

# Sweden: Nuclear power policy and public opinion

*More favourable attitudes toward nuclear power are emerging*

In 1990, nearly half — 45% — of Sweden's electrical energy was generated by nuclear power, 50% by hydropower, and 5% by fossil fuels. During a year of normal temperatures and precipitation levels, more than 50% of Sweden's electrical energy is generated by nuclear power plants.

Twelve nuclear plants with a total rating of 10 000 megawatts-electric (MWe) are commercially operating in Sweden. Their annual electrical generating capacity is around 70 terawatt-hours.

Nuclear power in Sweden has proved to be technically, economically, and environmentally highly successful. This is demonstrated by the fact that:

- Construction time (from beginning of construction to synchronizing to the grid) for every unit has been less than 6 years.
- Plant performance has been consistently high; average availability has been around 85%.
- Radiation exposure of plant personnel has always been far below the average at the world's light-water reactors.
- Few cases of fuel damage have occurred, and radioactive emissions have been very low. In terms of safety, Swedish nuclear power plants have been among the best in the world.
- Radioactive waste management has benefited from pioneering work done at a very early stage in Sweden. Swedish radioactive waste technology has become a world leader in several areas.

Manufacturers, power utilities, and safety authorities have thus done everything in the field of safety engineering that can reasonably be expected to build up a credible technology. But the superficial impression may remain that the nuclear power industry has failed to instill confidence in nuclear power engineering among the general public and the politicians.

by  
**Carl-Erik Wikdahl**

## The 1980 referendum

Following a referendum back in 1980, the Swedish Riksdag (Parliament) decided that the Swedish nuclear power system shall be phased

Forsmark nuclear power station. (Credit: Fotograf Göran Hansson)



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out no later than the year 2010. No decision of this nature has been taken by any other country. In addition, the Riksdag decided in 1988 that the phase-out would begin by shutting down two units in 1995 and 1996.

However, no Swedish commercial nuclear power unit has yet been shut down, either as a result of political decisions or the dictates of safety authorities. In contrast, nuclear power units have been compulsorily shut down

elsewhere in the world, including in Austria, United States, Italy, Spain, USSR, and Germany.

### Reappraisal in 1991

Towards the end of February 1991, the Swedish Government published a draft bill which represents a reappraisal of nuclear power. If adopted by the Riksdag, the Government's proposal will rescind the 3-year-old decision to start phasing out nuclear power by 1995. No new date has been set for shutting down the first reactor.

The proposal does not represent a reversal of the decision that nuclear power should be phased out by the year 2010. The Government proposed that US \$700 million be allocated over the next 5 years to the development of alternative energy sources, such as wind power and bio-energy, and to conservation measures. If this development work should lead to technology that will enable nuclear power to be replaced without national economic hardship, planning will begin for phasing out nuclear power. If not, nuclear power plants will be kept in operation.

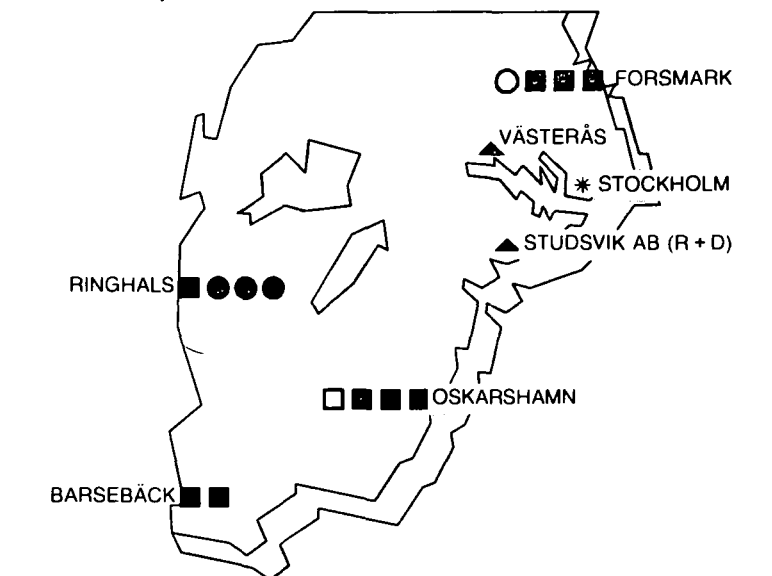
Practically all political observers agree that the new Government decision represents a significant U-turn, and that further changes may follow in the future.

Many reasons are responsible for this turn of events. On the one hand, it is due to Sweden being an exceptionally open society, with strong environmental opinions that began to emerge at a very early stage. On the other hand, optimism in technical development has long been firmly established in Sweden and is founded on a very broad public opinion base. It is particularly strongly supported by trade union organizations.

### Nuclear power in Sweden

		Rating (MW)	Commissioning date
FORSMARK	■ F1	970	1981
	■ F2	970	1981
	■ F3	1150	1985
	Total	3090	
OSKARSHAMN	■ O1	440	1972
	■ O2	600	1974
	■ O3	1150	1985
	Total	2190	
BARSEBÄCK	■ B1	600	1975
	■ B2	600	1977
	Total	1200	
RINGHALS	■ R1	820	1976
	● R2	860	1975
	● R3	915	1981
	● R4	915	1983
	Total	3510	

- Boiling-Water Reactor (BWR)
- Pressurized-Water Reactor (PWR)
- ▲ Nuclear fuel cycle facilities
- SFR
- CLAB
- } Radioactive waste facilities



### Political problems of nuclear power

Swedes tend to believe that they are known abroad as living in a clean, pristine country, and that they have a high technological and economic standard. This image describes the ambitions of Swedes, but it also reflects conflicts in Swedish society.

Way back in the mid-1970s, these conflicts focused on nuclear power. This phenomenon became an important symbolic matter, both for the technological optimists and for the environmental optimists. It became a principal issue for several of the political parties back in 1976. In practice, the nuclear power issue was the down-

fall of two Swedish governments. The current gradual reversal of the opinions of several political parties concerning nuclear power is partially the result of fatigue with the subject matter. Fifteen years is far too long for nuclear power to remain a dominant political issue.

Another reason for the Swedish Government now wishing to change the country's energy policy is that it has become increasingly obvious that prematurely phasing out Swedish nuclear power would cause serious problems to the national economy. Since 50% of the electrical energy typically is generated by nuclear power, a phase-out would exert strong upward pressure on the costs of generating electric power. Swedish authorities have estimated that the cost of electrical energy to industry would double. Since much of the country's welfare is dependent on the export of paper, steel, and timber — all of which are intensive users of electrical energy — the upsurge in prices would become a serious threat to employment in industry, and would thus jeopardize the welfare policy.

### Nuclear power information

How has information on nuclear power been disseminated to the general public and decision-makers, and how has the work been organized?

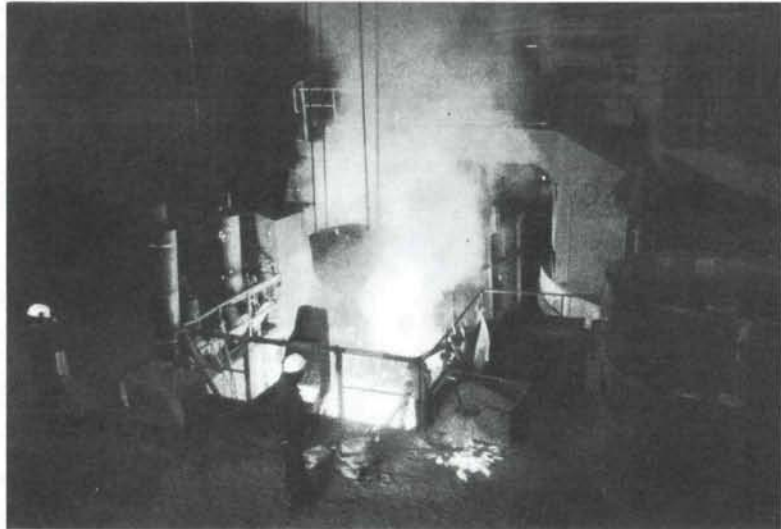
Ever since the introduction of nuclear power, the responsibility for disseminating information has rested with all of the companies engaged in the field of nuclear power, i.e. the power utilities and the reactor manufacturer, ABB Atom (formerly ASEA Atom). In recent years, the economic consequences of phasing out nuclear power have played a major role in moulding opinions. Industries that use electric power and the trade union movement have been responsible for a substantial part of the information work. No co-ordinated effort by a joint organization, such as is common in many other countries, has ever emerged in Sweden.

During the late 1980s, the dissemination of information has been pursued roughly as follows:

- The power utilities have centrally disseminated low-key information on nuclear power and other energy sources.
- Comprehensive local and regional information activities have been pursued at the four nuclear power stations. Each station is considered to have a range of influence of around 100 kilometres.
- The Nuclear Training and Safety Centre (KSU) and the Swedish Nuclear Fuel and Waste Management Company (SKB), both of which are owned by the power utilities, have

pursued comprehensive dissemination of technical and scientific information concerning their respective specialities of reactor safety and radiation protection, and nuclear waste management. KSU and SKB also have been responsible for running periodic opinion polls. (See box.)

- ABB Atom has pursued low-key information activities, principally for decision-makers.



- A separate public relations company, owned by industrial users of electric power, has disseminated information to all of its employees and to local and regional decision-makers concerning the local consequences companies would suffer if nuclear power were phased out.

Swedish paper, steel, and timber industries heavily depend upon electrical power, half of which is nuclear generated. (Credit: Jan Håkan Dahlström, Bildhuset)

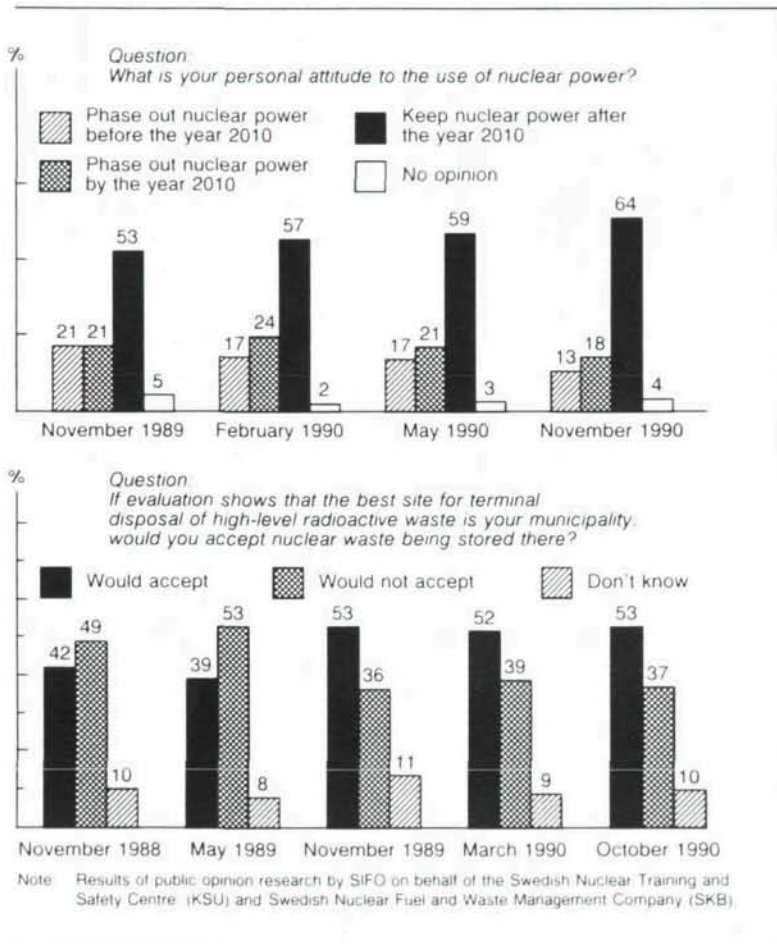
### Information to the general public

Local activities at the nuclear power stations have been diversified and very successful. Nuclear power has gained the highest degree of acceptance by the general public in the regions where the plants are located, in spite of the fact that waste storage facilities were taken into service between 1986 and 1988 at two out of the four stations. An intermediate storage facility for spent fuel (CLAB) was built at Oskarshamn, and a repository for waste from nuclear power plants (SFR) was built at Forsmark.

Local activities hinge on the exhibition centres at the plants and on the facilities provided for guided tours of the plants. Two of the places, Oskarshamn and Forsmark, are also of cultural and historic interest, and tourists therefore have an added reason for enjoying a

visit to the plant. In addition, extensive activities are pursued at all levels in the schools. Special personnel visit the schools to hold lectures and to make simple demonstrations, often in preparation for the pupils paying a visit to the station.

In most places, monthly advertisements are published in the local daily press, with news items of general interest from the plant. In addition, periodicals that are free of charge are mailed to all households a few times a year. Each periodical is published in a run of between 100 000 and 200 000 copies.



### Scientific information

Through an analysis group, KSU administers the publication of a technically and scientifically based information bulletin concerning nuclear safety and radiation protection, and this is circulated to decision-makers and journalists. The bulletin is also widely distributed to employees in the nuclear power industry. The detailed background information is written and checked by specialists in reactor safety and radiation protection at the power utilities, ABB

Atom, and the universities. Typical subjects discussed include:

- analysis of the Chernobyl accident and its consequences;
- life cycle of nuclear power plants;
- environmental matters in uranium mining;
- safety of reactor pressure vessels;
- nuclear power accident insurance;
- systematic review of the arguments advanced by nuclear power opponents.

In addition, the analysis group pursues extensive immediate debate activities. Misleading or incorrect information in the mass media or in the political debate is countered speedily and consistently, either by official statements or by mail.

### Information on radioactive waste

In recent years, SKB has been using a floating exhibition. During the annual holiday period, MV SIGYN, a vessel normally used for shipping spent fuel and radioactive waste, has been docking in harbours along the Swedish coast, with a radioactive waste exhibition on board. During such exhibitions, specialists from SKB have been there to answer questions from visitors and invited students. The activities were so successful that a mobile exhibition of the same type has now been arranged. The main benefit is that it can effectively be taken to all regions of the country. The keen interest aroused in the local daily press is an important element associated with these exhibitions.

During 1990, SKB launched a series of advertisements in periodicals and the daily press concerning the safety of terminal storage of high-level radioactive waste.

### Economic consequences

Information activities concerning the risks associated with nuclear power and its safety have proved to be of fundamental importance for better understanding and acceptance of nuclear power. But it is undoubtedly the information concerning the economic consequences of prematurely phasing out nuclear power that has been of greatest importance to the reversal of public opinion in recent years.

It is principally industrial users of electric power that have been responsible for disseminating information concerning the economic consequences. It was decided at an early stage that no efforts would be made in the form of advertising in the national daily press. Efforts were instead focused on employees, on

local and regional politicians, and on the mass media. The companies involved in this work are scattered throughout the country, although they have a high concentration in northern Sweden, where job security is traditionally poorer than farther south. Industrial plants that are intensive users of electric power are often the dominant employers in many places. In some cases, the collapse of a company could thus represent a direct threat to the whole of the region.

In many places, it was relatively straightforward to show that the cost of electrical energy to a company is normally of the same magnitude as the company's profit or even higher. If the cost of electrical energy were doubled, the company's entire profit, and more besides, would disappear, and it would have to go out of business.

During the late 1980s, signs also emerged that industries that are intensive users of electrical energy were unwilling to invest in Sweden. Wherever opportunities existed, such investments instead were made abroad.

### Attitude of the trade unions

Trade union organizations have undertaken their own studies, and have arrived at the same results. As a result of the collective flow of information, many individual trade union members exerted pressure on their leaders. Consequently, the entire collective trade union movement launched a very hard debate in the autumn of 1989 against the energy policy of the Swedish Government. This open debate, which involved known and credible persons who did not normally take a stance in energy policy matters, had a strong influence on public opinion and was probably the most important individual factor behind its reversal.

Another factor was a series of concrete attempts by the power industry to obtain permission for building new fossil-fired power plants to replace nuclear power units that were to be shut down. It was suggested that the new plants should be located adjacent to the nuclear power plants. The proposals sparked off a lively local environmental debate, which in one case gave rise to a decision to invoke a municipal veto. Many people considered that the fossil-fired alternatives were environmentally inferior to nuclear power. They also demonstrated in very concrete terms that wind power or bio-energy, for instance, were still not available as realistic alternatives.

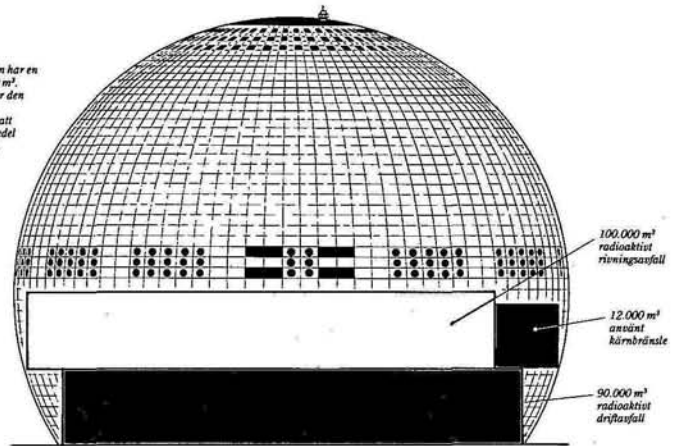
It remains to be seen whether the favourable attitude towards nuclear power will persist in Sweden and develop further. But it is clear that

nuclear power now has the wind of public opinion in its sails. The principal reason is the high technical quality of Swedish nuclear power, which has instilled confidence in the general public and decision-makers. The second important reason is that well-known trade union leaders have declared that continued operation of nuclear power is essential to the maintenance of full employment and welfare in Sweden.

In this advertisement by SKB, Swedes are informed that nuclear waste is being managed safely. It points out that the accumulated volume of Sweden's nuclear plant waste in the year 2010 will be only one-third of the volume of the *Globe*, a national landmark. (Credit: SKB)

## År 2010 har Sverige så här mycket radioaktivt avfall.

Globen i Stockholm har en volym på 500.000 m<sup>3</sup>. År 2010 kommer den totala mängden radioaktivt avfall att motsvara en tredjedel av Globens volym.



## Vi har redan börjat ta hand om det.

Sverige har producerat el med hjälp av kärnkraft sedan 1972. Men kärnkraften har också gett upphov till radioaktivt avfall. Med alla kärnkraftverk i drift till år 2010 får vi 200.000 m<sup>3</sup> radioaktivt avfall att ta hand om. Det motsvarar en tredjedel av Globens volym. Vad gör vi med det?

### Allt tas om hand.

I Sverige ansvarar Svensk Kärnbränslehantering, SKB, för att radioaktivt avfall från kärnkraft, sjukvård, industri och forskning tas om hand på ett säkert sätt.

I SKB:s system ingår ett slutförvar för driftavfall, ett mellanlager för använt bränsle, ett fartyg och ett antal specialbyggda transportfordon och behållare.

Eftersom alla svenska kärnkraftverk ligger vid kusten kan samtliga transporter ske till sjöss. Fartyget *Sigyn* är byggt uteslutande för detta ändamål. *Sigyn* motsvarar mycket högt ställda säkerhetskrav, men säkerheten garanteras främst av transportbehållarna som har upp till 30 cm tjocka stål väggar.

### Slutförvaring av driftavfall.

Det radioaktiva driftavfallet från kärnkraftverken utgörs av i ex filter, överdragskläder och utbytta delar. Detta avfall behöver hållas

isolerat några hundra år innan det är ofarligt.

Driftavfallet slutförvaras i berg 50 meter under havets botten i närheten av Forsmarks kärnkraftverk. När kärnkraftverken rivs kommer det radioaktiva rivningsavfallet också att förvaras i denna anläggning.

### Bränslet mellanlagras i 40 år.

Använt kärnbränsle, som är en hård keramik, avger strålning under mycket lång tid och måste hållas isolerat fram till efter nästa årtid om hundra tusen år.

Det använda kärnbränslet mellanlagras i en anläggning strax utanför Oskarshamn. Mellanlagringen sker i vattenbassänger belägna i berggrunden 25 meter under markytan och ska pågå i 40 år. Efter denna tid har radioaktivitet

och värmeutveckling minskat med 90% och då är bränslet lämpligt för slutförvaring.

### 500 meter ner i urberget.

Det som återstår att bygga är ett slutförvar för det använda bränslet. Detta ska påbörjas år 2010 och tas i drift 2020 (när det äldsta bränslet har mellanlagrats i 40 år).

Bränslet kommer då att inneslutas i 10 cm tjocka kopparkapslar som bäddas in i lera 500 meter ner i urberget.

Under 90-talet kommer SKB att färdigställa detaljerna och undersöka lämpliga platser för slutförvaret. Den slutliga platsen bestäms av regeringen, troligen omkring sekelskiftet.



Vi tar hand om Sveriges radioaktiva avfall.

### Vill du veta mer om Sveriges radioaktiva avfall?

Fyll i kupongen och skicka den i ett otryckert kuvert till: FRISVAR SKB 110 05 Stockholm

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Namn

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Adress

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Postadress

Future attitudes among people in Sweden will depend on a number of factors. High among them are the international development of nuclear power and the opportunities available for making alternative energy sources competitive on the market and environmentally acceptable.