

Working Paper

SAVING SWEDISH ENERGY POLICY: THE INTELLIGENCE OF PUBLIC PARTICIPATION

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April 1992



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Foreword

Energy is the focus of many national and international studies. One of the major questions is to select the energy options to match supply and demand. Because there are no immediate better alternatives a great amount of effort has to be spent on comparing the pros and cons of different supply options. The formulation of a national energy policy can be a process for making that comparison. Different countries have arrived at different solutions and it is interesting in hindsight to understand how these solutions were obtained.

This paper considers Sweden as a case for how the formulation of a national energy strategy can develop. It presents work done during the summer of 1991 by a member of the Young Scientists Summer Program (YSSP) at IIASA. It is of interest to scientists and policy makers working with energy policies, risks and public decision making.

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*Ragnar E. Löfstedt**

1 Introduction

Energy policy is a difficult topic for most nations. Predictions of future energy production and consumption are often highly inaccurate, flawed by the inability of analysts to adequately calculate the importance of political upheavals, energy accidents, war, other surprises, and the role of the mass media (Lee et al. 1990). Furthermore, energy prediction scenarios are based on past experiences which may be skewed or altered by the country's political process, or by the personal opinion of the scenario writers (Lindberg 1977a and b, Senior Expert Symposium 1991).

Sweden has often been used as an example to illustrate effective public participation in national energy policy. For example, Lindberg (1977b) makes the points that Sweden does not have the institutional and structural obstacles to policy making prevalent in other nations, and that the Swedish public are able to influence the policy process by active participation in the political party system. Although these observations may still be valid today, they have not prevented Swedish energy policy to suffer from a series of hastened, dogmatic, and contradictory policy decisions over the past twenty-five years.¹

Sweden is facing an energy dilemma. As a result of a national referendum in 1980 the government is committed to phasing-out the country's twelve nuclear reactors, representing 50 percent of the total electricity production. This policy, in conjunction with several others, has had far reaching effects on the production and consumption of electricity in Sweden. Although recent efforts have been made to adapt the energy policy in the changing political environment, it presents many problems. Partly due to this the Social Democratic Party (the strongest political party in Sweden) is in disarray.

In this paper, I seek to do the following: a) outline the major political energy decisions that have been made over the last two and a half decades, b) examine the reasons why they were made, and c) discuss the lessons learnt from (a) and (b), d) offer public participation as the best alternative to Swedish energy policy making.

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¹Lindberg's discussion on the energy syndrome has been criticized elsewhere as possibly depicting premature uncertainty (Tugwell 1980).

2 Energy Policy in Sweden

Swedish energy policy over the past 25 years can be looked at in three phases:

1. before the 1980 nuclear referendum, which came about because of the Three Mile Island accident;
2. the time between the referendum and the Chernobyl accident; and
3. the period following the Chernobyl accident.

2.1 The 1960's and 70's

In late 1967, the government decided not to harness the Vindel river for electricity production purposes. This decision was made in the face of intense local and national opposition to the hydropower alternative, arising from the realization that only four large, free-flowing rivers were left in Sweden, and a preference that they should remain unspoiled.

This controversy over hydropower led the State Power Board (the largest utility in Sweden) to invest in alternative energy sources to meet future electricity demand. At first the most economical replacement was thought to be oil condense power,² which in 1967 was about the same price as hydropower, but after the 1973 Arabian oil embargo (Sweden was dependent on oil for 70% of its energy needs at this time) these plans were permanently abandoned. The nuclear alternative, which had been steadily gaining popularity with the utility companies took the place of the oil alternative.

Sweden's nuclear program was highly ambitious: it led to the construction of twelve nuclear reactors at four distinct sites³ along the south-Swedish sea coast. This nuclear capacity contributed to a surplus of electricity, since production more than doubled from 66.5 TWh in 1971 to 142 TWh by 1990 (SOU 1990). In 1987, there were twelve nuclear reactors, generating nearly half of Sweden's electricity, making Sweden one of the most nuclear power intensive countries in the world. As a result of the large increase in electricity supply, electricity prices fell from 1978 to 1986 at a time when Sweden had the second highest inflation rate in Europe after Italy (Figure 1). This, combined with several other factors, such as the high price of heating oil,⁴ encouraged homeowners to install electrical heating systems to tap the cheap energy source (Tyler and Schipper 1990).

Nuclear power: technical development

The Swedish nuclear power program has a relatively long history. It began in 1945 with the formation of the Royal Commission on Nuclear Energy, which later became the Atom Committee. The commission was interested in the development of both military and civil nuclear technology.⁵ In the late 1940's, the Atom Committee helped coordinate a joint venture with the Swedish government, AB Atomenergi, which built the first Swedish reactor (fueled by natural uranium)

²Oil is burnt and the heat resulting from the combustion process produces steam which drives a turbine generating electricity.

³Four reactors were built at the Ringhals plant 50 kilometers north of Gothenburg, two at the Barsebäck plant near Malmö and Copenhagen, three at the Oskarhamn plant located close to the provincial town of Kalmar, and three 80 kilometers north of Stockholm at the Forsmark site.

⁴Also it should be noted that electric heaters are relatively cheap compared to other conventional types and their installation costs are low. This makes them popular in the Swedish building trade (Mills 1991).

⁵The military component was much debated by parliament, and military nuclear research continued secretly until 1972.

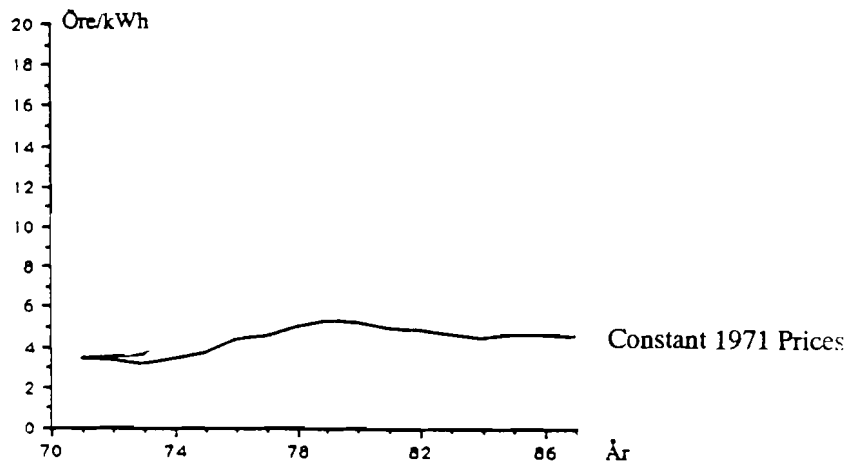


Figure 1: The electricity costs for the electric intensive industry* between the years 1971-1987. Constant 1971 prices.

Source: SOU 1990.

*) Similar price curve can be found in the residential sector (Mills 1991).

in 1954.⁶ This year saw a further boost to the Swedish Nuclear program with the Atoms For Peace conference in 1954 (Wittrock and Lindstrom 1984), resulting in the purchase of a light water reactor from the United States (Jasper 1990).

However, the tide turned back in favor of the natural uranium technology in the early 1960's following the decision by the Swedish State Power Board, in cooperation with AB Atomenergi, to build a third reactor, Ågesta (near Stockholm), which was to be the prototype for a much larger reactor at Marviken. The Ågesta project was delayed for several years and costs of the plant doubled. In 1964, the State Power Board, encouraged by the success of Light Water reactors in the United States and Germany as well as discouraged by the technical and economical problems associated with the development of natural uranium reactors, withdrew from the Marviken project, effectively ending the potential commercialization of natural uranium reactors in Sweden (Jasper 1990). From 1964 onwards, the State Power Board and private utilities focused exclusively on the use of light water technology, and by 1985 twelve nuclear reactors were on line.

Nuclear Policy

The build up of nuclear power went smoothly until 1973. The Swedish government and the opposition members of parliament vigorously supported nuclear power, seeing it as the energy source that would relieve the pressure to dam more rivers for electricity (Vedung 1980a).

In the Autumn of 1972, the Center Party's energy expert, Birgitta Hambreus, in an attempt to win votes from the urban middle class, and from people sympathetic with the environmen-

⁶The first and third Swedish reactors were fueled by natural uranium and used heavy water as a moderator. The atomic engineers at the time envisaged the nuclear program would use natural uranium, which the country has vast quantities of, albeit of low quality. However, light water reactors require enriched uranium which has to be imported.

tal movement, raised the moral issue of the dangers and persistence of nuclear waste (Vedung 1991b).⁷ This initial questioning of nuclear power promoted widespread discussion and resulted in the Social Democrats passing a nuclear moratorium for two years starting in 1973. Additionally, prior to the 1976 elections, the Social Democratic government passed the 1975 Energy Act as an attempt to diffuse the nuclear power issue. It called for a small increase in the use of nuclear power (from 11 to 13 reactors), and for increased emphasis on energy conservation (Jasper 1990, Lönnroth 1977). However, it failed to settle the future use of nuclear power, and the issue was again debated in the 1976 elections.

The anti-nuclear feeling among the voting public was partially responsible for the Social Democrats losing control of the Riksdag for the first time in over 44 years to a center-right coalition headed by the anti-nuclear Center Party (Jasper 1990, Jones et al. 1980, Kaijser et al. 1991, Sahr 1985, Vedung 1988).⁸ With the Center Party in power, the anti-nuclear activists both within and outside of the government had hoped that Sweden would exit the nuclear era. Yet during the center-right coalition, nuclear reactors were continuously put on line. Fällidin, the leader of the Center Party, was seen as a traitor to the cause, and this ultimately led to the Center Party losing control of the government two years later (Abrams 1979, Vedung 1980b, 1988).⁹

The nuclear policy controversy came to a head following the 1979 Three Mile Island accident. Olof Palme, the leader of the Social Democratic Party, had for a long time been a strong supporter of nuclear power and against a nuclear referendum. On April 4, 1979, however, after a week of intense media coverage of the nuclear accident, Palme, afraid of losing more anti-nuclear supporters to the Center Party in the upcoming September 1979 elections, announced that he was in favor of a nuclear referendum. Within hours the other parties agreed to Palme's suggestion.

The process of determining acceptable alternatives for consideration in the referendum was not easy. At the beginning of the referendum campaign there were only two alternatives: a) the six reactors in use would be phased-out over a twelve year period and the six under construction should never be completed; and b) a total of twelve nuclear reactors would be built and these would eventually be phased-out at a pace suited to the Swedish economy. The first alternative was supported by the Center Party, the Communists, and the small Christian Democratic Party, while the second alternative was supported by the Conservatives, Liberals, and the Social Democrats. The Social Democrats, however, did not want to be seen to support the same alternative as the Conservatives. The Social Democrats considered themselves a worker's party, whereas the Conservatives were supported by the businessmen/women and industrialists. Furthermore, the Swedish Social Democratic Party had been warned by their Norwegian counterparts that they could lose a large number of voters if they supported the same alternative as the Conservatives (Sahr 1985).¹⁰ Thus, the Social Democrats began including extra clauses

⁷As a result of the Center Party's environmental, and later anti-nuclear stance, it was able to attract voters who were distrustful of the intellectuals and technicians dominating Swedish politics. These same individuals saw opposing nuclear power as a way of signaling a protest to the centralized political system in Stockholm (Jasper 1990, Kelman 1976). In the 1973 and 1976 elections the Center Party was able to increase its electoral support by gaining votes among the urban, middle class whilst maintaining its electoral base in rural communities (Särilvik 1977).

⁸A case can be made, however, that many of those who voted for the anti-nuclear Center Party associated nuclear power with the distrusted intellectuals and technicians based in Stockholm (Jasper 1990). If this is correct, then the anti-nuclear vote was not a vote against nuclear power per se, but rather a vote against the political establishment in Stockholm.

⁹Although the Center Party lost control of the government in 1978, the Conservative coalition won again in the 1979 elections (a campaign in which the nuclear power controversy played only a limited role), enabling the Center Party to form a new government with Fällidin as Prime Minister.

¹⁰In Norway, during the European Common Market membership referendum in 1972, the Social Democrats supported the same alternative as the Conservatives. Following the referendum, many Social Democrats continued to vote for the Conservatives in the general elections (Jasper 1990).

and sub-clauses in the alternative, which the Conservatives could not support. This resulted in the breakup of the alliance with the Social Democrats and it precipitated to three alternatives for the referendum.

The referendum was conducted one year after the accident in March of 1980, enabling nuclear power to be a non issue at the 1979 elections (Sahr 1985).¹¹ Based on the results, with the majority of the public favoring to shut down the twelve reactors at a pace suited to the Swedish economy, parliament passed an energy act in June 1980 that included a range of measures to facilitate reduced dependence on nuclear power. The main stipulations of the act were as follows (after Jones et al. 1980): a) a decrease in the dependence on oil; b) the introduction of more renewable energy sources into the nation's fuel mix; c) increased safety in nuclear power plants; d) promotion of energy conservation; e) plans to reduce dependence on electricity;¹² and f) a phase-out of the twelve reactors by 2010, which at the time roughly corresponded to the projected lifetime of the newest reactors. Moreover, all existing nuclear reactors were discounted over the same twenty-five year period, meaning that the phase-out of nuclear power by 2010 would not theoretically result in gross capital losses.

2.2 Between Three Mile Island and Chernobyl

After the referendum most anti-nuclear groups, as well as the general public, were exhausted. The issues had been debated at such great lengths in the year between the Three Mile Island accident and the referendum, that people were tired of the topic, and in a matter of months it was little discussed (Sahr 1985).¹³ Only a year after the referendum, opinion polls showed that nuclear power was again gaining support as the Three Mile Island accident was forgotten (Biel et al. 1989).¹⁴

By 1982, nuclear power was no longer prominent on the political agenda. Energy policy makers had shifted their attention to the issue of reducing oil use, as a result of the second oil crisis that occurred in 1979. The Swedish government had detailed plans for decreasing the dependence of oil (per capita oil consumption was the highest in the world (Lönnroth et al. 1979)) from 70% of the nation's fuel mix to 40%, or by 9 million metric tons through the use of alternative energy sources and conservation (Sahr 1985). In fact, Palme, in his speech following the Social Democrats win in the 1982 elections, emphasized the issue of oil substitution over the phase-out of nuclear power (Sahr 1985).

Oil use decreased faster than most policy analysts had expected. This trend had several underlying factors: firstly, oil prices remained high in the early 1980's following the 1979 Iranian oil crisis. Secondly, the utilities were promoting heating to secure a market for the electricity from Sweden's last two nuclear reactors, Forsmark 3 and Oskarshamn 3. The utilities were further helped by the government's reduction of the tax on electricity in January of 1984 (Kajjser 1988).

¹¹The referendum offered three alternatives: (1) a total of twelve reactors would be used in the Swedish nuclear program. These reactors would be shut down at a pace suited to the economy; i.e., they would not be phased-out if economic growth was threatened; (2) was similar to (1), but additional clauses were added emphasizing energy conservation and renewables, and stating that all nuclear power stations should be owned by the state and municipalities; (3) implied that the six reactors in use should be phased-out over ten years, at most, and the six under construction should never be completed. The results of the referendum were as follows: 18.9% for (1), 39.1% for (2), and 38.7% for (3).

¹²This measure was added to the 1980 law, as an attempt to discourage the use of electrical space heating in homes. It was largely unsuccessful, as residential use of electricity continued to increase by 5% a year in the 1980's (SOU 1990).

¹³The decline in interest in the nuclear power debate after the referendum may also have been due to widespread industrial action by many unions, causing severe disruption in Sweden for five weeks in early 1980, and dominating public debate (Sahr 1985).

¹⁴Political leaders, however, continued in-depth discussions about the implications of the nuclear referendum (i.e., those surrounding the eventual phase-out of nuclear power) until 1986.

Already by 1985, the government's anti-oil policy seemed to have worked. The amount of oil in municipal centralized heating systems, for example, had decreased from 90% in 1980, to under 40% by 1985. Most of the heating oil was replaced by bio fuels (forest products), coal, and large amounts of cheap electricity generated by nuclear power (Swedish Energy Administration 1986).

In the mid-1980's, industrialists argued that nuclear power should be used beyond 2010 whenever possible, to maintain the cheap electricity needed to maintain the profitability of many Swedish manufacturing companies. Further support for the maintenance of nuclear power was seen in studies by the nuclear industry, showing that reactors would soon become profitable, despite over budget construction costs of the last two reactors. The Chernobyl accident of 1986, however, caused a dramatic upset in this increasingly pro-nuclear scenario.

2.3 Chernobyl and after

Following the Chernobyl accident, which spread radiation over wide areas of northern Sweden, contaminating reindeer, mushrooms, and fish (Broadbent 1986), there was general confusion and renewed fear over the role of nuclear power. This rising antagonism was illustrated in a 1986 survey (SIFO) where sixty percent of the Swedish public voiced their opposition to nuclear power (Biel et al. 1989). The Prime Minister, Ingvar Carlsson, was among those who voiced anti-nuclear sentiments (Flavin 1987). The Chernobyl accident also led the public to listen once more to the anti-nuclear lobby.¹⁵

By the spring of 1988 Birgitta Dahl (Social Democrat), the Environment and Energy Minister and an anti-nuclear activist, stated, with little initial parliamentary debate, that two nuclear reactors (one at Ringhals and one at Barsebäck) would be phased-out by 1996 as a first step in the removal of all twelve reactors by 2010 (Social Democrats 1989). Dahl's views were echoed by the Prime Minister and by much of parliament itself—where the Center Party, Communists, and Greens (who crossed the 4% support threshold to enter parliament in 1988) shared her opinion. However, there was little support from within the Social Democratic Party, or from the general public, for her accelerated phase-out schedule. In August of 1989, two powerful trade union officials, Stig Malm and Rune Molin (the Director and Vice-Director of the Swedish Trade Union organization), stated that an early phase-out of nuclear power would cause electricity prices to at least double causing severe economic and employment problems. Due to increasing political and public opposition to an accelerated phase-out of nuclear power, Rune Molin, one of those officials, replaced Birgitta Dahl as Energy Minister in January 1990, effectively terminating the discussion of the accelerated phase-out.

Concurrent to these developments in 1987, the government passed the Natural Resource Law, which stipulated that the four remaining free flowing rivers would be protected from hydro electric development for all time. This law was also passed at a time when certain elements within the labor unions were in favor of damming up one, if not two, rivers for hydro-electric production.

Real electricity prices in Sweden had actually fallen from 1978 to 1986, before stabilizing in 1988. The cheap electricity was a result of a number of intertwined variables:

1. Large amounts of hydropower were being generated from already discounted hydro-electric infrastructures enabling the hydro-electricity to be virtually free, as the production cost of electricity did not reflect any capital costs, but only the operation and maintenance costs (Vedung 1988). As a result, although nuclear power had high capital costs as well as larger

¹⁵ Additionally, two years after the Chernobyl accident, the Swedish public expressed anxiety about eating reindeer meat, seeing it as radioactive (Löfstedt and White 1990).

maintenance costs than hydropower, the price of electricity had to be uniform across the nation, causing the hydropower sector to, in effect, “subsidize” the nuclear power sector.

2. There was also a large surplus of electricity on the market due to miscalculations of the utility industries who foresaw greater growth in the electrical sector than had actually occurred.
3. Sweden had limited export possibilities, since most of its neighboring countries had enough electricity to meet their own needs (Norway even has a surplus of electricity). Also, since there were no large cables connecting the Swedish mainland to continental Europe at the time, the Swedish utilities were barred from the lucrative German market.

The cheap electricity caused two distinct problems: First, as electricity remained cheap, companies and utilities saw little incentive to promote energy conservation or to invest in renewable energy technologies. Energy was still conserved, due to the stringent building codes (Tyler and Schipper 1990), but research and development of new renewable energy technologies diminished significantly (Grubb 1989, Melander 1990). Second, the electricity intensive industries (pulp, paper, aluminum, and steel), also the largest Swedish net exporters, experienced a boom period in the 1980's and became heavily dependent on the cheap electricity. As the renewed discussion of nuclear phase-out escalated, some large companies (eg. Stora, MODO, SCA) threatened to move their production sights abroad where electricity prices were lower.^{16 17}

To add to the policy squeeze on electricity production, Sweden was striving to meet the Toronto Agreement calling for a twenty percent reduction of carbon dioxide by the year 2005. To facilitate this the government passed a bill in late 1988 stipulating that carbon dioxide emissions be maintained at 1988 levels (the bill was later modified so that the carbon dioxide emissions will be stabilized by the year 2000 instead of being maintained at 1988 levels). This bill, supported by the Conservative, Green, and Communist parties,¹⁸ was passed to block the attempts of Dahl and other anti-nuclear advocates to phase-out nuclear power and replace it with fossil fuels (Vedung 1991b). In Sweden's case this would be mainly natural gas imported from Norway or the Soviet Union, and coal imported from Poland, USSR, and the United States.

The confluence of outside events, domestic politics, existing policies, and subsequent policy decisions, have brought Sweden face to face with the following energy dilemma:

- a) Nuclear power may be phased out in Sweden by 2010, if not sooner; while
- b) no more free flowing rivers will be harnessed for hydropower purposes; and
- c) fossil fuels cannot be used to replace the electricity lost as this will substantially increase carbon dioxide emissions, which the government has pledged to stabilize by the year 2000; and
- d) other renewable energy sources do not seem to be economically viable or acceptable by the larger utilities; and
- e) energy conservation is an alternative that has already been widely implemented; while

¹⁶ An example of this is Stora's acquisition of Feldmühle Nobel, a large German paper company in the spring of 1990.

¹⁷ In several cases the uncertain policy situation has prevented the utilities offering energy intensive companies more than two-year contracts for electricity—greatly inhibiting the ability for energy intensive industry to invest. Meanwhile, Norway and France have offered Swedish pulp firms 20-25 year electricity contracts with prices that are similar, or lower than those in Sweden (Olofsson 1990).

¹⁸ Although the Socialists controlled the government, they did not have an absolute majority: in recent elections the Socialists have gained power with the help of the Communist Party. On this occasion, however, the Communists voted against the Socialist Party.

Table 1: Electricity consumption: breakdown by sector (1989).

	TWH	%
Industry	51.0	37
Public Sector	24.0	17
Heating	27.0	19
Household	15.0	11
District Heating and Refineries	7.5	5
Transportation	2.6	2
Losses	11.0	8
Total	138.1	100

Source: Vattenfall 1990.

- f) the importation of electricity is not in the long term a lucrative alternative as it is likely that all excess electricity in Scandinavia will go to the highest bidder.

2.4 Implications

Sweden currently consumes around 138.1 Tera Watt Hours (TWh) [one billion kilo watt hours] of electricity per year (Table 1). With a total production of around 142.5 TWh (Table 2), this gives a surplus of 4.4 TWh, which is sold to neighboring Scandinavian countries. The phase-out of nuclear power will, overall, decrease electricity output by 73.5 TWh (Table 2), while the market demand is projected to increase at around 6% per annum over the same period.¹⁹

3 The Energy Policy Situation Today

3.1 Resolving the dilemma

As Swedish policy makers seek to reconcile the energy policy decisions of the past, sharp divisions between various political groups, among policy makers themselves, and between policy makers and the general public have appeared. The ongoing debate has produced five alternative scenarios.

1. *Postponing the phase-out of nuclear power:* The 1990 Socialist Party congress decided, following intense pressure from the trade unions, that the 1996 phase-out of two reactors would be postponed. In January of 1991 this was ratified by parliament.
2. *Annuling the carbon dioxide agreement:* A movement within the Socialist government, the Center Party and certain environmental groups supporting this option has emerged. The emission levels stipulated in the 1988 carbon dioxide agreement would be exceeded in order

¹⁹Due to an extremely mild winter, and because of an economic recession, electricity consumption increased by only 1% in 1990.

Table 2: Electricity production: breakdown by sector (1991)

	TWH	%
Nuclear	73.5	51.5
Hydro	62.3	43.7
Oil Condensing Gas Turbines Combined Heat and Power		
Industrial Backpressure Coal	6.7	4.8
Total	142.5	100.0

Source: Energimagasinet 1992.

to phase-out nuclear power and replace it with fossil fuels.²⁰ The global environmental wisdom of such moves has been highlighted by recent studies that indicate it would be more economical for Sweden to finance carbon dioxide and other emissions abatement in foreign nations than at home (Swedish Energy Administration 1989).²¹

Despite the policy uncertainty surrounding this alternative, Swedish utilities have pressed ahead with the development of gas-fired and coal-fired generating capacity. In terms of coal-fired co-generation plants, the one that has received the most attention in the recent year is Stockholm Energi's plant located at Värtan. Although it is considered to be one of the most sophisticated plants built to date using state of the art fluidized bed combustion and advanced scrubber technology, it still produces large amounts of carbon dioxide.

In recent years, most discussions of fossil fuels have centered on natural gas. Based on economic analysis, the State Power Board, along with other utilities, has built a natural gas pipeline from Denmark to Malmö and then from Malmö to Gothenburg. This extends the potential use of gas imported from Denmark. The utilities argue that, although natural gas would increase carbon dioxide emissions, it will be the cheapest form of electricity to replace nuclear power.²² Others argue, however, that a large influx of natural gas onto the Swedish energy market is a further attempt by the large utility companies to consolidate their power in the energy sector (Kaijser et al. 1991).²³

3. *Annuling the hydropower agreement of 1987:* Many trade union officials, utility managers, and certain industrialists favor harnessing the four remaining rivers for hydropower as the only realistic alternative if nuclear power is phased-out. There are several advantages of

²⁰The Greens are split concerning this issue. At the party congress in June 1990, some members wanted to back down on the agreement to limit carbon dioxide emissions in order to phase-out nuclear power, while others believed that it could be phased-out without annulling the carbon dioxide bill.

²¹In this study the Swedish Energy Administration concluded that, in terms of pure economics, one would gain more by installing pollution control devices on Polish power plants (which currently do not have any such devices) than by investing on similar measures for Swedish plants (which already have state-of-the-art scrubbers installed).

²²It is also a much cleaner fossil fuel, and if nuclear power is not phased-out as planned, the policy makers argue that it should still be introduced as a replacement for coal and oil.

²³It should be remembered that although natural gas was successfully installed in homes around Malmö, mainly because gas lines remained from the town gas era (in fact Malmö, Helsingborg, and Lund still had town gas companies operating at the time natural gas was introduced) it is doubtful if it could make inroads in areas where there are no existing local pipelines (Kaijser 1988).

constructing large scale, hydro-electric schemes. Firstly, to do so would provide 35 TWh of energy, roughly the equivalent of six nuclear reactors and provide many jobs in the economically depressed regions of the north. Secondly, hydropower has already established itself as a profit maker with the utility companies, and there is a great deal of experience in the building and maintenance of dams. Thirdly, most of the hydro-electric schemes could be quite easily connected to the national grid, reducing the cost of installing new power lines. Fourthly, hydro-electric schemes are considered to be a centralized power source, meaning that they are controlled by the utility companies themselves, rather than by individuals: this preserves the source of financial power of the utility companies (Kaijser et al. 1991). Fifthly, studies show that a hydropower build up would be economically feasible, with the electricity produced accruing costs similar to those of on-line nuclear plants, and lower than those of fossil fuels or renewable energy sources (SOU 1990). Lastly, proponents suggest that the power companies constructing hydro-electric dams have learned from previous mistakes, so future hydro-electric schemes will be much more environmentally benign.

Opponents argue that the four rivers were not built-out initially because of high costs, and by doing so now would incur greater costs and serious environmental damage. All the political parties (except a few socialists) oppose this alternative.

4. *Expansion of energy conservation and renewable energy sources:* Certain academics, as well as the Green Party, believe that nuclear power can be phased-out with the development of new renewable energy sources (such as biomass and wind) and by energy conservation measures (Bodlund et al. 1989, Johansson 1990, Lönnroth et al. 1980).²⁴ This effort has been funded mainly by the Swedish State Power Board through a 373 million Swedish crowns (SEK) energy conservation program (Vattenfall 1988) and a billion SEK biomass program. Preliminary results show that energy conservation could reduce the electricity consumed by 10-30% (depending upon how optimistic one is) (Vattenfall 1990). Renewables could replace the remainder with projected price increases ranging from zero to over 200%.^{25 26}

The incorporation of renewable energy sources, especially biomass, into the Swedish energy mix will not be easy. Those in the pulp and paper industry have attacked the State Power Board's biomass plan. They claim the scheme removes valuable raw materials from the pulp and paper industry, where the net capital return is much higher than use for electricity generation (Malmeblad 1989). However, the recent declines in pulp and paper prices (resulting from over production) (Sundberg 1991) undermine this argument. Secondly, incorporating renewable energy sources into the Swedish energy market, means that there will be a massive influx of decentralized energy sources, ultimately resulting in the transfer of financial power from the utility companies to the individual power producers. Thus, it will be difficult for renewables to make inroads on the Swedish energy scene, as the utility companies are against their introduction (Kaijser et al. 1991).

5. *Importing electricity from other nations:* The final alternative favored by certain nuclear activists, as well as some utilities, is to import energy from neighboring countries to replace that lost when nuclear power is phased-out. In theory this could be done. A cable (capacity

²⁴The renewable energy debate is by no means new: in the 1970's renewables were discussed in terms of decentralized (renewables) vs. centralized (non-renewable) energy technologies. Academicians favored the former option due to its flexibility and less state control (Johansson and Steen 1978, Lönnroth 1977 and 1980).

²⁵Studies do, however, indicate that past projections for renewable energy have not been realized. It was planned in 1978, for example, that by 1990 2000 Giga watt hours (GWh) should be produced from wind power and 3000 GWh from solar. However, today only 4.6 and 25 are produced respectively (Melander 1990).

²⁶This wide range of price change depends upon the person/organization creating the scenario. People in the nuclear and energy intensive industries have calculated 200%+ price increases, while various environmental groups and the Green Party show scenarios with no price increase.

500 MW) now links Forsmark and Nadendal, although built to export electricity to Finland it could be used by Sweden to import power. At present this is unlikely as Finland currently has an electricity shortage. The recent application (in principle) by Perusvoima Oy to build a fifth nuclear reactor could, however, change this situation (Wahlström 1991b). More electricity could also be imported from Norway: currently about 2-4 TWh is imported each year. The Swedish State Power Board has recently signed an agreement with Norwegian Statkraft to buy an additional 2.4 TWh starting in 1995 (Fossekallan 1990).

Sweden is a member of the Nordel agreement allowing the country to trade electricity with its Scandinavian neighbors at stable, low prices. The future purchase of electricity under this agreement may be hindered as Sweden and other Nordic countries become more closely integrated with the European Community. For example, in early November, Sydkraft, the second largest utility in Sweden, signed an agreement with Preussen Elektra, a large German utility, to install a cable with a capacity of 500MW between the two countries. This will enable Germany, with its high domestic energy prices, to buy cheap Norwegian and Swedish hydro-electricity. This cable, and possibly others, will invariably lead to higher electricity prices in Sweden as excess energy production is sold to the highest bidder, rather than selling it cheaply to domestic energy intensive industries (Froste 1991, Kolare 1990).

3.2 Critique of alternatives: the role of public opinion

In economic terms it would seem wise to delay the decision of when to phase-out the twelve nuclear reactors, as the potential of alternative electricity sources to meet the shortfall is so uncertain (Swedish National Energy Administration 1990). Furthermore, the general public welcomes such a decision. As of July 1990, surveys indicated that 47% of the population favored nuclear power compared to 35% against, and in November 1990 and in June 1991, 57% of the Swedish public favored nuclear power to 2010, if not beyond (Dagens Nyheter 1991, TEMO 1990).

Annuling the carbon dioxide bill in order to phase-out nuclear power would have serious environmental consequences. With increased fossil fuel use, carbon dioxide and nitrogen oxide emissions will increase, exacerbating the problems of the greenhouse effect and acid rain. Additionally, one can make a strong case that by June 1992 all European nations, with the exception of the United Kingdom, will agree to comply with the Toronto accords (calling for a twenty percent reduction in carbon dioxide emissions). In this case Sweden would face European-wide opposition to building new fossil fuel generating capacity. In recent studies by the author, results indicate that the general public is against the tearing up of the carbon dioxide agreement. They, by a margin of almost 3-1, would like the carbon dioxide emission cap to be kept, as they are concerned about the changes in nature and preservation of bio diversity both in Sweden and abroad (Löfstedt 1990a and 1992).²⁷

Harnessing the four remaining rivers appears to be a viable economic alternative on paper. However, it too would cause environmental damage which can be seen as unnecessary, if more environmentally sound electricity production technologies can be found. Furthermore, it must be remembered that Sweden is the only country in Europe which still has remaining a set of large unregulated free flowing rivers and therefore they could be considered a vital part of the European heritage. Finally, the issue of political ethics is again raised in this case, as the rivers are protected by a law with wide political and public support (Löfstedt 1991a).

²⁷These results are supported by a November 1990 survey conducted by SIFO, indicating that over 60% of respondents were opposed to tearing up the carbon-dioxide agreement to allow the phase-out of nuclear power (*Svenska Dagbladet*, 1990.)

Perhaps the most valid alternative is to expand energy conservation and renewable energy sources. In the short-term it is still considered utopian by the Swedish utilities and industry, as well as by several energy experts (Moghissi 1991, Weinberg 1981). A certain percentage of energy could be conserved, and a certain amount generated from renewables, but it is unlikely that all the electricity lost in a nuclear phase-out could be replaced by this alternative in the short term. A longer-term view of this option, however, suggests its real potential. In order for this to occur, energy policy makers must understand that the environment, the economy, and energy use form a unified system. This means that energy costs of various production sources will reflect their true cost, enabling renewables to be more competitive in the market (Linberg 1977 a and b). The general public, by a large majority, favors this alternative, and would be willing to conserve more energy wherever possible (Löfstedt 1990, 1991b).

Importing energy seems viable at first glance, but the attendant increasing trade deficits would not be conducive to such an alternative. The global dimension of environmentalism is also raised by this option. It can be said to be of greater environmental importance, from a global point of view, for Sweden to keep its nuclear power plants than to import electricity that has been produced by coal from Germany. Importation of electricity from other countries also raises the problem of security, as supplies are unlikely to be as reliable as domestic ones. The public are in general against this alternative as they want Sweden to be independent in its use of energy sources.²⁸

3.3 The 1990-1991 Energy Commission: a government response

Despite the many political and policy conflicts, the government has been moving to resolve the energy dilemma. Based on the findings of the Commission, composed of energy experts from the Social Democrat, Center and Liberal Parties, Parliament approved an amended energy policy in early 1991 (Riksdagen 1990-91).

Firstly, it was decided that the nuclear phase-out will not begin by 1995-96, and nuclear power may remain after 2010. It will only be phased-out if the Swedish economy or work force will not suffer any ill consequences. This stipulation has been considered to be a face-saving clause for the political parties of the Commission. The Center Party, the most anti-nuclear of the three, can make the case that a nuclear phase-out will still begin in 1995, as they state there will be no negative effects on the economy by so doing. The Liberals, on the other hand, can equally claim that no nuclear reactor will be phased-out until long after 2010, as they believe that an early phase-out will damage the Swedish economy.

Secondly, the decision was taken to remove the carbon dioxide ceilings set at 1988 levels, as the Commission believed that 1988 levels had already been surpassed in 1990. Despite statistics to the contrary, from the Swedish Environment Protection Board, it was decided to be neither economically nor technically feasible to maintain the ceiling. Instead a greenhouse gas emission cap is proposed, in which all the greenhouse gases (carbon dioxide, methane, nitrogen oxide, and various CFC's) are combined. Such a cap will be far easier for Sweden to adhere to due to its plan to phase-out all remaining CFC's in accordance with the Montreal protocol. Furthermore, as CFC's have a longer life time than any other greenhouse gas, a complete phase-out will actually allow Sweden to *increase* carbon dioxide emissions by twenty percent without going beyond the 1990 greenhouse gas emission cap (Eriksson 1991).

Thirdly, three and a half billion SEK will be put into research and development of renewable energy sources and energy conservation techniques. Additionally, nine hundred million SEK will be invested in two prototype ethanol factories in an attempt to reduce Sweden's reliance on

²⁸In a recent study, for example, respondents indicated that they would be willing to conserve energy in order to help the Swedish economy (Löfstedt 1991b).

fossil fuels.²⁹ These measures are deemed essential for a nuclear phase-out, and they attempt to answer the critics who have suggested that from 1980 up to now there has been little government attention to these areas.

4 Public Participation

Energy policies in Sweden are largely decided by experts in the various political parties, those from the former Swedish Energy Administration, and some selected academics, but with little or no input from the general public. Policies vary depending on which part of the political spectrum they originate from, and with personal or institutional convictions about nuclear power.

The views of those outside of this group; including industry, business, the general public and the non-governmental sector are seldom solicited. Even when these groups are consulted, as in the case of the nuclear referendum, their input is not effectively incorporated into policy making. Thus, little time or effort is spent in informing the public of policy choices or in making decisions realistic for their needs.

The former Center Party leader, Fällidin, had firm moral, anti-nuclear beliefs. Along with the anti-nuclear movement within the Center Party, Fällidin devised fantastic non-nuclear electricity scenarios. These led the party—at the height of the 1976 election campaign—to promise that all of Sweden's nuclear reactors would be phased-out by 1985. Their reasoning was that a 50% saving in energy use could be achieved, at no cost to society, through residential conservation (Vedung 1980a and b, 1988). However, no data on the feasibility of such a large domestic energy saving exists for that time (Vedung 1980a).

Academicians have also advocated energy policies with little practical feasibility. An energy scenario for the year 2000 based almost wholly on solar energy (Johansson and Steen 1979), although technically feasible on paper, took little account of the large and costly changes in infrastructure (eg. solar panels on residential structures) or social implications of such changes (eg. driving battery powered cars).

The elitism discussed above illustrates politicians disregard of public opinion. The democratic nature of the country's government implies that policy makers are accountable to the public (Wahlström 1991a), but as the Swedish policy system is considered to be consensual, rather than adversarial, most political decisions take place behind closed doors with little input from the public (O'Riordan 1985, Sahr 1985).³⁰

The argument has been made that the public, by exercising their right to vote in elections and referenda, do actively participate in the policy making process (Lindberg 1977a and b). However, the public's influence exerted through this process is much more theoretical than practical. This is illustrated particularly with referenda.

A consultive vote was held in 1955 to see if the Swedish public wanted to "fall in" with the rest of Europe and change to driving on the right hand side of the road. They voted overwhelmingly (82.9%) to keep on driving on the left side. However, in 1967 the government went against the public consensus and passed a law to make the Swedes drive on the right. Similarly with the 1980 nuclear referendum, it is likely that the policy makers will not abide by it. Thus I would argue that public participation in the development of Swedish energy policy has had only a

²⁹These prototype ethanol factories may not in fact be viable. The Swedish farmers union has advised its members not to supply them as the factory price will be below production costs (Johansson, A. 1991).

³⁰One reason for the closed door policy is the policy makers belief that the general public has little ability to understand complex problems, and tend to respond emotionally to various energy issues concerning risk (NRC 1989).

minimal role. The consensual approach has led policy makers to assume that decisions will be accepted by the general public; it has gone so far that policy makers expect to shape attitudes and educate the public rather than, as in the United States, simply to influence them (Kelman 1981).

As policy makers themselves are divided about energy issues (an example is the split within the Social Democratic Party), the general public, subjected to widely conflicting information, has become disillusioned. Thus, the public expresses concern over the inadequate information they receive from policy makers, the media, etc. on various energy issues (Löfstedt 1991a). In a recent survey conducted by SIFO, for example, results indicated that the public are much more distrustful of the politicians than they were prior to the 1988 general elections (Ljungberg 1991).

The issue of poor communication between policy makers and the public is mentioned by several researchers (Boehmer-Christiansen 1990, Wahlström 1991a).³¹ Over recent years policy makers have not sought to gain further understanding of the topic as public opinion has not created a demand for energy research (Andresen 1989). The government's decisions to cut all funding (in 1990) to the Council of Energy Research (Energi Forsknings Nämnden) to integrate (in July of 1991) the Energy Administration's functions into an umbrella research/industrial organization, and the sale of the State Power Board all point to a decrease in energy research (both the Swedish Energy Administration and the Council for Energy Research provided sizable funds for academic organizations).

The Greenhouse Effect Example

The discussion of the greenhouse effect well illustrates the general public's lack of knowledge on energy and environment issues. Although probably the most widely discussed environmental problem, global warming has not been addressed by Swedish policy makers at the national level.

In the summer of 1990, the author conducted a study in the town of Umeå, Sweden, concerning people's knowledge of the greenhouse effect. The results indicated that the general public had a minimal understanding of the causes, consequences, and ways to prevent global climate change. Although similar results have been reported elsewhere (Childs et al. 1988, Kempton 1991) the results are surprising for Sweden, as one would expect the Swedish public to be more knowledgeable for several reasons. Firstly, the Swedes are considered to be one of the most environmentally aware people in the world (Västerbottens Kuriren 1990). Secondly, the nuclear power debate has brought to their attention the implications of alternative energy sources, including the use of fossil fuels and resultant increases in carbon dioxide emissions.

However, the results are supported by a local media analysis. The most widely read local paper (Västerbottens Kuriren), over the year prior to the study, carried only 13 articles discussing the greenhouse effect (Löfstedt 1991b). This figure is very small when compared with other newspaper sources such as The New York Times which carried eighty articles over a similar period (Kasperson et al. 1990).³²

While the Swedish public remain ill informed, policy makers may make decisions that the public

³¹It should be remembered that the Swedes follow a type of party discipline, in that they cast their votes for a political party rather than for an individual. The political system is devised such that there are 27 political districts, with each party having a ranked list of potential candidates in each district. The more votes a party receives in a district, the more people from its list will have a seat in parliament. Thus, there is less emphasis on individual candidates, as it is the parties' local strength that determines who becomes a member of parliament. This system is widely different from that in the United States, where the political future of the individual is determined much more by their campaigning ability (Sahr 1985).

³²Although not directly comparable in terms of style or circulation to the New York Times, the Västerbottens Kuriren represents a major news/information source in the area of Umeå, as does the New York Times for the United States.

would not accept if they had more access to information. In 1988 Sweden signed the Toronto agreement which called for a twenty percent reduction of carbon dioxide emissions by 2005. In order to achieve this goal the Swedish government passed a bill requiring stabilization of carbon dioxide emissions at 1988 levels. However, in January of 1991 that same Swedish government revoked the bill as a result of economic concerns. The Swedish government believed that it would be much more economical for Sweden to finance carbon dioxide emissions abatement in foreign nations than at home. However, only a month previously, a SIFO survey showed that more than 60% of the public were in favor of the carbon dioxide cap. Additionally, only six months earlier, the Swedish public had expressed fear of the greenhouse effect (Löfstedt 1991b and 1992.) This illustrates the government's failure to recognize public opinion in the decision making process, and to communicate accurate information about policy options.

The idea of effective public participation thus offers an expeditious way to address the current energy policy dilemma. It would force policy makers to increase their knowledge of energy and environmental issues so as to give realistic responses to public questions, and give a greater openness to the whole policy debate (Andresen 1989). And as such, it would provide a basis for overall policy formation that is likely to be sustainable and effective in the long term (Prins 1990).

5 Conclusions

Swedish energy policy can be characterized by controversy, elitism, and contradictory decision making. Decisions have been made without reference to the public, which goes against the values of democracy. In order for public participation to play a major role in the Swedish energy policy debate, the information flow between the policy maker and the person on the street must be increased and must be reciprocal. For this to occur, the policy maker must recognize that in the long term a one way information flow will not produce consensus and only lead to frustration (Stern 1991). Adopting this approach would mean that future energy policy is less likely to follow the incremental track, which has caused problems over recent years. Rather it would promote informed energy policies encompassing the needs of all the actors involved. Without such changes to policy formation, and as long as the Swedish economy can afford it, politicians will continue to press ideological and moral goals, and pass the real decisions to someone else's term of office (as Fällidin did); there will be no limit to muddling through.

If the public were to be consulted by policy makers (possibly through existing surveys and consultation with non governmental groups), the present energy policy situation would be much different: nuclear power would not be phased out until after 2010 (Dagens Nyheter 1991) (at which time energy conservation and renewables would be better placed to bridge the energy gap), the 1988 carbon dioxide cap would stay in place (Löfstedt 1991b, Svenska Dagbladet 1990), and there would be no more discussion of the build out of the four remaining rivers for hydro power (Löfstedt 1991a). Furthermore, there would be no energy dilemma.

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