated through 30 June 2023. All risk margins have decreased, which is due to somewhat higher expected return and somewhat lower expected inflation. The changes affect Barsebäck the least as its future cash flows are significantly shorter than those of the other reactor owners.

Table 13: Change in risk margins from the consultation paper to proposed levels

Different units, see table

Reactor owner	Proposal (SEK million)	Consultation (SEK million)	Change (SEK million)	Change (per cent)
Forsmark	19,144	19,594	-450	-2.30 %
Oskarshamn	10,356	10,538	-182	-1.73 %
Ringhals	17,049	17,404	-355	-2.04 %
Barsebäck	4,145	4,159	-14	-0.34 %

Note: Differs somewhat from Appendix 1: "Ortec Finance – ALM study report – June 2023" due to rounding effects.

Source: The Debt Office, Ortec Finance

7.3. Sensitivity analysis

Finally, we test the sensitivity of the risk margins when two of the most important parameters change – the size of volume risk and expected return.[12]

7.3.1. Volume risk

Table 14 shows changes in the volume risk (defined as a standard deviation relative to the mean) by ±10 percentage points relative to the current volume risk (25 percent). The volume risk for additional costs does not change in the calculation. The credit risk amount is kept constant.

Table 14: Risk margins in the event of change to volume risk by ±10 percentage points

SEK million

Reactor owner	-10 per cent	Current	+10 per cent
Forsmark	17,290	19,144	22,123
Oskarshamn	9,275	10,356	12,038
Ringhals	15,299	17,049	19,885
Barsebäck	3,641	4,145	4,915
Total	**45,505**	**50,694**	**58,961**

Source: ORTEC Finance and the Debt Office

7.3.2. Expected return

Table 15 shows the risk margins when expected return changes by ±25 and ±50 basis points (±0.25 and ±0.5 percentage points). The sensitivity analysis also takes account of how credit risk amounts are changed by this (since credit risk amounts are affected through a parallel shift of the entire discount rate curve). Table 16 shows how credit risk amounts change accordingly.

[12] For input data, more results and analyses see: Appendix 1: "Ortec Finance – ALM study report – June 2023".

Table 15: Risk margins in the event of a change in expected return of ±25 and ±50 basis points

SEK million

Reactor owner	-50 basis points	-25 basis points	0 basis points	+25 basis points	+50 basis points
Forsmark	21,499	20,231	19,144	18,252	17,324
Oskarshamn	11,785	11,005	10,356	9,793	9,224
Ringhals	19,105	18,056	17,049	16,153	15,372
Barsebäck	4,534	4,332	4,145	3,962	3,798
Total	**56,923**	**53,624**	**50,694**	**48,161**	**45,719**

Source: Ortec Finance and the Debt Office

Table 16: Credit risk amounts in the event of a change in expected return of ±25 and ±50 basis points

SEK million

Reactor owner	-50 basis points	-25 basis points	0 basis points	+25 basis points	+50 basis points
Forsmark	9,443	7,622	5,934	4,366	2,909
Oskarshamn	8,118	7,078	6,112	5,214	4,378
Ringhals	11,562	9,793	8,150	6,622	5,200
Barsebäck	1,629	1,188	772	380	8
Total	**30,752**	**25,681**	**20,968**	**16,582**	**12,495**

Source: Ortec Finance and the Debt Office

Glossary

Asset Liability Management (ALM): The model and analysis method used by the Debt Office to calculate risk margins. The method involves analysing both the liability and asset sides of a reactor owner together.

Fee asset: The present value of the future fee payments for a reactor owner.

Barsebäck Kraft AB (Barsebäck): Reactor owner with two permanently shut down nuclear reactors (B1 and B2).

Engineering cost: The engineering-related costs before a mark-up for expected price changes and uncertainties. Represents, according to the Swedish Nuclear Fuel and Waste Management Company (SKB), the most likely cost development for the nuclear waste programme.

Base portfolio: The nuclear waste fund portfolio in which Swedish government securities and mortgage bonds are managed.

Break-even inflation (BEI): The difference in return for nominal and real government bonds with the same maturity.

BWR: Boiling water reactor. In Sweden, all reactors apart from reactors R2, R3 and R4 are of this type.

Central facility for interim storage and encapsulation of spent nuclear fuel (Clink): Planned facility for the encapsulation of spent nuclear fuel in copper canisters. It is planned to operate as an integrated facility with the existing central interim storage facility for spent nuclear fuel (Clab).

Central interim storage facility for spent nuclear fuel (Clab): Existing intermediate storage facility for spent nuclear fuel located at the nuclear power plant in Oskarshamn.

Discount rate curve in the financing system: The discount rate which, according to section 7 of the Financing Act, shall correspond to expected return in the nuclear waste fund. The Financing Ordinance specifies that discounting shall be performed using a risk-free discount rate curve increased by 0.75 percentage points.

Dynamic Scenario Generator (DSG): The core of GLASS, which has the task of generating scenarios for what might happen in the future to economic and financial variables, such as bond prices, currencies or inflation.

External economic factors (EEF): SKB's designation of the input factors used to take account of the development of real wages and prices in the nuclear waste programme.

Credit risk amount (CRA): An amount that equals the difference between a reactor owner's remaining costs for residual products that have already arisen at the time of calculation, and the assets already included in the nuclear waste fund. The reactor owners are obliged to provide collateral to the nuclear waste fund equalling the credit risk amount.

The Financing Ordinance: Ordinance (2017:1179) on the Financing of the Residual Products of Nuclear Power.

The Financing Act: Act (2006:647) on Financial Measures for the Management of Residual Products from Nuclear Activities.

Balance sheet of the financing system: The position of a reactor owner in the financing system. The balance sheet consists, on the one side, of assets (share in the nuclear waste fund and the present value of future fee payments) and, on the other side, of liabilities (the present value of future expected costs).

Fund asset: The fund asset consists of the assets, measured at market value, in the reactor owner's share of the nuclear waste fund at the beginning of the fee period. The nuclear waste fund's capital is managed in two portfolios – the base portfolio and the long-term portfolio.

Forsmarks Kraftgrupp AB (Forsmark): Reactor owner with three nuclear reactors in operation (F1, F2 and F3).

RD&D programme: Research, development and demonstration programme that reactor owners submit via SKB every three years The latest RD&D programme was submitted in 2022.

Asset Management Ordinance: Ordinance (2017:1180) on the Management of the Assets of the Nuclear Waste Fund

Global Asset & Liability Simulation System (GLASS): The IT system used by the Debt Office to perform ALM analysis provided by consulting company Ortec Finance (Ortec).

Basic cost: The expected future costs presented by SKB in the Plan report.

Risk margin: An amount which, together with the credit risk amount and the reactor owners' share in the nuclear waste fund, implies that the reactor owner will, with a high degree of probability, fulfil its obligations. The reactor owners are obliged to provide collateral to the nuclear waste fund equalling the risk margin.

Nuclear waste fee: The fee that reactor owners are obliged to pay into the nuclear waste fund per kilowatt-hour of electricity delivered. Barsebäck (which has all its reactors permanently shut down) pays a fixed annual fee to the nuclear waste fund.

Nuclear waste fund: The fund into which reactor owners pay nuclear waste fees and to which they provide collateral. Fund assets are managed by a government agency of the same name – the Nuclear Waste Fund.

Investment policy of the nuclear waste fund: The policy setting out rules governing how the capital of the nuclear waste fund may be invested, how various risks are to be measured and limited, and how investment activities are to be reported and monitored. The policy is adopted annually by the Board of the fund within the framework of the provisions set out in the Asset Management Ordinance.

Nuclear waste programme: The Swedish programme for the decommissioning and dismantling of all nuclear reactors, and the management and disposal of nuclear waste and spent nuclear fuel.

The spent fuel repository (SFK): Planned final repository facility, 470 metres below ground level, for spent nuclear fuel at Forsmark in the municipality of Östhammar. The final repository is planned to consist of a large number of depositing tunnels with drilled disposal shafts at the bottom of the tunnels. The facility is dimensioned for a total volume of spent nuclear fuel equalling around 6,000 canisters.

Nuclear Activities Act: The Act (1984:3) on Nuclear Activities.

Log-normal distribution: A probability distribution. It describes the distribution of a stochastic variable whose logarithm is normally distributed. The distribution is used in modelling volume risk.

Long-term portfolio: The part of the nuclear waste fund in which corporate bonds and Swedish and global equities are managed.

Additional cost: The expected costs of the relevant agencies (and, in some cases, of municipalities and regions) for the operations they are commissioned to perform in accordance with section 4, points 4–9 of the Financing Act.

M/S Sigrid: SKB's existing ship that is used for transporting nuclear waste and spent nuclear fuel.

OKG AB (Oskarshamn): Reactor owner with one nuclear reactor in operation (O3) and two permanently shut down nuclear reactors (O1 and O2).

Ortec Finance (Ortec): Consulting company that provides the ALM system GLASS and related consulting services for ALM analysis.

Plan report: The cost estimate, for the outstanding basic costs for the disposal of residual products from nuclear activities, that reactor owners are obliged to prepare and submit to the Debt Office once every three years.

Price risk: Uncertainty in the future price progression of input factors in the nuclear waste programme. Price risk can furthermore be broken down into two categories – general inflation (measured as CPI) and price progression in excess of inflation (external economic factors – EEF).

PWR: Pressurised water reactor. In Sweden, reactors R2, R3 and R4 are of this type.

Reactor owner: An entity that, under the Nuclear Activities Act, has a permit for nuclear activity that produces or has produced residual products, and that has a permit to own or operate one or several nuclear reactors that have not been permanently shut down before 1 January 1975. Forsmark, Oskarshamn, Ringhals and Barsebäck are reactor owners.

Rebalancing: The annual reversion to strategic weights for all asset classes when simulating the investments of the nuclear waste fund in the ALM model.

Reference cost estimate: The first estimate established by SKB. The estimate is based on the scenario SKB presents in the RD&D programme.

Residual product: Spent nuclear fuel or other nuclear material not to be reused and nuclear waste generated at a nuclear facility after the facility is permanently shut down.

Strategic weight: The composition of asset classes that, according to the strategic weights in the nuclear waste fund's investment policy, determines the size of the share each reactor holder shall have of, for example, the base portfolio and the long-term portfolio.

Ringhals AB (Ringhals): Reactor owner with two nuclear reactors in operation (R3 and R4) and two permanently shut down nuclear reactors (R1 and R2).

Joint cost: The costs common to the reactor owners (e.g. construction of the spent fuel repository and the encapsulation facility). The joint costs are allocated among the reactor owners by SKB.

Liability in the financing system: The present value of the future costs for a reactor owner.

Final repository for short-lived radioactive waste (SFR): Existing final repository, located below the Baltic Sea with approximately 60 metres of rock overburden, located at the Forsmark nuclear power plant. Currently, only operational waste is deposited in the SFR. SKB plans to expand the facility to provide space predominantly for short-lived decommissioning waste.

Final repository for long-lived waste (SFL): Planned final repository for long-lived waste. The location of the repository has not yet been determined.

The stretching method: SKB's in-house developed approach for distributing, over time, the uncertainty mark-up (mark-up to go from Calculation 50 to mean) provided by SKB's stochastic calculation model.

Swedish Nuclear Fuel and Waste Management Company (SKB): The company tasked by the reactor owners with implementing the management and disposal of nuclear waste and spent nuclear fuel. The company has also been assigned the responsibility for presenting the RD&D programme and the Plan report once every three years.

Specific cost: The costs that are unique to each reactor owner (mainly decommissioning of the nuclear reactors).

Asset in the financing system: A reactor owner's assets, measured at market value, in the nuclear waste fund and the present value of its future fee contributions.

Waterfall chart: A chart showing a running total as values are added or deducted.

Volume risk: Uncertainties in the scope of input factors in the nuclear waste programme (i.e. uncertainties in costs measured in constant prices).

Ultimate Forward Rate (UFR): The long-term forward rate calculated by the European Insurance and Occupational Pensions Authority (EIOPA).

The 20-year rule: A provision in the Asset Management Ordinance stipulating that an amount equal to the sum of the discounted value of expected net disbursements of fund assets in the current calendar year and the immediately subsequent nineteen calendar years, although not less than 60 per cent, shall be placed in in the base portfolio.

References

[1] Svensk Kärnbränslehantering AB , *RD&D programme 2022,* ISSN 1104-8395: ID 1990062, September 2022.

[2] The Swedish Radiation Safety Authority, *Strålsäkerhetsmyndighetens yttrande över Fud-program 2022 [The Swedish Radiation Safety Authority's comment on the RD&D programme 2022], SSM2022-4764-3, 2023-03-22.*

[3] Government decision, *Kärnavfallsavgifter samt finansierings- och kompletteringsbelopp för 2022 och 2023 [Nuclear waste fees and credit risk amounts and risk margins for 2022–2023],* M2021/01827, 27/01/2022

[4] Svensk Kärnbränslehantering AB, *Plan 2022 – Costs from and including 2024 for the radioactive residual products from nuclear power. Basis for fees and guarantees for the period 2024–2026, SSN 1404-18-04:* ID 1990917, September 2022.

[5] Swedish National Debt Office, *Kärnavfallsavgifter och säkerhetsbelopp – remiss av kärnavfallsavgifter, finansierings- och kompletteringsbelopp för reaktorinnehavare 2024-2026 [Nuclear waste fees and collateral amounts – consultation regarding nuclear waste fees, credit risk amounts and risk margins for reactor owners 2024–2026],* RG 2022/814, 28/06/2023.

[6] Swedish National Debt Office, "Kärnavfallsavgifter och säkerhetsbelopp – Förslag på avgifter och säkerhetsbelopp för reaktorinnehavare 2021," *[Nuclear waste fees and collateral amounts – Proposal for fees and collateral amounts for reactor owners 2021]* Ref.: RG 2019/717, 29 September 2020.

[7] Swedish National Debt Office, *Kärnavfallsavgifter och säkerhetsbelopp – Förslag på avgifter och säkerhetsbelopp för reaktorinnehavare 2022–2023, [Nuclear waste fees and collateral amounts – Proposal for fees and collateral amounts for reactor owners 2022–2023]* Ref.: RG 2021/223, 30 September 2021.

[8] Swedish Radiation Safety Authority, "Förslag på kärnavfallsavgifter, finansierings- och kompletteringsbelopp för 2018–2020," *[Proposal for nuclear waste fees, credit risk amounts and risk margins for 2018–2020]*, Swedish Radiation Safety Authority, SSM2016-5513-66, 2017.

[9] Kantar, *Prospera Inflation Expectations – July 2023 report,* https://www.kantarsifo.se/sites/default/files/fceef646.pdf, 13 July 2023.

[10] European Insurance and Occupational Pensions Authority (EIOPA), *Report on the calculation of the UFR for 2024,* 28 March 2023.

[11] Swedish National Debt Office, “Modell för beräkning av kompletteringsbeloppet för reaktorinnehavare,” *[Model for calculating risk margins for reactor owners]*, RG 2021/223, September 2021.

Explanatory appendix 1: Basic costs

See separate file. Only available in Swedish.

Explanatory appendix 2: External Economic Factors

See separate file. Only available in Swedish.

Explanatory appendix 3: SKB's uncertainty analysis

See separate file. Only available in Swedish.

Explanatory appendix 4: Additional costs

See separate file. Only available in Swedish.

Explanatory appendix 5: Consultation response

See separate file. Only available in Swedish.

Annex 1: Ortec Finance – ALM study report – June 2023

See separate file.

Annex 2: Oxford Global Projects – Reference Class Forecast for The Swedish National Debt Office

See separate file.

Annex 3: National Institute of Economic Research – Calculation of benchmarks for EEF1 and EEF2

See separate file. Only available in Swedish.

The Swedish National Debt Office works to ensure that the central government's finances are managed effectively and that the financial system is stable. The Debt Office thus plays an important role in both the financial market and the Swedish public economy.

RIKSGÄLDEN
SWEDISH NATIONAL DEBT OFFICE

Visitors’ address: Olof Palmes gata 17 | Postal address: 103 74 Stockholm | Tel.: +46 (0)8 613 45 00

E-mail: riksgalden@riksgalden.se | Website: riksgalden.se