# From unclear to nuclear

Towards a more effective licensing

 process in Sweden

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**Abstract**

The last decades the policy and decisions affecting nuclear power in Sweden have shifted many times. Since the referendum in the 1980s, setting a definite end time to year 2010 which later was lifted, the possibilities and interest to invest in new nuclear power has been very low. After the election in 2022 policy has made a U-turn and the Swedish Government has expressed short and long-term goals for expansion of the use of nuclear energy in Sweden. As a step in the Swedish process for legal changes, in November 2023 the Swedish Government decided to appoint a committee of inquiry to perform analysis and propose possible legal changes to clarify important pre-requisites and issues in the existing licensing process for nuclear power in Sweden. The paper gives an overview of the assignment and issues to be investigated by the committee, including an assessment of how the parallel and partly overlapping licensing processes according to the Environmental Code and the Act on Nuclear Activities can be made more effective and efficient, supporting international cooperation and with due account to nuclear safety, security and safeguards.

## Background

### A short retrospect on the nuclear power industry and energy policy in Sweden

The Swedish build out of large-scale nuclear power during the 1970s and 1980s resulted in 12 light water-cooled nuclear reactors at four sites in the south part of the oblong country. Nuclear was established as a complement and balance to the hydro power in the north and contributed to a phase out of a high dependence to oil, driven by the oil shocks of the early 1970s and an increasing demand for energy. Following the Three Mile Island accident, a referendum took place in 1980, which led to the decision to allow the construction of the planned reactors, and for nuclear energy to be phased out by 2010. Political debate following the recommendations to recognise the continued need for nuclear energy from an energy commission appointed by the government in 1994, led to decisions to phase out the two reactors at the Barsebäck site, while lifting the specified end-time and allowing for continued operation of the ten remaining reactors.[1]

In 2010 the Swedish parliament passed legislation allowing existing reactors to be replaced with new ones on existing sites, which complemented a political agreement to set a target for 100 per cent renewable electricity production by 2040. In 2012 the utility holder Vattenfall handed in an application to the Swedish Radiation Safety Authority (SSM) concerning the replacement of up to two of the existing Ringhals reactors with new ones. Further energy policy decisions as well as turn in policy and public opinion following the Fukushima Daii-Ichi accident in 2011, however led to that these plans were put on hold. Based on the overall business and energy market situation, existing taxes and requirements with further licensing conditions for operation beyond 2020, decisions were also taken to permanently shut down another four of the remaining ten reactors, and consequently Oskarshamn unit 2 closed in late 2016, followed by unit 1 in 2017. Ringhals unit 2 closed in 2019, followed by unit 1 in 2020. The remaining nuclear power plants makes up for about 30 per cent of the Swedish energy production. [2]

### Regulatory framework – a perspective

The existing nuclear fleet was designed and constructed with very little regulatory framework in place, based in the Atomic Energy Act (1956:306) and the Radiation Protection Act (1958:110), the latter complemented by regulations decided by the Swedish Radiation Protection Institute (SSI). The Atomic Energy Act and several others were superseded by the Nuclear Activities Act in 1984. When the Swedish Nuclear Power Inspectorate (SKI) was mandated to decide on regulations (incl. license conditions) in 1993 followed by an assignment given in 1998 to develop and issue generally binding regulations for nuclear activities, they were developed with the existing facilities in mind.

In 2008 SKI and the former Swedish Radiation Protection Institute (SSI) were merged to become the independent Swedish Radiation Safety Authority (SSM), mandated to regulate protection and safety, nuclear security, and safeguards. At this point, it was noticed that there was a need to review the total set of regulations, at a first step comprised of the total set of regulations from the former authorities. This need was further pushed by the application by Vattenfall to build one or two new nuclear reactors. Also, the recommendations (see e.g. recommendation R15) from the IAEA Integrated Regulatory Review Service (IRRS) mission to Sweden in 2012 stated that SSM should develop a consistent and more comprehensive set of regulations and general advice [3]. A similar recommendation was given in the International Physical Protection Advisory Service (IPPAS) mission in 2011. SSM decided to conduct a full overview of the regulations, including the structure and a harmonisation of the regulatory approach. Also, the Nuclear Activities Act and related ordinance were updated in 2017 in order to implement the amendment Directive 2014/87/EURATOM to Directive 2009/71/EURATOM establishing a Community framework for the nuclear safety of nuclear installations, taking account of a review of the EU framework on nuclear safety in the light of the Fukushima Daii-Ichi accident in 2011 and the findings of the EU stress tests exercise [4]. In parallel, a new Radiation Protection Act (2018:396) was put into force. Also, a Committee of Inquiry was appointed in 2017 to conduct a review of the national nuclear legislation. In 2019 the Committee proposed that the current Act on Nuclear Activities be repealed and replaced by a new act with a new structure. [5] Within this new act, it was also proposed to introduce a formal stepwise licensing process for nuclear activities, including licensing of nuclear power reactors.

To date, new regulations applicable to nuclear power plants have been issued by SSM on the three main levels. Work is ongoing to complement the new framework for other nuclear facilities, as well as to modernize and issue new regulations on some more specific issues applicable to all nuclear facilities. Throughout the work on new regulations, new guidance documents are issued including explanations and examples of application of requirements as well as background and motives for requirements, giving reference to e.g. relevant parts of IAEA Safety Standards and Nuclear Security Series.

## initiatives for legal and other changes for new nuclear power

### The Swedish legislation process

Before the Government can draw up a legislative proposal, the matter in question must be analysed and evaluated. The task may be assigned to officials from the ministry concerned, a commission of inquiry or a one-man committee. [6]

Some issues the Government must deal with are more difficult to resolve than others and require more extensive analysis and preparation before a proposal can be drafted and submitted to the parliament for a decision. Examples range from major policy decisions affecting the whole of Swedish society over long periods to smaller but technically complex issues. In dealing with matters of this kind, the Government may choose to appoint a special expert or group, officially known as a commission or committee of inquiry, to take a closer look at the issues involved. Inquiry bodies, which operate independently of the Government, may include or co-opt experts, public officials and politicians. The reports setting out their conclusions are published in the Swedish Government Official Reports series (Statens Offentliga Utredningar, SOU).

### Several initiatives for new nuclear power

It is not unusual after an election resulting in shift of Government that the four-year term is started with many decisions to appoint new committees of inquiry, giving basis to implement given legislative and other suggestions before the end of term. So has also been the case after the election in 2022, when the new coalition government set short- and long-term goals for an increased capacity in nuclear energy as one of the main measures to battle climate change, as well as give enhanced stability to security of supply. The short-term goal is set to reach 2500 MW new nuclear by 2035. For the long term, the former goal of 100 per cent renewable energy by 2040 was replaced with a goal to reach net zero with an increased electricity demand of 300 TWh fossil free energy by 2045. Without further specifying the exact amount or type of new nuclear needed to reach the goals, and possible effects of long-term operation of existing reactors, a scale of 10 new large-scale reactors is used as reference [7].

In August 2022, right before the latest election to parliament, the former Government assigned the SSM to review which development of the legal framework and other measures that were needed to give preconditions to utilize both existing, and new nuclear power, such as small modular reactors (SMR). The Authority was to give suggestions on how the identified needs for new or changed preconditions could be met, e.g. propose new or changed provisions within existing acts and ordinances, and identify need to review regulations. SSM performed the work and reported in two steps, in February and August 2023. One of the recommendations was to move forward with the earlier given proposal [5] for the current Act on Nuclear Activities to be repealed and replaced by a new act with a new structure, and to introduce a formal stepwise licensing process for nuclear activities. Also, SSM identified other possible proposals on how the licensing process could be made more effective, including a request for the Authority to be given a mandate to perform pre-licensing design reviews.[8]

On 2 November 2023 the Swedish Government decided to appoint a Committee of Inquiry to further investigate several of the proposals given by SSM, the Inquiry on Licensing Process in Sweden.

## Inquiry on licensing process in sweden

The assignment for the Committee of Inquiry on Licensing Process in Sweden is to perform analysis and propose possible legal changes to clarify important pre-requisites and issues in the existing licensing process for nuclear power in Sweden, with due account to nuclear safety, security and safeguards.[9]

The Committee of Inquiry is led by an Inquiry Chair, supported by three inquiry secretaries and a group of experts. The group of experts is also appointed by the Government and consists of representatives from the Government offices, SSM, the industry and non-governmental organisations, thereby representing different fields of expertise, perspectives and experience deemed to be of importance for the inquiry. The secretariat investigates and identifies suggestions and issues to be further discussed with the group of experts, before the final suggestions are further described in the investigation report. Also, an impact assessment is performed during the inquiry to identify and, as far as possible, quantify the costs and effects associated with the final suggestions (including an assessment of suggesting alternative or no measures). The interim and final reports delivered by the Inquiry will be directed to the Minister for Climate and Environment.

The specified issues to be investigated are divided into the following parts:

* Make the licensing process more effective;
* Review the licensing fees for new nuclear power;
* Assess the national system for nuclear waste management;
* Assess the need for a graded approach for some emergency preparedness and response measures.

There are several other Government committees of inquiry that investigate or coordinate overlapping or adjacent issues which may affect or lead to changes in pre-requisites for nuclear power in Sweden, the main ones being (non-official English titles):

* Swedish nuclear co-ordinator;
* Committee on environmental permit and licensing;
* Committee on the electricity market;

Also, several authorities and ministry officials have been, or are planned to be, given assignments by the government to assess certain issues or develop processes or other measures which are related to the issues to be covered within the different inquiries. Some of the most relevant concerning the Inquiry on Licensing Process in Sweden, are an inquiry to repeal and replace the current Act on Nuclear Activities, an inquiry on a risk sharing model for investing in nuclear power, an assignment to the National Debt Office on financing of nuclear waste from new nuclear reactors, and an assignment to the Swedish Radiation Safety Authority to give a proposal on the implementation of a process for pre-licensing review of new nuclear reactors.

In the following chapters, an overview of the assignment and issues to be investigated by the Committee of Inquiry on licensing process in Sweden (KN 2023:04) is given.

### Make the licensing process more effective

The issue concerns to investigate how the licensing of nuclear power according to both the Act on nuclear activities as well as the Environmental Code may be made more effective. The goal is to achieve a clearer process and the needed time to license shorter.

#### Current licensing process

There are usually many types of licenses and authorizations needed to build a nuclear facility, also in Sweden. The main ones are the combined and somewhat intertwined licenses according to the Nuclear Activities Act (1984:3) and the Environmental Code. Another example is the process to obtain a building permit according to the Planning and Building Act (2010:900). One main difference between these processes is the approving entity, where the license decisions according to the first two is made by the government, whereas the building permit is given on a more local level by the municipality.

In Fig. 1 below, an overview of the current licensing process according to the Nuclear Activities Act and the Environmental Code is shown. The main steps with different involved parties, also involves a mandated coordination. To achieve a license to construct, possess and operate (implicitly also including to decommission) a nuclear facility according to the Nuclear Activities Act, the review done by the SSM should also include some provisions of the Environmental Code. The same provisions are also reviewed by the Environmental Court. Moreover, the Governments decision on permissibility[[1]](#footnote-2), needs to be coordinated with local municipality and the license decision according to the Nuclear Activities Act. Then, the licensing process according to the Environmental Code continues and deepens with formal court hearings, for the Environmental Court to decide on an environmental license with specified conditions.

*FIG. 1. Current licensing process in Sweden.*

The process according to the Nuclear Activities Act continues in a stepwise approval, following the construction and commissioning process until the nuclear facility is given approval to begin commercial operation (see steps after vertical line in Fig. 1 above). The practice of the stepwise approval is today implemented through license conditions to the nuclear license decided by the Government. To be noted is, that there is no stepwise procedure in practice according to the Environmental Code, i.e. all issues have to be fully assessed before the environmental license is given – the court does not get a second chance to follow up on an issue as more detailed plans have been made.

#### Further details on the issues to be investigated

In the Terms of Reference of the Inquiry [9], the issues to be investigated are specified further. These include to analyse if and to what extent the current licensing processes implicates that issues are reviewed according to both the Environmental Code and the Nuclear Activities Act. If so, the Inquiry will investigate if any issues may be taken out of one of the processes, and if or to what extent it is necessary to review ordinances in the Environmental Code in the process according to the Nuclear Activities Act.

Issues to be investigated regarding the formal processes include whether the SSM to a greater extent should be mandated to authorize a license for nuclear activities, and the review procedure if these decisions would lead to appeal, i.e. if such appeals should be reviewed by any other instance than the government. Also, if licensing reviews of nuclear power should be given priority in reviews and proceedings by the Land and Environmental Court.

There are also issues to be investigated regarding the steps and types of licenses to be given. Today, a combined license is given including site, design, and operating organisation for nuclear facilities, even though further details are reviewed as the project progresses through the stepwise process. The Inquiry is to consider if it could lead to a more effective process with separate licenses to a site, to construct and to operate. If and how the process could be accepting that the licensing review could include one reactor technology to be constructed on one or several sites is also to be investigated. In these discussions, different models for pre-licensing review are to be investigated, including international cooperation and harmonisation. In this work, special attention shall be given to ongoing initiatives, including the IAEA Nuclear Harmonisation and Standardisation Initiative (NHSI). Any other obstacles for new actors and reactor technologies to enter a licensing process will be discussed.

### Review the licensing fees for new nuclear power

The issue concerns to investigate how the fees related to an application to build nuclear power in Sweden may be more suitable and better tailored to different reactor types. The fees of today are mainly specified to a fixed rate in an ordinance, where the rates related to different licensing steps are estimated based on experience from e.g. the review of the full-scale light-water reactor now in operation in Finland. The task is therefore to propose a more graded approach to licensing and review fees, taking due account of different reactor types, new actors and without disbenefit to the first applicant.

The issues on the licensing process and licensing fees are to be reported before 30 December 2024.

### Assess the national system for nuclear waste management

The issue concerns to assess how the Swedish program on pre-disposal waste management and disposal may be adapted to include waste from new nuclear power. The task will include to assess types and amount of waste, if and how this would fit into the existing system and assess roles and responsibilities needed to assure safe and efficient waste management for new as well as existing licensees. The issue on the national system for nuclear waste management will be further specified and planned during autumn 2024 and is to be reported before 29 August 2025.

### Assess the need for a graded approach for some emergency preparedness and response measures

The issue concerns to assess the need to adapt the regulatory framework for the definition of the precautionary action zone and emergency planning zone for new nuclear power, as well as requirements to transfer process data to the competent authority in an emergency situation. Experiences and decisions in other countries preparing for new nuclear are to be considered. The issue on emergency preparedness and response will be further specified and planned in spring 2025 and is to be reported before 27 February 2026.

## Challenges and opportunities for the inquiry

When preparing the work plan for the Inquiry some general challenges, beyond the many and sometimes complex issues to be investigated, was identified.

### Co-ordination of different/overlapping initiatives

In Sweden, the quick shift in policy and political ambition and expectations for new nuclear power, means that many different initiatives, assignments and committees of inquiry have been activated within the same time span. Many are related or even partly overlapping. There is a moment of ”catching up” other countries, at the same time as many important factors are already in place. The mutual interest and similar ongoing activities in e.g. Sweden and Finland may also be seen as an opportunity to co-ordinate and learn from each other.

In the inquiry, issues where there might be a mutual interest to learn more about the process and status of any similar issues in other countries were listed, e.g. regarding pre-licensing review, stepwise vs. combined licensing process or other adaptations to new technology or operational models, back-end issues for new actors and new fuel/waste types as well as recent developments and decisions in several countries on precautionary action zone and emergency planning zone for new nuclear power. Going forward, the Inquiry is continuously making efforts to follow and try to understand in what parts there is a mutual interest and which countries or actors to involve in any further contacts, to make the activities as effective as possible for all parties.

### Comprehensive enough for all relevant design and licensing pathways for new nuclear in Sweden

There is a challenge to investigate and assess what different needs and expectations there are for actors preparing for new nuclear in Sweden. The Swedish process and legislation is in many ways goal oriented and technology neutral. It is important that any changes do not compromise the more traditional/expected pathways and existing licensees and operating models. It is also important to understand the need for flexibility and other pre-requisites for conventional and proven designs as well as for evolutionary and innovative designs, as well as for novel operational and licensee/ownership models. In these efforts, already existing opportunities for flexibility in application, i.e. the possibility to apply a graded approach, is important to assess and discuss related to the different suggestions for changes in the regulatory framework and licensing process that are identified. Also, continuous discussions and impact assessment and identification and assessment of alternative costs (if suggested measures would not be implemented) are important.

### Identify and suggest measures which lead to actual enhanced efficiency, in the short and long term

Continuously during the Inquiry, beyond the meetings and discussions with the group of experts, many bilateral meetings have been held with different actors, including industry, authority experts and other interested parties. In these meetings it has been evident that the goals set up by the government for expansion of new nuclear in Sweden may require some measures that might be more relevant for some actors in the short-term goal (2035), and other measures more relevant for the long-term goal (2045). Again, continuous discussions and impact assessment and identification and assessment of alternative costs (if suggested measures would not be implemented) are important.

## Concluding remarks

In many European and other countries discussions, preparations, and prioritizations to enable expansion of nuclear power have intensified the last years. As have been described in this paper, Sweden is no exception. Specifically, this paper has summarized the issues to be investigated in the ongoing work of the Inquiry on Licensing of nuclear power in Sweden. Even though challenging, it is important for the Inquiry to, within given time frames, thoroughly work through the many related issues and coordinate as much as possible with other ongoing initiatives in order to give the Government a good basis for a decision on next steps, which are fit for purpose, acceptable to the involved stakeholders, and have the potential to actually lead to a more effective licensing of new nuclear.

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1. A government decision of permissibility is needed for large and complex activities which can lead to hazardous effects on the environment such as nuclear power. The decision gives room to consider energy aspects, regional aspects, labour market aspects – as well as for political aspects, and competing or conflicting interests, besides the environmental effect the planned activity or facility will have on human health and the environment. [↑](#footnote-ref-2)