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Climate Change and the Energy Markets - Challenges and Options

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The 1990s was a decade of change. In many areas monopolies were transformed to competitive markets. Systems that had been dominated by technical optimization underwent total change, customers and real market demand were introduced.

In the European electricity supply industry deregulation was introduced. Old borders were removed. Economies of scale led to a consolidation process in the industry.

Vattenfall was incorporated from the first of January 1992. Ten years ago, Vattenfall's operations were virtually confined to Sweden. Today, Swedish operations are part of much larger operations. A decade ago, there were more than ten independent power generators in Sweden. Today, most of them have been acquired by larger companies. Vattenfall AB is the only remaining independent Swedish power company of any significance.

So, Vattenfall's competitors today are no longer Swedish power companies or energy boards, but large international groups with real financial clout. The electricity supply industry has been internationalised. German, Finnish and Norwegian interests are invested in Sweden. And Vattenfall has made vast investments abroad, especially in Germany.

Vattenfall's six-month interim report 2003 clearly demonstrates that Vattenfall has committed itself to Europe with a North European base in Sweden, Finland, Germany and Poland. Net sales increased by 18 per cent to SEK 59,498 million. Operating profit increased by 36 per cent to SEK 9,988 million. Vattenfall's generation is now divided 50 - 50 between Sweden and the other core markets Germany and Poland and around 25 per cent of our employees are Swedes and more than 60 per cent are Germans.

Vattenfall's vision is to be a leading European energy company!

A leading company has special responsibilities - for market performance, for not abusing its market position, for handling environmental issues, and for basing decisions on ethical considerations. Leading market players create standards that the rest of the market follows.

To summarise, I want Vattenfall to be a leading player:

for the environment
for the customer, and
for the economy

And I want to say right from the start that we set our sights high - we must have leading expertise and take responsibility for the environment, our customers and the economy in the broadest sense. Vattenfall is responsible for the future in these three key areas. We do our best to bring choice into the future, and contribute to a better world. Corporate responsibility is a natural part of all our business activities. Business ethics, environmental concerns, economic development are important aspects of electricity supply, electricity is not "just a commodity"!

2. The Climate change issue

A year ago floods in Europe and other places throughout the world accentuated the question of an ongoing climatic change. Now, one year later major parts of the northern hemisphere have been plagued with the opposite, extreme drought. You all know what has happened during the summer months in Europe so I do not have to go into detail about that. Neither will I go into the scientific debate whether there is a climate change and if so, if it is the result of man's emissions of greenhouse gases. However, the indications – and I underline the word indications - of a climate change caused by man have increased recent years. It is not only the extreme weather in Europe the last years. The timber line has risen some hundred metres over the past decade. The propagation area of many plants and animals has shifted northwards. Glaciers are withdrawing. The same indications are also present in many other parts of the world. The average temperature of the earth have changed so rapidly the last decades that modern civilisation seem to be at least part of the explanation. Thus, 2003 will probably turn out to be another record year to add to the row of increasingly warmer years. These indications are still not proofs, but they will continue to fuel the debate and the climate change policy. And climate change policy is not only an indication for the energy market - it is now hard facts after the decisions taken by the EU to implement an emissions trading system. The climate change issue will remain a reality, especially in Europe.

3. EUs emissions trading system

On July 2nd European Parliament by an overwhelming majority voted in favour of a Directive establishing an emissions trading scheme. Apart from some remaining formalities this means that the final political step towards a common European emissions trading system now has been taken. The purpose of the scheme is to direct physical reductions of emissions to where

they are most effective. Environment Commissioner Margot Wallström declared: "It means that the largest emissions trading scheme in the world to date will be a reality from 2005..." "Companies across 25 countries must now start incorporating climate change into day-to-day commercial decisions, and begin assessing what innovative steps they can take to reduce emissions." I will not go into the details of the emissions trading directive. In these slides the most important elements are summarised.

A very important element of the trading system are the principles of initial allocation of allowances and of the future revised allocations which, in a fair and equitable way, need to reflect current and future needs based on historical needs and at the same time honour voluntary recent reductions of emissions, so-called early action.

The details of the principles of allocation are basically up to each member state through the "National Allocation Plans". The NAP's are to be submitted to the EU Commission by 31 March 2004 for approval. Establishing these plans is a formidable task for the EU member states.

4. The consequences - general

Since the proposed trading system covers about 46 per cent of the total emissions in Europe, I don't think commissioner Margot Wallström exaggerated when she concluded that from now on companies in EU have to incorporate the emissions trading system into their daily life. This is especially relevant for the electricity and heat industry in Europe which will constitute as much as 2/3 of the trading system. However, the trading system does not only represent threats and difficulties for companies. I think it should be said that there are also opportunities.

At Vattenfall, for example, we are convinced that a society that is less carbon dioxide intensive is also an electricity-intensive society. Electricity is smart. In

future, energy systems will become increasingly electrified. The long-term demand for electricity will be stimulated. And we certainly have no objections to that.

I would like to make clear that Vattenfall fully recognises the basic potential advantage of an emissions trading system in terms of cost-efficiency. With an emissions trading system the “cheapest” measures can be commercially prioritized. And – also important – costs for measures can be distributed in a reasonable and fair manner between the countries taking part in the trading system. Vattenfall has worked with carbon dioxide reduction for many years, notably with large programs for biofuel utilization and for wind energy in addition to our role as a large hydro power producer. We know that there is a whole spectrum of different measures at different costs in different sectors of the community. This slide show some of the different measures for reducing carbon dioxide emissions and what they cost, calculated per kg “avoided” carbon dioxide emission. This is not by any means a complete list of measures, but a collection of examples that apply in different sectors of the society.

On the other hand, our traditional generation plants will face restrictions and increased costs. Today, almost half of Vattenfall’s power generation takes place in Germany. Most of this is based on fossil fuels and the introduction of carbon dioxide restrictions beyond the initial trading periods could prove very costly. Fossil fuels can become so expensive that they weaken the competitive strength in many industries compared to companies and production facilities in Canada and the USA, for example. In the end this might affect the whole society. To avoid this, climate measures have to be introduced on a global level in a longer perspective. Otherwise the measures taken will prove inefficient by just moving emissions to other countries.

Regardless of the details in climate policies, the results will be increased costs for using fossil fuels. This will raise the price of electricity, also on the Nordic electricity market where most of the production is carbon-free, that is based on hydro-power and nuclear. This is a consequence of the emissions trading system that worries us at Vattenfall. Let me go a little bit into this important issue:

As allowances become scarce there will be a market value for them. Hence the allowances must be regarded as a production cost irrespective of whether they are purchased or given for free. This will increase the spot price of electricity. How much will depend on the price of allowances. The price of the allowances can be roughly estimated on the basis of anticipated reduction requirements and the costs to physically accomplish that reduction. We have estimated that allowances by 2012 may cost up to 20 €/ton carbon dioxide if the current EU members (EU-15) have to meet their remaining Kyoto reduction and the new EU member states receive no credits for their reductions since 1990. For the estimated 20 €/ton the electricity price increases are significant, in the order of 40-60 per cent on the wholesale level in the worst hit markets.

If the trading system on the other hand does recognize the achieved reductions of the new EU members, the estimated allowance cost is reduced to 7-10 €/ton carbon dioxide. The corresponding increases of electricity prices are estimated at 15-30 per cent.

These results have raised questions within my company: What will be the reactions of the market, the customers and the politicians to these effects? It is likely that trading prices of allowances less than 10 €/ton and the corresponding electricity prices can be absorbed by the "system", even if certain customers and producers suffer and others gain financially?

However, the impact is considerably larger in the case of higher trading prices (at the level of 20 €/ton) and will result in significantly higher electricity prices. What will then be the reactions if the trading system permanently make key industries (steel, p&p) suffer badly both from direct cost for allowances for their own process emissions and from significantly higher electricity prices? Will governments try to compensate suffering industries? What will the reactions be if the trading system makes power generation very profitable in general and for hydro and nuclear power in particular and thereby create “windfall profits”, at least temporarily? What will be the reaction of electricity customers?

The main conclusion we have drawn from these exercises is that emission allowance prices must be kept at a reasonably low level at least as long as the trading system is not global. This is not just in the interest of the actors on the market but also the trading system itself. If the consequences of the trading system turn out to be unacceptable it will not be sustainable.

The best way to keep the allowance price at a low level is probably to incorporate sufficient amount of allowances from the accession countries into the trading system. Therefore the EU should not impose unnecessary restrictions on so-called Joint Implementation or other ways of supplying allowances from the accession countries. This is one of my main messages today.

5. What can be done to reduce emissions? - carbon sequestration

As I have already shown there are numerous possible measures to decrease emissions of greenhouse gases, but the number of existing low-cost measures is limited. The reduction potential is also limited. The three major possibilities are:

- To change fuel to one with less carbon, as e.g. build new plants based on gas firing, or bio fuel firing instead of older oil and coal fired.
- To increase the efficiency of coal fired plants. A good example of this is the replacement and development of older plants from the DDR time into the worlds most modern coal fired plants, which has been done in Germany and thus decrease the emission to almost half for the same production volumes.
- To separate the carbondioxide from the combustion process and store it permanently and safe in pourous geological formations under ground.

One of the most promising options for the future is the third one - carbon separation and storage in bedrock - carbon sequestration. The storage principle is exactly the same as for oil and gas, which naturally has been stored underground millions of years. The difference is that now we pump down liquid carbondioxide in similar geological formations. The technology has been used for 25 years in the oil and gas industry for enhanced oil recovery. Now it is developed for the purpose of storing the carbondioxide. It is tested in full-scale in the North Sea, where Statoil separates and stores about 1 million tons of carbon dixide per year.

Ten years ago, separation of carbon was more or less a utopian technology that hardly no one believed was possible. The cost estimates showed costs of around 0.1 per kg carbon dioxide or more. Today we can set a realistic target to separate, transport and store carbon dioxide from coal fired plants in a large scale at a cost of 0.02-0.03 /kg carbon dioxide, which means that this technology can prove to be one of the cheapest methods for reducing carbon dioxide emissions. Further it could probably meet the cost established by the trading system when the technology is expected to be commercially ready sometime after 2015.

It would also create a possibility to make use of coal, which by far is the most long lasting fossil fuel, without any significant significant environmental impact. It would also create the time span necessary to develop the real sustainable energy sources we sooner or later need.

The geologists claim there exists more storage capacity in the world than fossil fuels available. The separation technologies necessary are already to a large extent

existing, but not adapted to this purpose. Thus, from a technical standpoint this is a real option for the future. However, there is still a considerable research and development effort necessary to make this option commercial. As there is rather little R and much D remaining, the last and most costly parts of a development process are in front of us.

Vattenfall has taken a leading role in this development process. We have launched a project we internally call “the carbon dioxide free power plant”. The aim is to be able to build a large scale demonstration plant for coal after a five year period. As part of this, we collaborate in several international R&D projects, together with our colleagues in the power business, the leading manufacturers and a number of leading universities and institutes. These projects cover the whole process from capture over transport to the storage options.

Since all other emissions from power plants can be eliminated down to very low levels already, it is the carbon dioxide, which is the major challenge. If the development work succeed, it will be possible also to eliminate emissions of carbon dioxide down to almost zero, at a cost which probably the trading system will set anyway. Conversely, since the potential is so large for this carbon dioxide free coal technology it will set a cap for the carbon dioxide cost, for the benefit for both the economy and the environment and consequently for our customers. The physical storage capacity is judged as being substantial, in principle, unlimited. The storage possibilities are widely dispersed. The restrictions are first and foremost political and ethical.

Vattenfall considers responsible separation and storage to have a great future. However this technology is still in the development stage and a commercial breakthrough is perhaps 15 to 20 years away.

6. Conclusions

An increasing number of indications put the blame for climatic changes on man. As long as this theory resides, the climate change issue will be an

important and even dominating environmental and strategic issue for energy-intensive companies.

In spite of remaining unknown factors Vattenfall believes the proposed emission trading system can successfully serve its purpose. However, in setting up the final system the initial allocation of allowances and reduction requirements of the National Allocation Plans must honour already accomplished reductions since 1990 as a result of modernization of production capacity and other “early action”.

The entry and full participation of the new EU members into the system is highly desirable, as it will enlarge the market and dampen the price effects.

The main threat to the EU emissions trading system is an initial high price level of allowances. This does not just threaten companies and the overall economy in society, it can undermine the trading system itself. If a trading system is to function and give satisfactory results (i.e. reduced emissions), it must be built up in a long-term sustainable manner. This is a major and difficult task, and we must accept that it will take time!

Up until the first commitment period, i.e. 2012, the EU should therefore aim to include at least a portion of the surplus of allowances in the accession countries into the trading system.

It is not possible to solve the carbon dioxide issue in the short term; there are no simple solutions. There is no point in creating more problems for (northern) European energy-intensive industries if the same products can be produced elsewhere. Symbolic policies that are marginal from an international perspective are meaningless in individual countries. We must focus on joint solutions and common responsibilities.

After the first commitment period also new technical options can be introduced. These technologies can, if the development work succeed, create a limitation to the carbon dioxide reduction costs. Especially if coal can be utilized without carbon dioxide emissions, this will have a large potential to meet future reduction targets at a reasonable cost. At Vattenfall, we believe that the “zero emission power plant” for fossil fuels actually can be created sometimes around 2015.

Someone has compared the climate change issue with the question of free trade. Free trade has developed gradually since the end of WWII and has still not reached its goals. The same goes for the climate change issue: we are still in the introductory stage of a great question whose solution will be developed gradually over the next few decades. We can easily identify threats but also opportunities and without being over-optimistic I am sure we will see more of the latter given that wise political decisions will be made.

Vattenfall is strongly committed to responsibly handling of the climate change issue. However, action has to be taken in a long term, investment cycle time perspective based on cost effective measures. Today, the world has no real alternatives to fossil fuels in electricity generation. Vattenfall therefore works actively to create solutions where fossil fuels can be used in the future with no or substantially reduced carbon dioxide emissions.

Vattenfall's strategy on climate change can be summarized as follows:

- Cost effective measures must be the basis for all actions
- A sustainable energy system is built on:
 - Renewable energy sources
 - Efficiency in generation and utilization
 - Emissions trading
 - Carbon dioxide separation and storage

- Trading solutions have to be properly designed and reward early actions since reduction of carbon dioxide emissions is crucial for investments