Sweden's Energy Policies
By Ken Altrell*

The climate of the earth is slowly but undoubtedly becoming warmer.[1] Many inhabitants of the northern latitudes would probably welcome this fact, but the development carries potentially serious consequences for human life here on earth.

Some of the changes may not sound dramatic viewed from a short-term perspective and makes it difficult for politicians to receive consensus in regard to changes in energy-policies that will be required, but by the time today's newborns are retired circumstances will have drastically changed.

The ice expansion in the Arctic has diminished successively since the 1950s. Most glaciers on the planet are decreasing in volume. Torrential rains and floods are becoming more common. The dessert regions are spreading out.

The UN's climate experts express concern regarding increasing climate changes: since 1860 the average temperature has increased by 0.6 degrees Celsius. While this number might sound low to the general population, this is the fastest expansion in temperature change the earth has experienced the last thousand years. Over the next one hundred years the temperature is expected to rise between 1.4 and 5.8 degrees Celsius. The span depends on predictions concerning civilization expansion and policies implemented to curb development.[2]

Although the existence of greenhouse-gases is one of the conditions for human life on earth, most experts today agree that today's level of CO_2 output will lead to an undesirable greenhouse effect, elevating the global temperature. Although one may not predict the risks in a long-term perspective, reason dictates that we should proceed with caution, as most of the causes for the elevated temperature increases can be traced to human activities. This discussion has provided the background framework for the Rio-Agreement, the Kyoto Protocol and European Union's policies regarding the climate.

The paradoxical question is, can we limit the greenhouse-affect and maintain a high standard of living? The Swedish system of policymaking has attempted to come up with a solution to this pressing environmental issue.

Sweden takes environmental concerns very seriously. While the state did not implement it energy policy with global warming specifically in mind, Sweden has made strides to reduce the production of greenhouse gases. Sweden is one of the few countries in the OECD to implement CO_2 taxes and taxes on NO and SO_2 emissions. The target is to stabilize carbon dioxide emissions from fossil fuels at 1990 levels.[3] These changes, however, represent only a few of Sweden's reforms.

Major changes have occurred in the Swedish energy system during the last twenty years. The most important of these changes is that the proportion of

the country's energy supplied by oil has fallen substantially, from 77% in 1970 to 39% in 2002. At the same time, electricity production from hydropower has almost doubled, to which must be added the contribution from nuclear power. Over the thirty-year period, the proportion of Sweden's total energy supply accounted for by electricity has risen from 14% to 34%.[4]

The relative proportions of final energy use accounted for by the industry and residential/service sector have each fallen somewhat, while the transport sector has increased. Industry's proportion has fallen from 41% to35% and the residential/service sector from 44% to 40%, while the internal transport sector's share of the country's total energy use has risen from 15% to 21%.[5]

Other than renewable energies, primarily hydropower, Sweden has few indigenous energy resources. Nuclear electricity represents about 38% of the electricity production. Altogether there are 12 nuclear plants at four sites in Sweden.[6] Sweden has reduced its dependency on oil from 74% of TPES in 1973 to around 39% in 2000.[7]

Energy intensity is far above the OECD-Europe average. While there were some substantial gains after the first oil crisis, energy intensity has increased since the early 1980s. Electricity intensity, however, is one of the highest in the OECD and has grown since the 1970s. It showed a small decline in the past few years.

While Sweden is a unitary state, local authorities are very active in the energy field. Many municipalities are involved in electricity and heat distribution.

There are several companies in Sweden that are producing electricity and other energies. The government decides the strategies for the energy policy and dictates the overall trade for the companies. In the process of trying to control the energy market, the government has created a number of federal agencies.

There are several thousand industrial units producing electricity in Sweden. Three companies, Vattenfall, Sydkraft, and Fortum own most of these units. These companies are all owned by the state, (over 50% of the stocks). Together they produce 90% of all electricity in use. Around the country there are also approximately two hundred local electricity companies who own the local distribution structure and sell electricity to households and companies.[8]

Roughly half of Sweden's structures are heated by distant-heating.[9] The majority of the plants that are producing distant-heating are owned and operated by Swedish communes (localities).

Oil products correspond to one third of Sweden's total energy consumption, and virtually all is imported. Almost half of the oil imported comes from Norway. The largest oil companies in Sweden are Preem, Statoil, Shell, and Q8. There are five refineries that produce consumer products from crude oil. Very small portions of the products are exported, but most are used in Sweden for transportation in the form of petrol, diesel, and airplane fuel.

What is left over is used in the industry and for heating.[10]

The following government agencies are involved in shaping, controlling, and creating Swedish energy policies:

Näringsdepartementet	Has the overall responsibility in the government concerning energy consumption and transportation politics.
Miljödepartementet,	Is responsible for questions relating to the climate and transportation, essentially climate politics
Finansdepartemantet	Is responsible for energy- and climate taxation.
Statens Energimyndighet,	Oversees the changes in the energy-system and is responsible for determining that those changes are acceptable from a climate perspective. They also monitor the existing system and enforce laws and regulations; they are responsible for the countries energy reserves, and give large grants for research relating to the energy field.
Svenska Kraftnät	Owns and operates the large national electricity grid and connections to the Scandinavian neighboring countries.
Statens Kärnakraftsinspektion	Is responsible for security with regards to nuclear plants.
Elsäkerhetsverket	Are working according to a preemptive strike formula with regards to damage to humans and structures caused by electricity.
Elradgivningsbyrån	Informs the households and the industries regarding energy-regulation and energy-efficiency.
Boverket	Regulates building codes regarding energy efficiency. Sweden has the toughest regulation in this area in the world
Verket för Innovationssystem	Regulates and encourages innovations in the energy field with generous research grants.
Forskningsrådet för miljö, areella näringar och samhällsutbyggnad	Has an informative responsibility and regulates grants geared toward environmental improvements.
Vetenskapsrådet	Guides academic researchers in the right direction with regards to technological advancements.
Länstyrelserna	Contributes by evaluating new energy political decisions.[11]

During 2004 two very important decisions within the framework of energy policies with regard to Sweden need to be addressed. One is the implementation of a phase-out of nuclear power plants dictated by the referendum from 1980[12]. The other is the trade with CO_2 certificates within the EU.[13]

Access to inexpensive electricity has been one of the variables in the success formula that has provided the basis for the very strong economic growth development the Swedes have enjoyed during the twentieth century. Sweden's access to waterways and hydro production of electricity has provided the base-industries; forest, paper, mining, and steel, with environmentally friendly electricity. The high level of technology in Sweden's industry during the decades after WWII provided them with an advantage that lead the way to an early advanced nuclear program. ASEA[14] developed nuclear reactors that were introduced during the seventies and rapidly decreased the Swedish dependency on oil.

Large parts of central Europe based their electricity production on coal, oil, and gas; energy sources that created large levels of CO_2 gases. Today, Sweden is the EU country that produces the least CO_2 gases per capita.

The Swedish Riksdag has made at least four energy policy decisions that are incompatible: 1) The phase out of nuclear plants, 2) the large rivers up north that are not developed for hydro electricity may not be developed, 3) CO_2 emission level's where freezed on the 1991 level, and 4) economic growth in Sweden shall increase.[15]

Even the Swedish government has realized that these goals are not fully synchronized and are now actively trying to down-prioritize the CO_2 goal. There is no other way to read the signals. The government negotiators are discussing a timetable with nuclear producers to phase out all nuclear reactors. Meanwhile, government owned Vattenfall is projecting a large expansion of oil-powered power plants while Sydkraft, also government owned, is planning the production of a large gas-powered plant in Malmö. The government is working on a proposition with regards to the upcoming EU CO_2 certificate negotiations that would allow Sweden to increase its CO_2 levels due to its energy reshuffling.[16]

It is paradoxical that Sweden, which has an electricity production that the rest of the world should envy, (half hydropower and half nuclear power and hardly produce any CO_2 gases at all), has a current political leadership which seems content to abandon this production structure and instead increase CO_2 levels, which the rest of the world is working so hard to decrease.

The Riksdag approved the latest official Energy bill June 11, 2002. Entitled "Co-operation for a Secure, Efficient, and Environment-Friendly Energy Supply"(2001/02:143), this report essentially re-affirmed Sweden's established energy policy objectives:[17]

- Create the conditions for efficient energy use and a cost-efficient Swedish energy supply with low adverse impact on health, the

environment and the climate.

- Facilitate the transformation into an ecologically sustainable society, promoting sound economic and social development in Sweden.
- Contribute to the creation of stable conditions for a competitive business sector, energy, the environment, and the climate.

The energy bill also contained three main proposals:

- A new method to promote environmentally friendly and renewable electricity production through a quota-based trading program for green electricity certificates.
- Measures designed to encourage more efficient energy consumption through the rationalization of existing policy measures and the national and regional dissemination of knowledge.
- A strengthening of the competitiveness of combined heat and power by exempting such plants from certain taxes on energy products. The issue is to be decided in connection with the budget decision 2004.

Swedish energy policy today is hence still largely based on the 1980 referendum, manifested in several large political energy decisions since. The bottom line is that nuclear power shall be phased out and be replaced by environmental friendly, renewable energy sources. Some might remember the demonstrations at the time, and one particular slogan that many have unsuccessfully tried to erase from their memories, which said; "What shall go out? Nuclear plants!- What shall come in? Sun and water!"

Changed Since the 1980 Decision

Today the greenhouse effect has reached the point of realization; research was at its infancy in the late 70's. If the nuclear plants where to be phased out by 2025 for instance, and be replaced by natural gas, the CO_2 levels would increase 65%.[18] If replaced by oil and coal the increase would be far larger.

Improvements in technology have since 1980, led to a substantial increase in energy-efficiency. Bio-fuel and distance heating today account for a significant part in heating households and industry structures. A modern refrigerator uses less than half the electricity compared to its predecessor. On the other hand households have increasing number of ovens, computers, and VHS/DVD players. Garbage burning disposal plants recycle heat to households. Still technological advances have not evolved in any significant way toward replacing nuclear fuel with energy produced from the wind and the sun.

The government is in the near future forced by EU stipulations to allow for a greater flexibility concerning ownership in the energy field. The deregulation and internationalization of the energy market have changed the circumstances. Many were hoping that the deregulation of the nuclear plants would force forward alternative energy sources. Instead consumers will now be able to buy electricity from neighboring countries. Finland will be able to

deliver competitively priced electricity from their new nuclear reactor with a 10-terrawatt/hour capacity, now under construction.[19]

Knowledge concerning low security standards within electricity production in Eastern Europe has increased. Russian nuclear plants and electricity plants fueled by gas have significantly lower security standards and pollute far more than their western European counterparts. To phase out (safer) Swedish nuclear plants when the Russians could potentially simultaneously export electricity to Sweden would be ludicrous.

The common belief that Swedish nuclear plants are reaching their potential life span around 2010 seems to be based on inaccurate data. Experts in the field argue that most parts in a nuclear plant can be renewed and replaced. Today experts estimate that a nuclear plant has an economic life–span reaching as far as 60 years.[20] Sweden's oldest reactor will not celebrate its 60th birthday until 2030.

In 1980 Sweden seemed fixed in an illusionary belief that economic progress was given indefinitely.[21] Today they have realized that political implementations can be very influential with regards to economic growth. There is no doubt that supply of cheap electricity is an asset to the industry that cannot be underestimated. A substantial part of the population is still working within the electricity-intensive industry sector, which represents a large part of Sweden's export income.

Twenty-five percent of the population that voted in the 1980 referendum is today now deceased. Over fifty percent of the population (everyone over the age of 42) did not vote in 1980.[22] The latest polls show that voters today favor continuous use of nuclear energy.[23]

An Overview of Swedish Energy Politics and Planning Philosophies

There is a general pattern dictating how different questions and activities are implemented into public life. One can distinguish three phases; the market phase, the political phase and the bureaucracy phase. The political phase, which is short in comparison, replaces the original (virgin, if you will), market phase and evolves into the bureaucracy phase. During a short period while the political debate and activity are alive, a planning philosophy, a bureaucracy and a system of rules that allow for manipulations in what was a free market are created. Once completed, the political interest will diminish, but the system of rules and the bureaucracy will remain. The evolution is, if not impossible, very hard to curb.[24]

The political system's decision-making organs, parties, mass media, and so on, do not have the capacity for one or even a few large complex questions at a time. The system therefore focuses its interests on different areas, one at a time. During the focusing, the topic transfers from the market phase to the political phase. When the political system loses interest and moves on to a new area the topic moves into the bureaucracy phase. In this way

different topics are systematically transferred from an original market reality into a bureaucratized reality. The bureaucratized existence of Swedish policies can best be described in this manner. The planning philosophy and the system of rule that an area receives during the political phase is very often specified to a short time frame. There seems to be no theoretical planning basis for insurgence within the different areas. The principles for the government's insurgence are extracted from ideas that are popular at the time or easily accessible during the political phase. In this manner different planning cultures, or special ideologies, within the different areas emerge. Swedish energy politics is produced largely from a concept of energy-balances. The planning philosophy that is being implemented in reality within an area and transferred to the bureaucracy phase is often a degenerated or "watered down" version of the philosophy that was formulated in the political phase. This is due to the shaky foundation of the original philosophy and the difficulties that occur when it is confronted with reality. A good example of this phenomenon is apparent in Swedish energy policies; the energy balance discussion in its original form has lost its relevance.

When a topic is transferred to the bureaucracy phase it becomes essentially "hidden" from the two types of public influence that exist; the free market, and the political- democratic process. It is hidden from the market because it has been manipulated, and from the political system because it does not have the ability to control and maintain topics that have been transferred to the beau racy phase when simultaneously politicizing new areas. This problem obviously becomes larger the greater the public sector.

Swedish energy politics and planning philosophy have been inspired in part by a natural science perspective and in part by ideas that were actual or perhaps, trendy at the time for the first large energy political decision 1975.[25] The natural science perspective was originally formulated in terms of quantified societal energy balances. These should represent a balance; the usefulness of energy consumption on one hand, and on the other, problems that are too large or unsynchronized with regards to consumption. Problems were related to national security, balance of payments, and the relationship between rich and poor countries, environment, limited resources and future business without constraint. These ideas represented the problems conception at the time.

The quantified energy balances have now largely disappeared and have been replaced by general guidelines, such as energy conservation, diminished dependency on oil, and an increase in use of domestic energy.[26]

The goals for energy politics today are implemented through market manipulation. To an extent market insurgencies originate and are implemented on a governmental or federal level. But localities and municipalities also play a large part in decision-making. Existing organizations are used when executing decisions; in essence, administrations dealing with regulations, fixed capital, and research. Some new organizations, notably, Statens Energiverk, have been

created. The authorities that control the agendas have effectively shut out the general population's influence by controlling the bureaucracy involved. The market insurgencies that are part of energy policies regardless of whether the goals are the original energy balance policy or today's policies are too extensive and often misdirected. The national security reserves problems are best resolved with actions directly targeting that area. A balance of payment problem does not even belong in an energy-focused political discussion, but should be resolved within the framework of currency politics. The relationship between rich and poor countries cannot be solved through domestic energy politics. It should be viewed from an international perspective. The environment problems are unquestionably real, but should be handled in the same manner as the national security problem, with actions directly targeting the problem. Problems regarding diminishing resources and future business flexibilities are dictated by market principals, and are from a political point of view, not a problem at all. In other words, relevant energy politics with regards to the National Security reserve problem and the environment problem should be handled by directly targeting these areas. Meddling politically with a future energy-balance perspective, or general directions, does lead to larger than necessary insurgents in the market than the problems justifies, and probably ineffective solutions to the problems in question.

Swedish energy politics probably does more damage than good. The damage from over-extensive manipulation in the market process leads inevitably to Swedish citizens will enjoying less of life's benefits than if the market was allowed to develop optimally. This damage could be eliminated if everything, except concrete action directed towards National Security reserve and environmental problems were discarded. The energy-balance strategic thinking, both in its original form and today's watered down version, has a high potential for failure.

Conclusion and Recommendations

The big energy policy decisions Swedes are facing can be roughly stated as follows; either they accept higher CO_2 levels or they choose to keep their nuclear power. Regardless of which direction the decision takes, Sweden must continue their quest toward energy efficiency, technological advancements, and investments geared toward renewable energy production. If they choose to phase out nuclear plants the energy will have to be replaced, to a large extent, with oil, coal, and gas.[27] The Swedes will then jeopardize their position as the "good boy" on the block in regards to their excellent international reputation concerning environmental preservation. They will essentially breach environmental agreements and promises, both to the EU and the international community.

Sweden should, of course, participate in limiting the greenhouse effect. Sweden should actively participate in creating the new EU trading system with

CO_2 certificates. European trade under a common CO_2 bubble should replace these national limitations.

There should still be a potential for continued energy efficiency, such as extended distance heating and an effective use of heat generated from the burning of trash. The possibility to combine power and heat production in local energy plants should be further explored.

The government should immediately abolish the decision to phase out nuclear power. The reactors should run as long as they can fulfill existing safety regulations. According to Swedish Nuclear Producers it would then be profitable to plan and execute new investments in the existing nuclear plants that would increase capacity as well as safety.[28]

Kärntekniklagen is a law prohibiting the production of any new nuclear energy plants. Assuming the regulation prohibiting any elevation in CO_2 levels dictated by the EU will be followed, economists estimate that it will be profitable to erect new nuclear plants in ten years. It is, however, important to point out that the government-dictated thinking that guided the expansion of nuclear plants in the 1960's and 1970's was unfortunate. It is not the government that should decide at what rate new nuclear plants are built; the market is perfectly capable of making those decisions. The role of the government should be limited to regulate environmental and security issues.

Tankeförbudslagen is an amendment, under the Kärntekniklagen,[29] which prohibits any research relating to nuclear power. This extends not only to the general public, but universities and private companies. This has created a situation where Sweden, once pioneer in nuclear research, is now hopelessly lagging behind. Today's advances in nuclear research are originating from France, Canada, The United States and Japan. This is obviously insane. Research geared towards nuclear plants in generation IV, where a meltdown is impossible, should be given the highest priority.

Notes

*Ken Altrell is a former staff member of the *Journal of International Affairs* and graduate of Towson University.

[1] www.unep.org/Default.asp?DocumentID192&ArticleID=2763

[2] www.unep.org/documents/DocumentID=189ArticleID=2747

[3] Trine Pipi Kraemer p2.

[4] www.akf.dk/emg/udland11.htm Data collected from an article by Trine Pip Kraemer issued by the institute of Local government studies-Denmark. P 1.

[5] http://library.iea.org/dbtw-wpd/Textbse/stats/oecdbalancetable.asp/oecd=Sweden IEA data on the Internet.

[6] Sains Ariane, "Ringhals chief predicts Sweden will reconsider, embrace nuclear", Nucleonics Week,vol.44, No.42: P.15

[7] Trine Pipi Kraemer p4.

[8] http://naring.regeringen.se/fragor/energi/ Swedish government information website.

[9] Distant-heating is a direct translation from the Swedish word *fjärvärme,* which refers to direct delivery of hot water to households, usually distributed by municipalities or localities. The way the water is heated differ firm location to location. Sometimes very efficient ecological methods are used e.g. When burning local garbage, heat that generates from that process is recycled and used to heat water that is then distributed throughout the community

[10] Information gathered from an information folder distributed by *Energikontoret* A Swedish government agency operating under *Näringsdepartementet* (the Domestic market department). *En Resurs I Klimatarbetet.* Issue 1, 2004

[11] The information regarding the government agencies listed, are gathered from a variety of government websites. Each agency has its own website and provide a generous amount of information relating to their activities. Interesting to note is that information continually overlaps. It is as if each agency is desperately trying to justify its existence, by introducing information that is not always related to their micro-field.

[12] www.Svenskenrgiiskolan.nu/pdf/kk6 Sweden had a referendum with regards to nuclear energy. Incidentally, only one year after the accident at Three Mile Island. The policy that the voters preferred was a slow phase out of Sweden's 12 nuclear reactors, completed by 2010. It was written into law shortly thereafter and much of the public debate concerning energy policies are still centered on this fact. Latest polls show that most Swedes today do not want to scrap the nuclear program, if this fact is going to influence Swedish policy makers remains to be seen.

[13] www.naring.regeringen.se/pub/road/Classic/article/11jsp/Render.jsp?m=print&d=2922
www.stem.se/web/otherapp/ekunskap.nsf/3EE9419DCE030192C1256E44
www.dn.se/Dnet/road/glassic/article/0/jsp/print.jsp?&a-225719
The EU is in the process of deciding on quotas to the industry with regards to CO2 emissions, each industry will be given a fixed amount of *pollution*, essentially

its existent level, which cannot be expanded. Trading between companies and countries with these certificates will then be established. The Nordic countries are implementing these policies in trial arrangement. April 27th Sweden handed over their list of domestic quotas to the commission. The trial period will be implemented in 2005. The trade with the quotas is a method of choice for the EU to guide the member countries in achieving their promises made in Kyoto.

[14] ASEA is a large Swedish company, which has played a major role in producing Swedens existing nuclear plants. They have exported their technology and built a plant outside Hamburg.

[15] www.stem.se/web/otherapp/ekunskap.nsf/D89220C839A257E8C1256B68 Information by the government, facts regarding political decisions. How the Swedish government think they can decide on economic growth is beyond my understanding of economic principles, but it is a direct quote.

[16] This was not successful, the Swedish CO2 quotas are now established, The EU discussions did allow leniency with regards to Sweden's dilemma. www.regeringen.se The Swedish governments website. (Pressmedelande 27 April 2004).

[17] www.riksdagen/se/debatt/0102/utskott/NU/NU17/Nu170004.ASP

[18] www.naturvardsverket.se/dokument/hallbar/klimat/utslapp/utslapp.htm *Naturvårdsveket,* is a government agency researching environmental effects.

[19] www.fortum.se/document.asp?path+14021;14269;18174&level=3 Finland is essentially the only Western European country building a nuclear reactor.

[20] www.kommers.se/binaries/attachmnents/1237_klimatremiss20000823.doc

[21] Kander, Astrid, "Economic Growth, Energy Consumption and CO2 Emissions in Sweden 1800-2000", Almqvist%Wiksell International, ISBN: 91-22-01973-1, p 204-216; Ms Kander describes how Swedes during the seventies where lured, partly by the government, and also by the market forces into a false sense of security with regards to indefinite resources. Researchers that pointing out obvious facts about diminishing resources where often viewed as dooms-day prophets, and obstructers of progress.

[22] www.library.uun1/wesp/populstat/Europe/Swedeng.htm-may1-2004

[23] www.ekan/dn.se/images/e11.gif

[24] Lofstedt, Raganr E.,'Hard Habits to Break" Environment, March 93, Vol.35, Issue2
Lofstedt provides the foundation and framework for the discussion and overview, especially his discussion on the three different phases. I reflected over this framework and continued the discussion with a more liberal market guided approach. But the foundation for my discussion is derived from Lofstedt's framework.

[25] www.dn.se/Dnet/road/Classic/article/o/jsp/print.jsp?&a=253482 Newspaper article describing the influence at the time of the 1975 energy decisions.

[26] L.Schipper, "The Dynamics of Electricity Use in Scandinavian Households," Energy 15 (1990):841 63.

[27] Timmons, Heather, "After Heat Wav, Europe Gives Nuclear Power a Second Look", Print Media Edition: New York, N.Y. Sep 18, 2003; Timmons discuss in her

paper, new reactors emit almost no greenhouse gases or other pollutants, it may be the only way Europe can reliably add to its power generation capacity within the environmental constraints of the Kyoto treaty on global warming

[28] Hibbs, Mark, "Politicians yet to bite the bullet on Phase-out", Nucleonics Week, February 26, 2004

[29] www.chalmers.se/hypertext/prof_S/Sihver-S.html *Tankeförbudslagen* is a nick - name for an amendment in the Swedish law regulating nuclear energy. Translated to English it means *the forbidden to think law,* which essentially prohibits any nuclear research within Sweden.