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Energy in the Future

The basis for a sustainable, intelligent and flexible energy system in Denmark has been made

Common understanding

- › **Through an open dialogue, the project of the Danish Board of Technology on the future Danish energy system has created a common understanding of the challenges of energy policy – across political disagreements and interests of various actors. The first half of the road to a climate neutral**

Intelligent and flexible

- › **Denmark with a reliable energy supply is paved with difficult assignments. The project of the Danish Board of Technology shows that they can be solved in a flexible energy system with intelligent management.**

The music must play together

- › **Many decisions must be made and many means must be used. The actors should coordinate their activities. The investments, changes and teamwork will begin for real when the objectives have been determined and the framework defined.**

The sooner the better

- › **The costs of the reorganization will get higher as time goes by. In general, the costs are low in comparison with the economic growth and the new export opportunities. If the oil price does not decrease, the reorganization will present a surplus.**

This issue of From Board to Parliament is based on a conference in the Landsting Chamber at Christiansborg on 17th September 2007.

After almost four years' work, the Danish Board of Technology has finalised its project The Future Danish Energy System. The result is a solid foundation for decisions leading to a halving of Denmark's CO2 emission and oil consumption before the year 2025. By then, windmills can cover half of the Danish energy consumption.

In the scenario of the Danish Board of Technology, the energy consumption will decrease, even if the economic turnover grows, the consumption of housing and transportation increases and people get more electrical appliances. The supply reliability

will improve and good opportunities of an increased exportation of renewable energy plants and of system solution know-how will exist. The reorganization takes extra investments, but they will on the whole equal the expenses saved on coal, oil and natural gas.

Common understanding

The project is not only an expert review. The challenges have been discussed and the tasks defined in an open dialogue with politicians from all parts of the political spectre. The problems have been ana-

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lysed and the solutions found in an equally open dialogue between actors, researchers and critics with very different backgrounds.

This demanding process has created a common understanding and applicable results across political disagreements and different interests. This was what the spokesmen of energy policy from both the Liberals, the Socialist People's Party and the Social Liberals highlighted at the concluding conference at Christiansborg.

'The energy policy has been given high priority on the political agenda. The project of the Danish Board of Technology is a strong foundation for the future political work. It has been established in close cooperation with the politicians of the Parliament and the actors of the energy business. It includes ideas pointing ahead. They are ready to be implemented,' said Lars Christian Lilleholt, the Liberals.

The spokesman of the Social Liberals, Martin Lidegaard called the project a 'fantastic and unique knowledge-based sector cooperation. It cannot be done more openly,' he added.

The end of the beginning

At the conference, the baton was passed on. Both to the politicians of the Folketinget and to the many actors within the energy field.

'This is the end of the beginning,' said the Director of Secretariat from the Danish Board of Technology, Lars Klüver. 'This has up to now been the longest (and most expensive) project of the Danish Board of Technology. And there are limits as to how long we should 'settle for' making reviews. Now is the time when others start the end.'

He pointed out that the political decisions must be made soon if the objectives should be reached within the remaining 18 years. Many actors need to carry through large changes. But the required investments will not start for real and the music will not play properly together, until the direction of the changes is known and its framework and means are fairly determined, Lars Klüver said. Therefore, it has been important to ensure the relevance of the results through the open dialogue.

The politicians of the widely represented 'future panel' have discussed the challenges and the objectives and asked the question: how far can we reach in an integrated energy system if we combine a strong effort to get energy saving with a powerful enlargement of the wind power, full exploitation of biomass and efficient use of natural gas?

The steering group in charge of finding the answers was also widely represented. It was a very mixed group and its members did not in advance guarantee consensus,' Lars Klüver said. 'But in fact, the group has concluded a result that I would call a kind of consensus.'

The baton passed on

'Now you must take the next rounds on the track.' - With this motto, the members of the steering group passed on the baton to the Minister for Climate and Energy, Connie Hedegaard, Britta Thomsen and Margrete Auken as representatives of the European Parliament, Risø's Director Henrik Bindslev as the representative of the education and research sector, the chairman of Technology and Environment in the Local Government Denmark, Bjørn Dahl, Head of the Secretariat in the Ecological Council, Christian Ege as the representative of the NGOs, René Kaalø Rothmann as the representative of the energy industry and Carsten Gregersen, Copenhagen Business School as the representative of market research.

They all promised to take their part of the responsibility: 1. Denmark will show the world a good example and use the climate summit in 2009 as a display window. 2. EU will turn their objectives into means that work. 3. Children and adults will get the required education. 4. Known technologies will be developed and new invented, in particular within the areas where Denmark can play the role of pioneer. 5. Reorganization will be planned and carried out, locally. 6. Decision makers will be kept to the mark and stay there. 7. New products will be developed and marketed in a way that the Danish windmill adventure will not become a once-only story. 8. Find the best suitable means to lead the market in the desired direction.

Direction marks

Four technology scenarios were made to illustrate how Denmark up to the year 2025 can create its energy future with the best possible exploitation of Danish capacities, technologies and means. One scenario focused on energy saving, another on wind power, a third on biomass and a fourth on natural gas.

Upon a wish from the 'future panel', the four scenarios were then combined. System solutions were designed and calculated in a way that the energy from the various sources was exploited in the optimum way, without imbalance and power failure but also without unnecessary over-capacity.

'But firstly, we made many efforts and had many meetings to discuss the objectives,' Poul Erik Morthorst, Risø, said. Objectives of climate and environment, supply reliability, technological development, economics and global responsibility. 'Oddly enough, all the pieces in the puzzle fitted around two single direction marks: to half the CO2 emission

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in comparison to year 1990 and to half the consumption of oil in comparison to today,' he said. 'The more I think about it, the more I find global responsibility to be most important: to develop technologies that can be transferred to other countries and pave the way for the future,' he continued. 'For instance, I was recently in Austria. They have three percent wind power, and this already worries their system operators. Then it was nice to be able to inform them that the windmills in January this year supplied 44 percent of the power in Denmark. That is a world record worth telling about.'

The example also indicates the pioneering touch of the combination scenario in which you include the number of windmills required to cover 50 percent of the yearly consumption – without having to export the excessive power at a low price when there is strong wind and a low electricity consumption. Instead, the excessive electricity will be utilised in heat pumps and electric cars. And the peak load will be lowered, both by energy saving and by moving the consumption to the small hours – flexible electricity consumption.

Energy saving is the most important of the four technology tracks, Poul Erik Morthorst underlined. The more you limit the energy loss and make appliances, buildings and vehicles more efficient, the larger part of the remaining demand can be covered without using coal, oil or gas.

'But the service level has not been compromised,' he said. It is based on a growth in the gross national product of 40-50 percent in the period of time. This corresponds to approx. 100,000 kroner per capita. The consumption of services requiring energy is calculated to increase by 45 percent in households and 30-40 percent in business. The transport will increase by 25 percent and the warmed-up building space by 12 percent.

Means

This spring, the Danish Board of Technology had five workshops concerning the means with the participation of specialists as well as people with specific and passionate interests from many fields. The results are described in the newsletters From Board to Parliament nos. 236, 237, 239, 240 and 241, which can be read and downloaded on www.tekno.dk under Newsletters.

The STREAM model

As part of the project a calculation model, STREAM, has been developed which can quickly and easily calculate what will happen in the Danish energy system if the conditions of energy sources, technologies, prices, financial development and mixture of technological means are changed. Model and guidance are – like any other report on the project – available on the homepage of the Danish Board of Technology www.tekno.dk under the project The Future Danish Energy System. With the model, you can test how things influence on each other. What will happen if you calculate with lower growth or larger energy saving? Or with more windmills? How many conventional power stations are needed? How often is there a surplus of power? How large a capacity can be spared at the conventional stations, if the consumption of electricity is moved away from the hours when the system is most heavily in use, to the hours when the windmills produce power and there is a low consumption?

The model can also calculate what it costs our society as a whole to carry through the scenario of the Danish Board of Technology. If you calculate with an oil price of 50 dollars a barrel, CO₂ quotas at 150 kroner a tonne and an interest rate of six percent, the yearly extra investments will be approx. 13 billion, and the working expenses will increase by approx. 1.5 billion. The yearly saving on fuel is 13 billion. The total additional expenditure is approx. 300 kroner per capita a year.

After the energy crises of the 1970s, the Danish energy policy showed its strength by introducing the energy plan in 1976 and the legislation in 1980. Since then, Denmark has succeeded in keeping the gross energy consumption constant while the economy grew. Oil was replaced by coal and later by natural gas and renewable energy. The export of technology within this sector has increased tenfold. Now, the oil price has increased to the same level as the peak in 1980 calculated in fixed prices, Helge Ørsted Pedersen, EA Energy Analyses, pointed out. It is likely that the oil prices will continue to increase and that the Danish oil production will decrease. The climate threat is added to the list of challenges: economy, supply reliability, environment and preparation. And the Prime Minister has declared that a total independence of fossil energy sources is the objective.

The energy system of today is a network of local units, interrelated and with extended connections to the countries surrounding us – both electrical wires and gas pipes. The number of houses with dis-

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trict heat has doubled and there is a close connection between electricity and heat supplies.

'The challenge is not to calculate and make plans, but to make people use the means,' said Helge Ørsted Pedersen. He explained the large net of actors who should work together in order to make the reorganization a success: politicians and authorities, consumers, companies, business, research and education, NGOs etc. Furthermore, the initiatives must play together on local, national, EU and global levels.

It is a complicated but necessary process to make everybody part of the team and think in entirety, Helge Ørsted Pedersen pointed out. If not, the connected energy system cannot work in an optimum way, work flexibly and be managed intelligently. For instance, the extension of wind power on land should be ensured through planning and local support, at sea also through cross-national agreements. The capacity of the electricity net should also be taken into consideration and be coordinated with the heat supply and the introduction of a more flexible electricity consumption. Use of biomass and extension of biogas plants should be compared to natural gas and take place at the right speed. Campaigns of retrenchment, building renovations, zero-energy building, energy labels and new standards should be coordinated on local, national and EU levels. Research and development, tests and demonstration projects should be introduced with the best possible effect. Specialists should be trained to handle the new systems and technologies.

The advantage of being the first

When many people do a puzzle together, they usually start by finding the corner pieces. And when one person has laid the first pieces, others start looking for matching pieces. 'Therefore it is of great advantage to Denmark to be the first,' said Flemming Nissen, the STRATEGrummet, in his presentation on market and adjustment.

The three energy politicians present agreed fully on his view.

'The EU will become the centre of rotation, but that is exactly why it is decisive for Denmark to present a good concept. We will show that an ambitious energy policy can be realised and secure its conditions, but avoid too much regulation of details,' said Lars Chr. Lilleholt.

Anne Grete Holmsgaard emphasised the power of the example, especially in the international climate negotiations in which many doubt that reorganization as described by the Danish Board of Technology can be carried out in practise. Within the EU frame, she saw the biggest problem to be the success of the EU quota system and to have it intensified to such an extent that it will truly work as an incitement to invest more in energy efficiency and alternative sources.

Martin Lidegaard said: 'it is evident that the objectives can only be obtained in co-operation with the countries surrounding us. But we also need to demonstrate that a small society can make a giant step without tremendous costs.'

Market and regulation

The steering group has discussed market and regulation with Professor Frede Hvelplund from Aalborg University, Chief Consultant Jens Holger Helbo Hansen from the Ministry of Taxation and Associate Professor Jørgen Birk Mortensen from the University of Copenhagen.

There is a basic conflict between the technical and the economic way of thinking: the engineer sets a technical objective whose implementation will be in competition. The economist prefers to set objectives for the economic and environmental results and to leave the choice of means up to the market. But there was agreement that the environmental costs by using energy are high and that society and not the market should price them. The more guarantee the politicians create of the long-term objectives, the cheaper it will become for the actors on the market to fulfil them.

There was also agreement that the politicians on behalf of society have the responsibility for supply reliability. The value increment from extraction of raw energy to the final use of energy services is big. It should be found in the last link of the chain. A more efficient use of the energy is better for the supply reliability and financial situation of the consumer than an additional agreement with an energy supplier.

Finally, it was agreed that the taxes and dues system should be revised thus avoiding negative side effects and wrong impetus. The environmental costs should be included in the prices whenever possible – however, the politicians should not interfere with the short-term market as this would cause the actors to lose faith in it.

It takes hard work

Jørgen Henningsen, the European Policy Centre, suggested to forget the ideological bias. We must take a look at where the market works and where it does not. It does not in the electricity sector, he pointed out. The liberalisation of the electricity sector has not meant price decreases. Nobody can produce power cheaper than the established companies.

Another ideological dispute prevails between those who have for years claimed that the world oil production will reach its peak next year and those who say that this will never happen. None of the parties have been right. But no matter whether the curve will turn in five or twenty years, it would take off the top pressure if the EU implements a policy leading to energy saving, Jørgen Henningsen pointed out.

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He also criticised the ideological concept that the trade in CO2 quotas will solve the entire problem by 'internalising the external costs', making the prices reflect the real costs of environment and climate. It does not work that way. Even though you issue fewer quotas and sell them by auction instead of issuing them for free, we will still be facing major problems. The industry, for instance, which is subject to international competition, cannot add the costs onto the price. But the electricity works can, as they do not meet competition. And the advantage of increased electricity prices will primarily benefit nuclear power.

The companies must know the gains, both on a short and long-term basis, by investing in energy efficiency and sustainable energy. That is not the case in the present quota system. Furthermore, the costs by a quota price of approx. 20 Euro per ton CO2 are insignificant, both in relation to the general financial growth and in relation to the heavy costs of the climate changes, which the report of Nicholas Stern to the British government has mentioned. Energy saving takes hard work, Jørgen Henningsen continued. Year after year, people have said that the potential for retrenchment is huge in the years to come. But economy campaigns and energy labels and consumption taxes have not been sufficient to realise the potential. They only influence marginally on the behaviour. Jørgen Henningsen urged to 'pension the fear of dealing with the transport sector.' Measures should be taken to stop dumping prices on air tickets. And the sales price of a new car with a low energy consumption should be lower than the price of a corresponding car with old-fashioned technology.

The Future Panel:

The Liberals, Lars Christian Lilleholt, Eyvind Vesselbo, Jens Kirk, Jacob Jensen

The Danish Social Democrats: Kim Mortensen, Torben Hansen, Niels Sindal, Jens Christian Lund

The Danish People's Party: Aase D. Madsen, Tina Petersen

The Conservatives: Charlotte Dyremose, Per Ørum Jørgensen

The Socialist People's Party: Anne Grete Holmsgaard, Poul Henrik Hedeboe

The Danish Social-Liberal Party: Martin Lidegaard, Morten Østergaard, Johannes Poulsen

The Red-Green Alliance: Keld Albrechtsen, Per Clausen

The Christian People's Party: Emanuel Brender

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Peter Børre Eriksen, Energinet.dk

Benny Christensen, former County of Ringkjøbing

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No. 243: Doctor prescribed heroin now

No. 242: National strategy for bio diversity necessary

No. 241: Biogas - a neglected opportunity

No. 240: District heating gets a new meaning

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