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LEARNING TO LIVE WITHOUT NUCLEAR POWER

Sweden's decision to phase out its twelve reactors is put to the test

By Al Burke

Swedish voters elected in 1980 to phase out, eventually, the country's twelve nuclear power reactors. But plans to begin the process in 1995 have aroused anxieties about the economic consequences. Nuclear power now accounts for nearly half of all electricity production, and the search for alternatives has been complicated by strict environmental protection measures.

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LEARNING TO LIVE WITHOUT NUCLEAR POWER

THE TIME IS FAST APPROACHING for Sweden to begin preparations for the phase-out of its twelve nuclear power reactors and, to no one's surprise, it is a task that confronts the nation with some difficult choices. It also presents some intriguing opportunities, but those have yet to be fully illuminated by the public debate that has flared up around the doomed reactors. Although it seems to have generated more heat than light, that debate *has* managed to outline the thicket of relationships between energy consumption, natural resources, environmental pollution, and the international economy.

The phase-out is mandated by a 1980 special referendum, the result of a long campaign by anti-nuclear activists whose alarms had been partially certified by the 1979 accident at Three Mile Island in the United States. The referendum's winning alternative called for the eventual phase-out of all nuclear reactors, including the six then in operation and six more in various stages of construction. No specific schedule was provided, but a subsequent decision by Parliament stipulated a deadline: All twelve reactors were to be taken out of production by the year 2010.

Little has occurred since the referendum to increase public trust in nuclear power. Worldwide, the industry has been unable to keep crucial promises regarding safety, security and the disposal of radioactive waste, and there has been a steady stream of alarming reports— of serious accidents and near-misses, the unexplained disappearance of weapons-grade nuclear fuel, contamination of ground water reserves, radioactive liquids spilled onto public highways, etc. The most disturbing recent event was, of course, the 1986 Chernobyl disaster in the Soviet Union which — among its other effects and from a distance of over 1200 miles — deposited a persistent residue of radioactive debris in Swedish plants and animals.

Accordingly, the 2010 deadline remains in effect; but there is some dispute about pace and timing. Reasoning that problems of adjustment could be best avoided if the process were carried out gradually, Parliament voted in 1988 to begin the phase-out in 1995, with two reactors which will then have approached the limit of a somewhat arbitrary 25-year life span. But critics object that no adequate provision has been made for replacement of the electric generating capacity that would be lost, and that the reactors can safely be kept in operation for forty years, perhaps longer. The latter argument recently received a measure of support from the two government agencies charged with overseeing nuclear safety; they have declared an inability to specify any of the twelve reactors as significantly less safe than the others, and are therefore unable to suggest which two ought to be dismantled first.

The ruling Social Democratic Party is now sharply divided on the question of timing. Partly as a result, Prime Minister Ingvar Carlsson has appointed himself and three other key party members to an unusual special committee whose task is to find a political balance for the four cornerstones of current energy policy: nuclear phase-out, greenhouse gas restrictions, preservation of remaining wild rivers, and competitive electricity prices.

The price of watts

As things now stand, all twelve reactors will have to be gone by year 2010. The question of how to replace their generating capacity has become more difficult to answer since the 1980 referendum, because the nation has since become even more dependent on nuclear power — largely as the result of a policy decision to decrease the nation's dependency on petroleum products. The twelve reactors now account for 68 terawatt hours* per year, just under half of all electricity generated, and Sweden has become the largest *per capita* consumer of nuclear power in the world.

Finding a substitute is not merely a question of supply: The price has to be right. That may not be easy to arrange in the face of legal restrictions on both the emission of greenhouse gases and the further development of hydroelectric power (see page 3). There is, for example, a strong likelihood that the government will soon impose a special surcharge on fuels, such as oil and coal, which contribute to the global "greenhouse effect". That would mean an increase in the price of electricity, something of particular concern to basic industries such as mining and forest products; they are heavy consumers of electricity and account for a very significant portion of the nation's export earnings. On this issue, corporate and union leaders speak with one voice: A sharp rise in electricity costs would lead to competitive disadvantage abroad, and economic difficulties at home.

On the evidence of official statistics, however, it should be possible to nearly double the cost of electricity without adverse effect. According to the International Energy Agency, Swedes pay only slightly more than half the average price for OECD countries. But leaders of the basic industries contend that their international competitors benefit from secret contracts that result in prices roughly equivalent to those in Sweden. To which critics respond that, unfair competition or not, there are plenty of opportunities to compensate for higher prices through conservation and the use of more efficient technology.

It is a form of disputation that is familiar from past environmental debates. Every demand upon industry which implies some kind of additional operating cost tends naturally to be met with resistance — much of it due no doubt to the anxieties and unknowns of the marketplace. But Swedish industry has been more than adequate to the challenge of past environmental demands, and experience suggests that the only way to find out if basic industries can absorb higher electricity costs is simply to impose them and see what happens.

Some economists have even suggested that it would be less than disastrous if the historical trend in Sweden, away from basic industry toward an increased reliance on manufacturing, were to continue. They note that basic industries consume vast quantities of electricity, are often harmful to the environment, and are extremely sensitive to international market forces beyond their control. If they played a less important role in the national economy, there would be less pressure to tailor the power system to their demands. But that is hardly the kind of talk that wins elections, and it is unlikely that any public official will soon be heard justifying an increase in electricity prices on the grounds that it is good for chasing basic industry out of the country.

* One terawatt hour (TWh) equals one trillion watt hours, or one billion kilowatt hours.

Environmental constraints

The most pressing requirement at the moment is to find a replacement for the 9 TWh that will be lost if the phase-out begins with two reactors in 1995. At current world market prices, it would be a relatively simple matter to make up the loss with oil and coal. But that solution has been more difficult to apply since 1988, when Sweden became the first nation to legislate specific measures for combating the accelerating greenhouse effect. By a wide margin, Parliament voted to limit carbon dioxide emissions to the 1988 level. In addition, sulphur dioxide and nitrous oxide emissions are to be sharply reduced by 1995.

Although the electricity sector now accounts for only a negligible portion of total greenhouse gas emissions, that would change if nuclear power were to be replaced by coal and oil. It is therefore hoped that the increased use of fossil fuels for electrical generation can be minimized or avoided.

The fossil fuel dilemma has diverted some thoughts northward, to the four major river systems that remain unmolested by dams. Hydroelectric power is generally regarded as the cheapest and cleanest alternative available, and it is quite safe to humans. Roughly 70% of the country's potential hydropower has already been developed, and the four remote rivers represent a tempting portion of the remaining 30%. Their combined estimated yield is 15-20 TWh, which would go a long way toward compensating for the nuclear phase-out. It is a temptation which appears irresistible to leaders of four of Sweden's most influential labour unions, who last year called upon the government to dam the rivers in the name of international competition.

But there are substantial obstacles in the path of this solution, as well. By far the largest is yet another decision by Parliament, a 1985 ban on development of the four wild rivers. Political support for this decision is as broadly based as that for the restrictions on greenhouse gases, and it flows from an apparently large reservoir of public sentiment in favour of preservation. This is not the first time that the rivers have been proposed for sacrifice at the altar of electrification, and a well-organized coalition has emerged to protect them. The preservation movement has subsided in recent years, due to its success, but it retains many friends in Parliament and is now starting to percolate into action again in response to the latest threat.

Even were the wild rivers completely unprotected, they would not be able to satisfy the most immediate need. Hydroelectric development is a lengthy process, and it is very unlikely that new dams and transmission lines could be in place by 1995. There is, however, room for improvement to the existing network. It is estimated that one or two additional terawatt hours of hydropower can be extracted through more intensive use of rivers already developed, modernization of older power plants, and other measures.

That still leaves a large deficit to make up, but it may be possible to do so without adding further burdens to the environment.

Conservation and efficiency

By some accounts, the industrial world is in the early stages of a "quiet revolution" in the efficient use of energy. Sweden has already benefited from conservation measures adopted after the oil-price shock of the mid-1970s. Now, it appears that even greater savings can be achieved through the use of simple technology that is already available for a wide range of industrial machinery and household gadgets.

Adoption of the new technology can be as simple as changing a light bulb and offers the possibility of significant reductions in electricity demand. A typical refrigerator, for example, consumes between 300-700 kilowatt hours per year; but there are new models capable of the same cooling effect with only 100 kWh annually. Similar economies can be achieved by replacing incandescent light bulbs with newer "compact fluorescent" bulbs; these fit into standard sockets, but consume only 20% as much electricity for the same lighting effect.

The total savings available from the use of such energy-efficient devices has been investigated by a joint team of researchers from Lund University and Vattenfall, the state-owned utility company which produces half of the nation's electricity. The researchers have prepared several alternative projections which vary according to how rapidly and extensively the new technology is adopted, among other factors. The mid-range estimate suggests that total electricity consumption can be reduced from its current annual level of approximately 140 TWh, to 96 TWh by year 2010. The study concludes that if such conservation measures were combined with a major shift to biomass fuels (see below), there would be no need for nuclear power or additional hydropower, oil imports and greenhouse gas emissions could be reduced, and electricity costs would be lower.

Such findings have obvious significance for the current debate over price and supply. It is far easier on the environment and the pocketbook to conserve electricity than to build new power plants of whatever sort. Consumers need not be called upon to pay for additional generating capacity, and a factory or a household which reduces its consumption by half could absorb a 200% price increase at no additional expense.

There is not much debate as to the technical feasibility of dramatic savings through energy-efficient technologies. But there is some question as to whether or not the nation's homeowners and business leaders can be persuaded to adopt them. Toward that end, Vattenfall and several private utility companies are investing in a large-scale development and marketing effort, the purpose of which is to explain the advantages of the more efficient devices and make them available at affordable prices. The effects of that campaign should be measurable within the next two or three years.

Another "incentive" has just been imposed by the government — a value added tax (VAT) on all energy sources, the effect of which is to increase costs for retail consumers while maintaining low electricity prices for basic industry. It is hoped that higher prices will motivate greater conservation, but some studies indicate that the relationship between price and consumer behaviour is not always simple or direct. It remains to be seen if Swedish consumers will adapt to higher energy prices by reducing their consumption.

Biomass energy

Along with several others, the Lund/Vattenfall study recommends that Sweden look first to its forests and fields for any new energy requirements. Branches, bark, "junk" trees, straw and other vegetation already contribute the equivalent of 60 TWh in heat and electricity to the national energy budget, and there is great potential for more. Despite steady expansion of the forest industry, total forest reserves are increasing at the rate of 25 million cubic meters per year.

It appears that a fundamental shift in national farm policy will add even more to the supply of biomass. Last year, the government decided to eliminate tariff barriers and

direct subsidies for a number of crops that can be produced at lower prices in countries with warmer climates and cheaper labour. Now, Swedish farmers will have to match world market prices for such commodities as apples and grain, and many will not be able to do so. It is estimated that up to one million acres of farmland will be abandoned unless profitable alternatives can be found.

One promising substitute is "energy forest" with fast-growing trees that can be harvested in cycles of less than ten years for the production of heat and electricity. Possibly even more productive would be the conversion of familiar grasses to methane gas. Many farmers have already begun to experiment with such crops, and the area devoted to them is expected to increase rapidly during the next few years.

With or without new energy forest, current reserves are sufficient to generate large amounts of additional heat and electricity. The great environmental advantage, of course, is that the net contribution to the greenhouse effect would be zero, since the combustion of vegetation entails no greater release of carbon dioxide than is absorbed by its growth. According to a study by the Swedish University of Agricultural Sciences, the potential increase of biomass energy over the next ten years is the equivalent of 20-35 TWh.

Few experts dispute the general range of such estimates, but there are sharp disagreements over the ultimate cost. Gathering straw and shrubbery from all over the countryside is a far more cumbersome process than pumping oil from a hole or digging coal out of a pit. Storage areas per unit of heat value are much larger, transportation costs are higher, and something has to be done with the vast quantities of residual ash. For these and other reasons, sceptics maintain that the final cost of electricity from biomass fuels could be as high as three times current levels.

The experience to date of district power plants suggests that some sort of price increase can be expected. In response to the oil price shock of the mid-1970s, several communities installed such plants, which use biomass to heat water and generate electricity for local buildings. These district heating/electricity systems operate efficiently enough, but have been unable to compete economically with oil since its price subsided. That was before the new restrictions on greenhouse gases, however. The government is expected soon to impose a surcharge on fossil fuels that will eliminate their price advantage. The net result: higher prices for energy, in general.

Other alternatives

Importation of natural gas is likely to increase during the years ahead. It now contributes the equivalent of 5 TWh, and current projections are for that figure to increase to 20 TWh by 2000. Unfortunately, natural gas also adds greenhouse gases to the atmosphere — slightly over half as much as coal and oil. In addition, it takes a great deal of capital and construction to install a new distribution network, and environmentalists argue that its expansion will place non-polluting alternatives at a competitive disadvantage. As a result, the future role of natural gas is somewhat uncertain.

Wind power has recently been given a boost by a government study which concluded that it could replace up to half of the electricity currently provided by nuclear power. To do so would require the construction of 4000 wind generators, a third based on land and two-thirds in coastal waters. A pilot project in southern Sweden has performed reliably at a fairly competitive price for the past several years, and the government may soon introduce a subsidy for wind power that could make it attractive from an economic standpoint.

As for solar power, a country that bestrides the Arctic Circle is not a very promising candidate for its use — except during summer, when it is least needed for energy production. It is also, with current technology, relatively expensive. It is at present being used in some limited applications, primarily for heating water, but is not expected to play a major role in the foreseeable future.

If a clean and economical process can be found for gasifying coal, it may eventually become an important source, since world reserves of that fuel are so vast. Research into coal gasification is currently under way, and the same is true for wind and solar power. But there are at present no definite plans for using such alternatives to solve the nation's most urgent energy problems.

Doubtful commitment

On paper, at least, there should be no difficulty in replacing the 68 TWh that will be lost to the nuclear phase-out: Conservation and biomass alone can be reckoned to make up the entire deficit. But there is a great deal of scepticism about such reassuring calculations, and that may turn out to be more significant than any set of facts and figures.

Satisfying half of the nation's total electricity demand with alternative energy and higher efficiency would not be an automatic process. It would require a major educational effort to change habits and attitudes, conversion of existing power plants, research and development of new and diverse technologies, establishment of a "biomass industry", and much more.

Thus far, there are few indications that government and industry leaders are prepared to invest great expectations and large quantities of capital in any such transformation — certainly nothing approaching the level of investment that has been made in nuclear power. Vattenfall is a case in point: While it has set aside SEK 2 billion* over the next ten years for various biomass and conservation projects, it is planning to spend at least seven times as much on 10-12 TWh of new generating capacity based on fossil fuels, including natural gas.

Supporters of alternative energy complain that government funding for research and development of such alternatives has been inadequate, and the cabinet was recently shuffled in a manner to cause alarm in environmental circles. Responsibility for energy policy has been transferred from the Minister of Environment, who has been firmly committed to starting the nuclear phase-out in 1995, to a new Minister of Industry with decidedly more flexible views in such matters.

The new Minister of Industry was recruited from the second most powerful position in the national Trade Union Confederation, the traditional base of the Social Democratic Party. Along with other critics, he has characterized the 1995 phase-out starting date as "premature" and certain to cause economic problems. He has acknowledged the legal basis of the 2010 deadline, but with an evident lack of enthusiasm, and has urged development of at least one of the four wild rivers in the north.

Inevitably, the assignment of the energy portfolio to one of such inclinations has been widely interpreted as a signal that the government is preparing to seek a reversal or modification of Parliament's decisions on the nuclear phase-out.

* SEK 1 (Swedish krona) = USD 0.16 or GBP 0.10 (approximate values at date of publication)

If the government does alter its nuclear policy, that may become apparent when the special committee of four Social Democrats (see page 1) announces its findings later this year. Another indication will come this autumn, when the government is scheduled to present its assessment of the current energy situation, along with a detailed plan for replacing nuclear power.

Unanswered questions

It is already clear that there is substantial resistance to betting the nation's electrical future on conservation and alternative energy sources. That may be due, in part, to simple disbelief: The notion that the country might get out of its electrical fix with nothing more elaborate than a better light bulb and a mass of home-grown vegetation may seem too good to be true.

It would require something like a leap of faith to gamble the country's economic welfare on what many regard as a technological step backward. Critics are particularly sceptical about claims that demand for electricity can be made to decrease, since the historical trend has been in the opposite direction. Some studies suggest that demand can increase despite successful conservation programs and more efficient technology. This happens because new devices keep getting invented and marketed, new "needs" created and electrically gratified.

There is, however, at least one episode in recent history which illustrates that energy demand curves do not always describe a straight line upward. Industrial countries affected by the oil-price shock of the 1970s somehow found the means to severely limit their energy appetites; total energy consumption in the United States, for instance, remained fairly constant from 1973-1985, despite substantial economic growth. Such a result indicates that there is no simple relationship between economic activity and energy consumption.

For that and many other reasons, it is difficult to predict how much electricity the country will need by the year 2010, in addition to the 68 TWh lost to the nuclear phase-out. The National Energy Administration has projected an average increase of 2 TWh annually, but officials readily concede that such projections are entirely speculative. In fact, nobody knows.

This lack of certainty does not, however, prevent adherence to strong beliefs. That can be seen in reactions to one of the most thorough investigations of these issues to date, the Lund/Vattenfall study cited above (see page 4). It has been dismissed as hopelessly unrealistic by those who feel that conservation and biomass cannot replace nuclear power. The criticisms are based primarily on the historical trend toward ever-increasing energy consumption; but the study suggests ways to reverse that trend, and no one has yet specified in which particulars its conclusions are wrong. To a large extent, the study's implications have simply been ignored, with the result that a proposal with obvious environmental advantages — universally acknowledged to be of the highest priority — has yet to be thoroughly analyzed and debated.

That peculiar state of affairs could change at any time, of course. The current debate over energy policy is still at an early stage, and is expected to intensify in the months ahead — partly in consequence of the national election to be held next year. There are already signs of growing interest in the potential of biomass and conservation among former sceptics. The forest industry, for example, recently acknowledged that the energy potential from forest by-products is much greater than it had previously estimated.

Nuclear debate continues

There is one other solution to the problems posed by the nuclear phase-out: Don't do it. Nuclear power is now a trillion-dollar industry worldwide, and it comes as no surprise that the financial and professional interests it represents have been working energetically to protect their investments. Since it would be the first, Sweden's phase-out represents a crucial test case, with implications far beyond the nation's borders. That was underscored in February of this year, when the U.S. government took the trouble to declare the planned phase-out to be "incomprehensible".

In Sweden, the political and public relations efforts of the nuclear lobby have become increasingly conspicuous in recent years. Most of the arguments on behalf of the industry are familiar from past debates, but there is at least one new angle: Nuclear power is now being touted as a blessing to the global environment, since it contributes virtually no greenhouse gases to the atmosphere.

Nuclear opponents point out, however, that to achieve even a 25% reduction in greenhouse gas emissions would require thousands of new reactors. Associated construction and mining activities would consume large quantities of fossil fuels, and the resulting release of greenhouse gases would partially offset the presumptive benefits. Furthermore, uranium mining is an inherently messy business which, among its other effects, releases large quantities of sulphur dioxide and nitrogen oxide into the atmosphere. In any event, there is not enough fuel available for thousands of uranium reactors. Expansion on such a scale would require the creation of a plutonium economy with its attendant dangers of home-made atomic bombs, a security system of police-state (and probably inadequate) dimensions, and continual emissions of the most poisonous substance on earth. In addition, the risk of serious accident and the problem of radioactive waste disposal would increase proportionately.

The industry also maintains that the dangers of nuclear power have been greatly exaggerated, particularly with respect to the Chernobyl accident. Not a single death in Sweden has yet been attributed to the accident, and it is estimated that Chernobyl-related cancers will cause only two or three hundred deaths over the next 50 years. Nor are there are any signs of an increase in Swedish birth defects, as had been feared.

But critics note that four years is not an especially long time for substances, the half-lives of which are measured in decades or centuries. Nor do such events always have the good grace to occur thousands of miles away; trivializing Chernobyl by reference to its effects in Sweden is rather like arguing that there is little cause to fear a similar accident in this country because it probably would not kill many people in Ireland.

Even so, there have already been palpable consequences: the fish in 14,000 Swedish lakes will be unfit for human consumption for at least the next 30 years; mushrooms in large areas of the country have also been contaminated; the reindeer economy and culture of the northern Lapps have been severely affected; although no unusual pattern of birth defects has yet emerged in Sweden, strong statistical correlations with Chernobyl fallout zones have been detected in neighbouring Finland and Norway. As for the Chernobyl region, the devastation has been extensive and undeniable, and there are indications that it has been underestimated to date.

Costs and benefits

Probably the most effective argument on behalf of nuclear power is the oldest — that it provides large quantities of electricity at a low price. The country has been warned repeatedly that, without the cheap benefits of its reactors, Swedish basic industries will be priced out of the international marketplace and large numbers of jobs will be sacrificed.

But the alleged economic advantages of nuclear power have also been called into question. Crucial problems surrounding the dismantling of spent reactors and the disposal of waste have yet to be solved, or to be factored into the price equation; estimates of the ultimate cost keep rising. Of perhaps even greater significance is the statutory limitation of the industry's legal liability, which makes it possible to avoid insurance and compensation costs that reflect the actual risks involved. An attempt to privatize part of the nuclear industry in England has foundered on just this issue; no private company has been willing to assume the full burden of risk. For this reason, some critics have suggested that the easiest way to get rid of the nuclear industry would be to expose it to the full blast of the marketplace.

There are, of course, additional arguments both for and against nuclear power, and it may be assumed that they will all be presented with mounting fervour in the years ahead. At the moment, it appears that the industry is making some progress in its struggle for public approval. A recent opinion poll found that, although 70% of the respondents were still opposed to nuclear power in the long run, two-fifths of those (28% of the total) now feel that it should be retained until some indefinite time after the 2010 deadline. That represents a significant shift in public opinion, and it has raised hopes among nuclear advocates that the phase-out decision might eventually be reversed. There are twenty years remaining until 2010 — only four have elapsed since Chernobyl — and a new referendum on the issue is far from unthinkable. The two leading opposition parties have already urged such a national reconsideration.

The international context

Sweden's nuclear industry is probably on its safest ground when it seeks to distinguish itself from its counterparts in other countries. Its reactors are superior in design, the training and performance of its personnel have been exemplary, government supervision has been strict, and there is no recorded instance of radioactivity being accidentally released. All of which suggests that the first nation scheduled to phase out nuclear power is among the last that should be required to do so. That paradox appears even more bitter to industry supporters when they contemplate the pro-nuclear climate in competitor nations. One of those is France, which maintains an office in Stockholm for the purpose of attracting Swedish industry; the availability of cheap French electricity, much of it derived from nuclear power, is a prime selling point.

Sweden's restrictions on greenhouse gas emissions raise a similar issue. There are only 8.5 million Swedes, and each is on average responsible for adding 2.2 metric tons of carbon to the atmosphere annually. There is not much they can do to offset the effect of 260 million U.S. residents adding 5.5 tons *per capita* annually, or that of China's one billion adding 0.5 ton *per capita*. Nevertheless, a broad coalition in Parliament has determined that Sweden should provide an example of responsible behaviour in protecting the biosphere.

There is some hope that the United Nations environmental conference scheduled to he held in Brazil in the summer of 1992 may yield a strategy for dealing with such problems at the international level. In that case, the energy debate within Sweden would almost certainly be affected. If, for instance, other nations agree to adopt similar measures, electricity price competition could well diminish or disappear as an issue.

Assuming that Sweden manages to solve its immediate energy predicament in one way or another, there remains the question of what happens after 2010 and beyond. Exactly how much energy can be extracted from the earth and sun, and how much poisonous waste can the biosphere tolerate?

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Appendix: The shape of parliamentary debate

The energy debate in Parliament is expected to intensify during the coming months, partly because the issue is ripe and a national election is due next year, but also because 1990 has been set as a "checkpoint" in the nuclear phase-out process. Sometime this autumn, the government is expected to present its assessment of the current energy situation, along with a detailed plan for replacing the generating capacity of the nuclear industry.

Of the issues discussed here, the least controversial is the fate of the four wild rivers in the northern part of the country: All six parties are formally opposed to developing them for hydroelectric power. Thus far, the strongest pressure for development has come from the leaders of labour unions connected with basic industries. But that is of considerable significance, since the labour movement is the traditional base of the ruling Social Democrats. Party leaders have been accused of stifling internal debate on energy issues, and some powerful labour leaders are visibly nervous about the employment implications of the nuclear phase-out. It is not improbable that such internal divisions will also become apparent in other parties as the debate unfolds in coming months.

For the moment, however, all six parties represented in Parliament have declared themselves on three key issues: phasing out nuclear power, alternative energy and conservation, and tax policy. In brief summary, their positions are as follows:

Social Democrats (156 votes in Parliament)

Nuclear phase-out: Despite growing doubts among some elements, the party as a whole retains its formal commitment to a complete phase-out by 2010, with the process to begin in 1995.
Alternative energy: Increased diversity of energy sources and a shift to smaller scale generating units, coupled with a major investment in improved conservation technology.
Tax policy: Value added tax (VAT) on all energy sources; this places the tax burden on Swedish consumers in order to maintain low electricity prices for basic industry. In addition, greenhouse gas surcharges on polluting energy sources such as oil and coal; this is intended to make alternatives such as biomass and wind power more economically competitive.

Conservatives (66 votes)

Nuclear phase-out: The party feels that current estimates of nuclear reactor life span are based primarily on accounting considerations. Favours keeping the present twelve reactors in operation "as long as they are safe". No immediate demand for additional reactors, but feels that government policy violates 1980 referendum.
Alternative energy: Viewed as potentially significant in the distant future, but not adequate to replace the present nuclear industry.
Tax policy: Argues that the government is using taxes and surcharges to finance tax reform of 1989. Recommends uniform VAT and surcharge on carbon dioxide, to the advantage of non-fossil fuels such as biomass.

Liberals (44 votes)

Nuclear phase-out: Not necessary to start phase-out in 1995. Favours keeping all reactors in operation until 2010, then reassessing situation after more data is collected.
Alternative energy: Emphasis on rapid development of biomass and improved conservation techniques.
Tax policy: Same position as Social Democrats.

Centre Party (42 votes)

Nuclear phase-out: Favours complete phase-out before 2010; will specify date after government presents its assessment this autumn.
Alternative energy: Recommends heavy investment in all non-polluting alternatives, including biomass, solar and wind. Accepts replacement of natural gas for oil and coal.
Tax policy: Objects to VAT on biomass and other non-polluting sources, arguing that they need special treatment in order to become economically competitive. Prefers direct taxation on energy consumption by businesses as means of stimulating conservation measures.

Communist Party (21 votes)

Nuclear phase-out: Complete phase-out by 2000, *if* alternatives in place.
Alternative energy: Emphasizes higher efficiency, plus investment in biomass, wind and solar.
Tax policy: Surcharges on all environmentally harmful sources, including nuclear. Special treatment for biomass and other non-polluting fuels. Sharp price increases, with rebates to businesses that improve efficiency.

Green Party (20 votes)

Nuclear phase-out: Favours shutting down three reactors immediately, and all twelve within the next three years. Argues that nuclear danger outweighs Sweden's contribution to greenhouse effect. Willing to allow increase of greenhouse gases during next few years, but has presented plan to reduce fossil fuel consumption by 85% within next 25 years.
Alternative energy: Emphasis on conservation technology and biomass. New natural gas installations should be avoided, since they will divert scarce investment funds from less harmful indigenous sources.
Tax policy: Favours special treatment for all indigenous, non-polluting, recyclable sources. Wants surcharges on all polluting emissions, not just greenhouse gases; e.g. lead and mercury.