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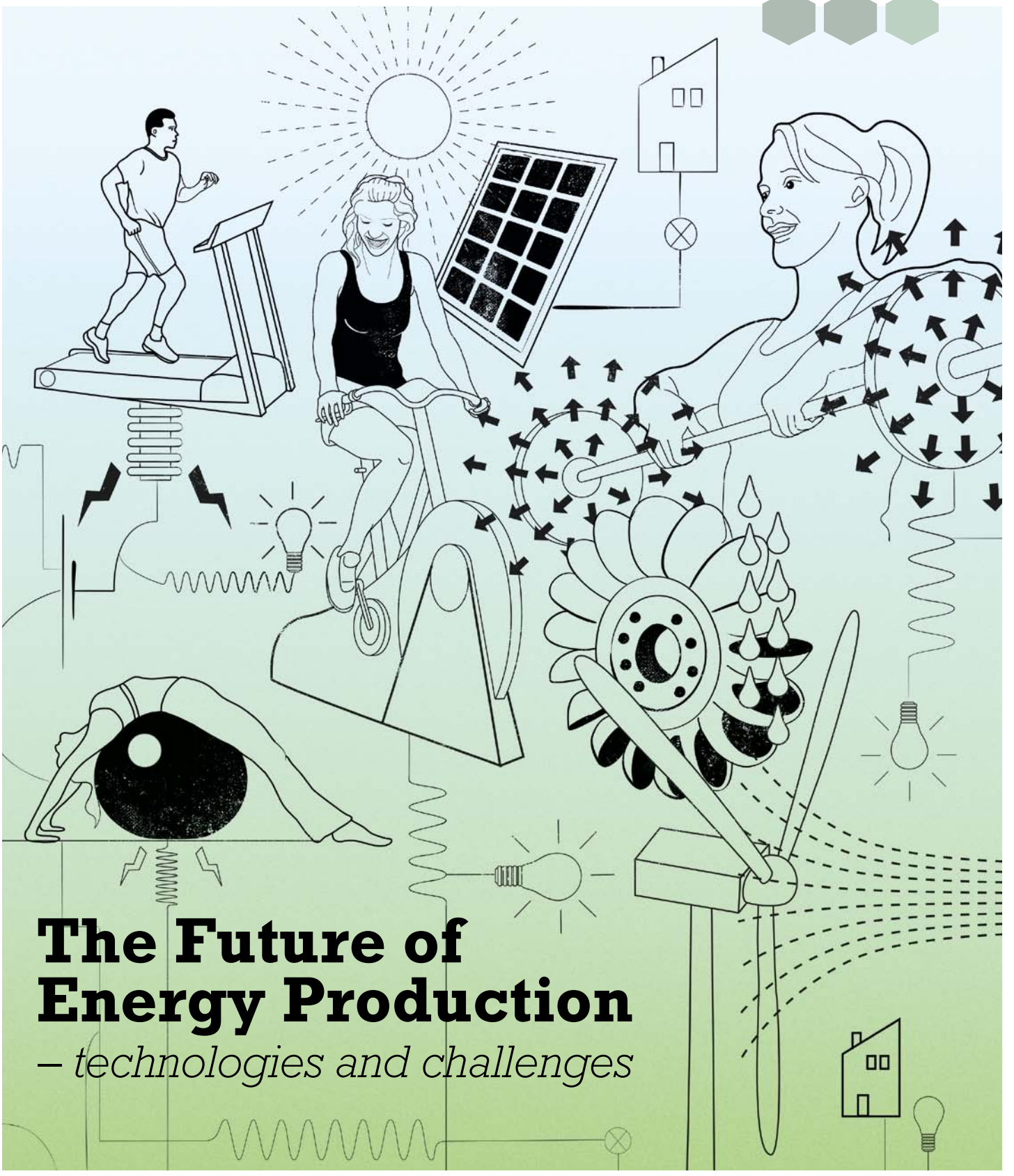

The Future of Energy Production

– technologies and challenges

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EDITORIAL

Debates on national policy seldom excite me. I consider my time here on earth too valuable to preoccupy myself with marginal discussions on the distribution of domestic resources. Instead I want to trouble myself with the big questions in life – the stuff that really matters in regards to prosperity and development of mankind.

One might consider the theme of this issue a matter of national policy. Such an assumption is at best oversimplified. Let there be no mistake; the future of energy production is a global concern. The aftermath that will follow the domestic choices we make will be immense, and the debates on energy transformation and consumption present implications for social development, economic growth, employment, energy output and global sustainability. Factors that are all interlinked.

New and more renewable energy is necessary in order to cut CO_2 emissions and develop new technology and competency. However, the transformation from fossil to renewable energy is often debated in hindsight, and have the tendency of dwelling on what we did wrong rather than what we can do better. The arguments thus lack a constructive component.

This editorial staff would like to see that a more fertile approach is adapted, so that we can define where we are today and where our future possibilities lie. Not as a tool of criticism, but as a suggestion for future direction.

Public debates establish the norms of which many of us choose to follow, and are essential for the development of society. Unfortunately our path of development is somewhat worrisome. Nevertheless, our expressed worries can hopefully become a platform to stimulate consent, solutions and better policy. Our worries should always be used constructively to create awareness and discussion on issues we find troublesome or unjust. To be able to concern ourselves with societal problems is only human, while the expression of concern is nothing less than our duty to society. Hence we in Teknovatøren wish to publish our worries with the objective of creating hope and direction instead of criticism and hindsight.

On that note, I would like to welcome you to another issue of Teknovatøren!

This issue consists of an interesting selection articles ranging from Germany's post-Fukushima challenge, to new technological opportunities for energy production in Norway. I am also happy to present two external articles in this issue that provide special insight on carbon capture and storage, and the importance of hydropower in developing countries.

I hope you will enjoy this issue of Teknovatøren, and I can only urge you to keep worrying and keep discussing.

Christian Guttormsen
Executive Editor

Technology: The application of scientific knowledge for practical purposes and the employment of tools or processes to do work.
Innovation: A new combination of existing or new resources in order to develop new products, services or processes.

Teknovatøren is a semi-scientific magazine published by the master students at the Centre for Technology, Innovation and Culture, University of Oslo. Teknovatøren seeks to illuminate issues on technological development, innovation and knowledge production.

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Illustration: Veronika Hansen

Norwegian Energy Policy
Ready for Renewal?

Norway has a long history of an economy based on natural resources, but is Norway's path dependency on oil and hydropower a facilitating or obstructing factor for a more renewable future?

For more than a 100 years, Norway has had an energy system dominated by hydropower. Extensive construction of hydropower plants created the foundation on which Norwegian industry was built in addition to provide Norwegian households with electricity. Since the discovery of oil and gas in the North Sea in the late 1970's, Norway has developed as one of the largest exporters of these resources. Due to increased consumption of carbon based energy in the oil, gas and transport sectors the share of renewables in the Norwegian energy mix has been substantially reduced the last 20 years. Seen in light of climate changes and the United Nation's International Panel on Climate Change's (IPCC) aim of avoiding a temperature increase above 2 degrees Celsius, the use of energy from carbon based energy sources should be reduced.

Norway has a great potential in producing more energy from renewable energy sources such as bio, wind, tidal and more hydro, but considerable little has been done within this field. For example, Norway is considered to have especially good wind conditions, but currently wind power constitute a very small part of the energy mix. So what makes Norway lag behind at a time when renewable energy is so high on the agenda worldwide?

Renewable energy is more than words

"This is not the end. This is not even the beginning of the end. But it is probably the end of the beginning." [1]

The Norwegian Minister of Petroleum and Energy, Ola Borten Moe, stated this after new discoveries of oil were made in the North Sea in August 2011. Several new discoveries lately have increased the optimism among those who consider oil and gas to continue to constitute an important part of our nation's economy. It is important not to deny the vital role the oil and gas sector has played in building up Norway as a welfare state, and there will be considerable activities associated with this sector in the time to come. However, that does not challenge the fact that it is also time to look into the future. What will be Norway's main competency and income-generating activity when the oil and gas era comes to an end? Norway has built considerable competencies both when it comes to technology and knowledge associated with offshore activities and hydropower generation. This is knowledge and experience we can make use of to build new competencies within renewables. But is there political will?

Need for a holistic plan

Today Norway has the highest renewable energy share of all European countries, so maybe there is no point in nagging about lack of political will to do more. However, decisions and incidents abroad are likely to influence Norwegian energy policy in the time to come. What we are seeing today is that European policy is framing the development of energy policies also in Norway, for instance through the EU Directive on Renewable Energy. Norway has to increase the share of renewable energy production, and the government has to follow up with a strategy on how to achieve that.

What is important to keep in mind though, is that renewable energy production is not about producing "clean energy" for its own sake. Related actions need to be taken. Therefore Norwegian politicians should make a plan on how to create a new direction for the economy in the time to come. This will include considerations concerning the national carbon based energy consumption, transmission lines to the European continent, how to build new knowledge and technology, local industry and entrepreneurship. Without doing any reflections on how to utilize the renewable energy, politicians can be tempted to ask whether there is any reason for Norway to increase the share of renewables as most of the electricity in our households comes from hydropower anyway.

"Today Norway has the highest renewable energy share of all European countries, so maybe there is no point in nagging about lack of political will to do more"

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(Photo: NORWEA)

1. Dagens Næringsliv 17.08.11

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A Cheap, Clean and Convenient Solution to Global Warming

The Norwegian government will spend billions on CO_2 capture and storage at Mongstad in Norway. Even though many say the project is too expensive, it can turn out to be a cheap solution to global warming.

The Prime Minister of Norway has said that development of CO_2 capture and storage, CCS, will be Norway's moon landing. This is supposed to be Norway's contribution in the battle against global warming.

The first step of the project is building a test centre at Mongstad that will be in operation early 2012. This test centre will pave way for full scale CO_2 capture and storage at the refinery at Mongstad where the cost is estimated to 3 billion euros. Too expensive, says critical voices, but if we take a closer look on the project this could actually turn out as a cheap investment.

The aim

First, we must consider the objective of the moon landing. It's not only to clean the emissions at the refinery at Mongstad. That would have been very little ambitious as only a few million tons can be captured there annually. The aim of the moon landing is to develop and commercialise technology that can be deployed globally. If this is achieved, the Mongstad project can pave way for the capture of billions of tons of CO_2 each year.

There are about 8 000 fossil fuelled power plants and industrial plants globally that emits more than fifty percent of the total anthropogenic CO_2 emissions. CCS is in theory applicable to all these plants, provided that the technology is developed into a cost effective solution.

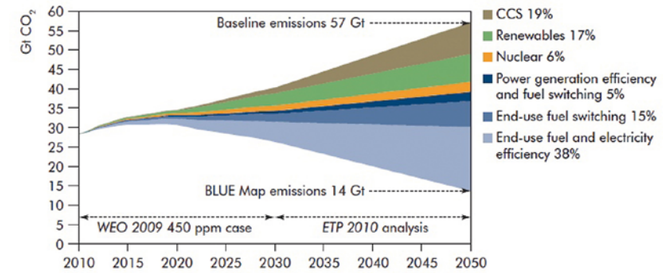
Technology development does not happen by itself. Someone has to take the first step and be a front runner, and this is the essence of the moon landing. Together with other planned demonstration projects around the world, the Mongstad project can result in development of a technology that can eliminate a substantial share of global man-made CO_2 emissions.

"Technology development does not happen by itself."

The solution

Global warming is an enormous challenge, and every possible tool must be deployed to reduce greenhouse gas emissions. In the long run, towards the end of this century, the main solutions will be renewable energy and energy efficiency. But the emissions must be cut now, which is not possible with only renewables and efficiency. That means that additional solutions are required, and CCS is one of them because it can give considerable emission cuts while renewable energy sources are being developed.

Other solutions are also required, and one example is life style changes to reduce our environmental footprint. Another example is to reverse the land use changes that today are causing quite a big share of man-made greenhouse gas emissions.



The IEA Blue Map Scenario shows technologies that can cut half of global CO_2 emissions by 2050. CCS can account for as much as 19 percent of the emission cuts. Source: IEA, Energy Technology Perspective 2010.

CCS can cut 19%

The International Energy Agency (IEA) has established a scenario for how to reach he international target of limiting global warming to 2 degrees Celsius. This scenario, called the Blue Map Scenario, shows a mix of technological solutions that can cut half of the global anthropogenic CO_2 emissions by 2050. CCS can deliver as much as 19 percent of the total emission cuts.

A cheap investment

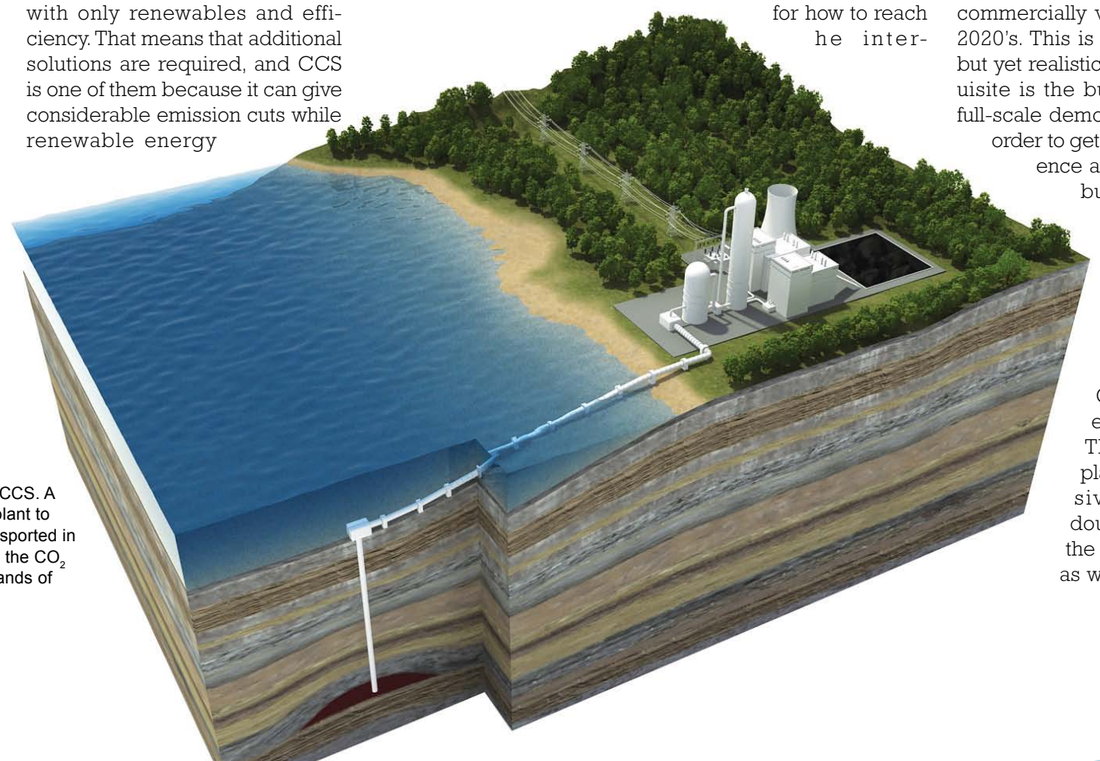
There is an international agreed objective that CCS should become commercially viable in the early 2020's. This is a very ambitious, but yet realistic target. A prerequisite is the building of several full-scale demonstration plants in order to get necessary experience and competence in building. This must be done parallel with comprehensive R&D programmes. If this is done globally we will be able to deploy CCS as a cost efficient solution. The demonstration plants will be expensive. There is no doubt about that. But the cost will decrease as we climb the learning curve and gain experience, and it is believed that CCS could be cost competitive with other low carbon technologies within ten years.

The Norwegian ambition for CCS at Mongstad is actually a good example of good political leadership. A substantial budget is allocated for the expensive demonstration phase. But it is too narrow-minded to say that the investments of billions of euros are too expensive. This must be compared with the alternative of not succeeding with the commercialisation of CCS.

The IEA says it will be 70 percent more expensive to achieve the necessary emission cuts without CCS. In this perspective, the investments at Mongstad actually become very small.

Norway's contribution to development of CCS should in other words be considered as a cheap investment to combat global warming.

Still I would like to emphasise an important point – full-scale CCS at Mongstad has been delayed several times since the project was launched five years ago. Further delays will be unacceptable.



The figure shows a coal power plant with CCS. A CO_2 capture plant is added to the power plant to extract CO_2 from the gas. CO_2 will be transported in a pipeline to a suitable storage site where the CO_2 can be injected for safe storage for thousands of years. Source: Bellona and Prosjektlab.

CCS AT MONGSTAD

The Norwegian government has spent more than 600 million euros on a test centre for CO_2 capture at Mongstad, Norway. This is phase one of the Prime Ministers moon landing where Norway will develop technology for CO_2 capture and storage (CCS). The test centre is called Test Centre Mongstad (TCM), and experiences and competence building based on operation of the TCM will pave way for the next phase of the moon landing – full scale capture and storage of CO_2 from the refinery at Mongstad.

The Cost of Going Green – German Nuclear Policy in the Aftermath of Fukushima

All photos: Wikimedia Commons

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With Germany deciding upon closing all nuclear power plants within the next ten years, the rest of Europe will be monitoring the steps taken to make up the deficit in locally produced energy. In the transitional phase to an energy infrastructure based on renewables, experts disagree on the cost of going green.

In September 2010, the Liberal Democrat and Christian Democrat coalition government negotiated an extended period of operation for the nuclear plants built before 1980 as well as the newer ones, with some of the taxation being marked for R&D of renewables.

Despite the majority of Germans being opposed to nuclear energy, Chancellor Angela Merkel expressed the necessity of nuclear power as a "bridge" to a future of green energy. However, shortly after the Fukushima disaster in March this year, the German government decided upon a three month shut-down of the older nuclear plants, in which time they would be given a safety evaluation. Eight reactors were immediately shut down, their total output equaling approximately 6,4% of German energy usage. With the decision to shut down the remaining nine reactors, Germany now faces a challenge to make up the energy deficit as the nuclear plants provided nearly a quarter of the national energy production.

German Chancellor Angela Merkel

"Germany is now in a position to innovate in the field of renewables"

Looking ahead

The government voted for expanding into gas and coal industries, in addition to renewable energy sources, like wind and solar power. Despite these changes in energy policy, already defined goals of reducing CO_2 emissions will not be altered. Deutsche Bank has already stated that the emission goals will not be met in the coming years due to the sudden change in energy policy. With the situation being that coal and gas, imported mainly from Russia, will be the bridging technology, these concerns might be well founded.

However, Germany is now in a position to innovate in the field of renewables, and could potentially secure a leading position in what will arguably be a new energy infrastructure in the near future.

A question of pricing

There is disagreement about what the effect of the German *zeitgeist* will cost. The government estimates as little as a 1 cent increase per kilowatt hour. This is contested by the Rhenish-Westphalian Institute for Economic Research, which claims that the cost might end up being five times as high. At the same time, heavy subsidizing of solar energy is facing criticism, since the comparatively weak output in energy does not warrant its current level of subsidization.

One thing that remains certain, despite disagreements over the how's, is the turning to a greener future. With Siemens recently announcing they would follow German popular opinion and cease all operations in the nuclear sector, the opportunity seems ripe for Europe at large to take the lead in a global market of renewable energy R&D and consumption.

"Germany now faces a challenge to make up the energy deficit as the nuclear plants provided nearly a quarter of the national energy production"

"The heavy subsidizing of solar energy is facing criticism"

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The Norwegian *Zeitgeist*

Norwegian politicians describe Norway as being "post petroleum", and are increasingly supporting R&D of new renewable sources of energy. However, the politics are inconsistent and the government lack a clear national strategy on how to support such an industry.

Renewable energy represents enormous potential and is recognized as a way of meeting the increasing demand for energy as well as preserving our climate. However, the sun and the wind come and go, so we need to control them. Wind power in the North Sea represents a potential of 14 000 TWh that is yet to be exploited. In comparison, the total energy consumption in Norway per year is approximately 120 TWh. The successful establishment of Offshore Windmill Parks (OWP) is important for the environment, for society, and in order to secure future energy supply.

Path Dependency

Norway is often claimed to be path dependent, meaning that prior action is decisive for future decision-making. Oil and gas have played a significant role in the wealth accumulation that has taken place in Norway throughout this past century, which may also explain the position oil and gas have in politics today. The petroleum industry is responsible for approximately one third of all green house gas (GHG) emissions in Norway. According to the Kyoto Protocol, Norway can increase GHG emissions by 1 % compared to the 1990-level subsequent to other quota mechanisms in the agreement being accounted for.

It's now 20 years since the first OWP was established in Denmark. The pioneering country has altered an environmental friendly path to meet their demand for energy. Norway on the other hand is lagging behind with the idea that "we shall be the best – just not at home". But is this really possible? It's a paradox how Norway is blessed with an enormous potential within energy – both sustainable and not – whereas the rest of the world struggles to ensure energy supply while preserving the environment.

Wind for the Win

In headwind and tailwind, Norwegian businesses and researchers are trying to facilitate a Norwegian offshore wind power industry. More than 300 Norwegian companies are involved in the value chain with regards to offshore wind power by research and supplying technology such as jackets, composite materials, grid systems etc. New renewable energy solutions are rarely competitive in the market without state interference. This is the reason why Norwegian companies invest in other countries where there are markets and incentives for this type of business.

Norway has a competitive advantage within offshore power from 100 years of experience within hydropower as well as in oil and gas. A country's traditional industry often forms a platform for new areas to grow – industries a country is more likely to succeed in than others. Norway has traditionally had a resource-based economy which once also formed the basis for the petroleum industry in the mid-sixties. We have great possibilities to succeed with offshore wind power national if only politics will allow it.

The Best Abroad

Hywind is foremost the most successful Norwegian example of how technological innovation can change how we produce energy. Norwegian politics express that Norway should be the best in offshore windpower technology as long as we don't do it at home.

There might not be anything wrong with an export industry of renewable technology – the clothes we wear mainly come from China. What is blocking a future development is a *laissez faire* strategy where the conditions for new energy industries and innovation are not altered nearly enough.

A Market for Renewables – Funded by the Consumers

From January 1st 2012 a green certificate market will be established between Norway and Sweden. Not heard about it? You're not alone. It might also surprise you that it is the Norwegian electricity consumers that will make it become a reality.

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Illustration: Kristine Czynski

Norway is currently the only country in Western Europe not subsidizing energy production from new renewable energy sources. However, as a member of the European Economic Area (EEA), Norway has committed to increase the renewable share to 67,5 %, following the EU Directive on Renewable Energy, aiming for a renewable energy share of 20% in the EU by 2020. To achieve this, a green certificate market will be created. Sweden established such a market in 2003. Initially Norway also considered joining the market, but negotiations with Sweden failed. The main reason for this was the Norwegian government's skepticism to the certificate market as an appropriate mean, fearing little new energy coupled with high electricity prices for Norwegian consumers and industry.

The constructed market

The green certificate market is guided by a political goal of increasing the production of renewable energy with 26,4TWh in Norway and Sweden by 2020. Producers of renewable energy will be given a certain number of certificates by Norwegian authorities, according to the amount of renewable energy they produce. Energy suppliers, responsible for distribution of electricity to households, are obliged to buy a certain number of these certificates. As such, a demand for renewable electricity is created. Consumers will pay their regular electricity bills, as well as the additional costs associated with the increase in electricity from renewable energy sources in the grid. The energy producers will receive income both from the electricity production and the certificates. The certificates will be issued from 2012 until 2020 and the market will be phased out by 2035.

Killing Innovation?

This fictitious market is intended to generate demand that can attract more investments, resulting in increased production of renewable energy. The intention is to make renewable energy production more profitable in the long run. However, as it seems today, only a few renewable energy technologies will benefit from this system. Due to technological neutrality, the market mechanisms will pick the "low hanging fruits", meaning

"What if the certificate market results in more renewable energy, increased energy consumption and no reduction in CO_2 levels – can we still consider it mission accomplished?"

The dam at Berdalsvatnet (Photo: Østfold Energi).

the most mature technologies and affordable projects. Therefore, it is expected that the increase in renewable energy production will be mainly from hydropower in Norway, bio energy in Sweden and onshore wind power in both countries.

There are a number of research projects on renewables in Norway, for instance on tidal and wave energy, but there are not sufficient support systems to help develop and commercialize these technologies. How will emerging technologies develop from the research and experimentation stage to the commercial market without proper support systems attracting investments? The certificate market can therefore be a hindrance to innovation, including technological development and commercialization.

Challenges ahead

Several Norwegian energy producers are ready to enter the certificate market, but considering the investments needed to achieve the goal, there will also be need for new actors and significant financial resources. Are the investors and producers ready? There are risks and uncertainties related to a market, such as future prices on electricity and certificates, as well as weather conditions such as precipitation and wind. In addition, the global financial market is posing further risks.

In Sweden the system has delivered the expected energy amount of 11,5 TWh from 2003 to 2010. However, Swedish consumers have faced higher costs than expected. In total, Swedish consumers have paid 19.5 billion SEK for the increase in production. Still, very few consumers are aware that they are financing renewable energy production because the increases in electricity prices are marginal for each individual. Current future analysis predicts that Norwegian consumers' electricity bill will increase with approximately 200 NOK in 2012 to 900 NOK 2020 due to the introduction of certificates.

Why more renewable energy?

The question that remains, assuming the certificate market achieves the set goal; what to do with the energy? It seems the only concern for Norwegian politicians is to fulfill the EU Directive, but then what next? Many countries want to increase their renewable energy production in order to address an energy shortage, with the end goal of becoming self-sustained. Norway is in a different situation: We have enough energy, and most of it is already renewable.

The reason for increasing the renewable energy production is based on the idea that it will reduce the dependence on carbon based energy around the world. The problem is that there is no strategy for how the renewable energy in Norway can substitute the carbon based energy. Several options are on the table, but no decisions have been made. Should Norway electrify the oil and gas platforms with renewable energy? Or should we connect to the European mainland and provide renewable energy, reducing the use of carbon based energy? An energy surplus without reduction in CO_2 emissions will only result in negative environmental impacts. What if the certificate market results in more renewable energy, increased energy consumption and no reductions of CO_2 – can we still consider it "mission accomplished"? We need a holistic strategy to be agreed upon. Now.

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Empowering People

– the importance of renewable energy investments in developing countries

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Penstock: The river run off hydropower plant Bugoye in Uganda. Photo: Norfund

The challenge of the developing countries is a hot potato in the international climate policy debates. It is all too obvious that poor countries cannot develop with the same type of fossil fuel consumption as the developed countries if the emission and temperature increase targets are to be met. However, in history, no country has risen out of poverty without economic growth, and the economies cannot grow without massive increase in energy supply. The solution to both the climate and poverty challenge must be renewable energy. The main question is *how* to develop a sustainable energy supply.

Electricity and development

What does it mean to live in 2011? For us in the West, with relatively worry-free lives, nearly all activities important to us is connected to technologies run by electricity: We are in touch with our friends and families with mobile phones and the Internet, we can read books at home at night under the cozy light of a lamp, and the bank or shop can with a click on the computer or the payment terminal check our credit status when we need something. Technologies has become so obvious that we don't even think about it: Women now have time to go to school and have active social lives because of washing machines, and if we get sick we can go to the hospital any time of the day. The easiest way to describe the lives of the poorest in the world in 2011 is to remove electricity from this picture. Leaving out South Africa, the remaining 47 countries in Sub-Saharan Africa has the same amount of available electricity as the one country of Norway, with only 5 million people.

Another main difference

between our lives and that of those in the least developed countries is the availability of jobs. The comforts above are also tightly interlinked to having paid jobs and not living from hand to mouth. Most salaried jobs for the poor, dominantly unqualified labor, can be created in relatively simple industry, for example in agricultural related business of processing foodstuff. Again electricity pops up as a prerequisite: No electricity, no industry. In a survey done by the World Bank, the lack of reliable and affordable electricity is given as the number one constraint for entrepreneurs in Sub-Saharan Africa, way past political instability and corruption.

The poor want better lives – first of all stable income jobs, but also what we in the West consider everyday technology such as washing machines and mobile phones. Electricity is the most important enabler for all this.

Blinded by the sun

With its obvious abundant sunshine, many look to solar energy as the solution for Africa. But the seemingly cheap and plentiful energy source seems to blind many from seeing a just as important side of the equation: The costs of development and maintenance of the electricity production, and the appropriateness for the all-important grid-supply. Sustainability is not just about environmentally sustainable projects – they also need to be economically viable. Further, to enable large scale, nation wide economic development, grid supply of electricity is a necessity so that diverse economic activities can flourish. Even in developed countries one have not succeeded in building solar-based grids.

With more than 100 years of experience, hydropower has proven to be the cheapest and best technology for large scale electricity supply. The experience has also taught us how best to hydro projects taking care of the local environment and societies (e.g. river run of projects rather than large scale dams). In Sub-Saharan Africa, less than five per cent of technically viable hydropower has been developed, and thus the opportunities for utilizing the experience from hydro development are great.

"Sustainability is not just about environmentally sustainable projects"

At present, solar technology is profitable and well suited for small scale (e.g. house hold lighting enabling kids to do their homework at night), but this is not the same as industrial needs. For industry development, diesel generators and coal fired power plants are currently more economically sound. Before costs are locked into these technologies, hydropower should be developed.

Profitable aid investments

For decades the main instrument used by the West supporting the development of poorer countries has been aid. This has not given the wanted results. Regarding electricity in Sub-Saharan Africa, there has been a decline in per capita availability. Enormous investments are needed, both in the production and distribution capacity.

The building of power plants is something the private sector has proven best at in the West, and the competency and driving force of private capital should be utilized also in the project of powering developing countries. However, "The Lost Continent", as The Economist labeled Africa in 2000, does not attract a lot of investment. Many perceive the risk as very high, particularly in a field where few projects have been completed.

Rather than only using aid money for direct spending, it can also be used as a catalyst to release the power of other private investments. By funding power projects on commercial terms and showing that economic returns are possible, aid money can trigger the forces of commerce in powering parts of Africa. This is the reasoning behind Development Finance Institutions (DFIs); aid money being invested with the same terms and conditions as other private investments – including the expectation of profits and economic returns. Further, the money can be recycled in other projects when the investment is paid back. This is also more sustainable for the donor countries, an increasingly important point given the current economic climate in the West.

Due to the win-win characteristics of renewable energy in developing countries, the Norwegian DFI Norfund has chosen this to be their main investment sector. Based on the success of the frontier company SN Power (a partnership between Norfund and Statkraft), the Norwegian government has allocated additional capital to Norfund to further strengthen this work. One Norwegian *krone* from the government to Norfund as released nine from other investors. Just as the availability of electricity can be a catalyst for development, aid funding can be a catalyst for private sector investments.

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PORTRAIT OF A POSTGRADUATE FROM THE TIK-CENTRE IN OSLO:

The Road Ahead

Who are the students at the Centre for Technology, Innovation and Culture (TIK)? I sit down with Bent Frøyland Bakken for an informal talk about the programme, past experiences, and future plans.


Photo: Teknovatøren

Every class has one - the overachiever. Always sitting front row when class starts. Perfect hair, creased pants and shiny shoes. The one who knew what he or she wanted to be before they even knew how to walk. Who spends every waking hour with their nose in a book just to nail that straight A diploma.

Bent Frøyland Bakken strikes me as nothing even remotely close to that.

In front of me sits a happy-go-lucky kind of guy. Scruffy hair and a big smile. He just happened to land a highly renowned three-year traineeship with the Norwegian Ministry of Foreign Affairs. For the next year Bent will be working in the Section for the High North Project, Polar Affairs, Energy and Resources. After that, three years at one of the Norwegian embassies awaits. Now how did this happen?

– I think it has been a great combination of coincidences.

"My initial plan was to become a teacher"

Everything takes time: things like this do not happen over night. It's a matter of patience and hard work.

It began with a bachelor's degree in economics, which led to a semester in France and a master's degree in European and American studies. Now he just finished his degree in Society, Science, and Technology in Europe (ESST). Bent wrote his thesis on how Statoil, a well-known Norwegian energy company, manage international technology transfer along with corporate social responsibility.

"A common misconception about technology is that it is a social evil"

– My initial plan was to become a teacher.

– But?

– No buts really, I just happened to pass ESST's information stand one day and thought "why not?".

What matters

– What was the most important lesson learnt during your time as an ESST-student?

– I can't really say this book or that theory has had a great impact on me. It is more the programme as a whole. You develop a way of thinking with space for thought and reflection. For instance, a common misconception about technology is that it is a social evil: stealing jobs from people, desensitizing human interaction, and taking over society – the list goes on. In my eyes, this argument is not well thought through. It is important to see the big picture. When analysing the impacts of innovation and science, it is important to see the dynamics and interactions between us humans, technology, knowledge, and society. After all, technology is an outcome of human development, and it is therefore wrong to isolate technology as the only troublemaker.

Future plans

I ask Bent if he has any thoughts about the future.

– It is not too late you know.

– Too late for what?

– To become a teacher.

– Are you still considering it?

– Who knows? Maybe not now, but that does not mean that I am going to exclude it.

BOOK REVIEW

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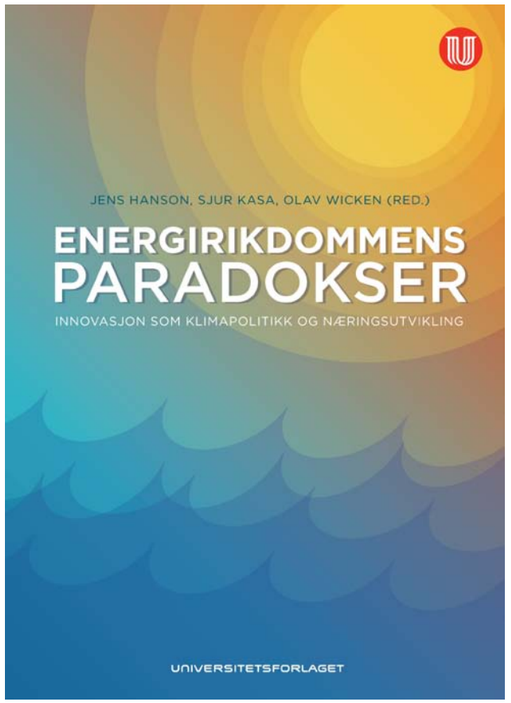
The Paradoxical Nature of Norwegian Energy Riches

Global warming and energy security are arguably two of the greatest challenges the world faces today. The culprit is, as we all know, fossil fuel. Norway has, due to its geographical location a vast coastline, easy access to large bodies of water and plenty of wind – great and unexplored opportunities to expand its renewable energy production, both on and offshore. So why is Norway so slow at adapting these new technologies? This is the main question that is explored in Hanson, Kaasa and Wicken's new book on Innovation as Climate Policy and Business Development.

While remaining a considerable exporter of both petroleum and hydroelectricity, Norway has in many respects been an outsider when it comes to clean energy policies, or lack thereof. As a result, Norwegian domestic production of electricity has come to a complete halt. Another reason for this outsider status is likely due to the two already very large incumbent energy sectors mentioned above.

From the early 1900s production of hydro-electrical power has been heavily politicized and closely tied in with the interests of labour movements, power-intensive industries and government. The supply of cheap energy has been the lifeline of major Norwegian electrochemical and electrometallurgical industries. According to Hanson, Kaasa and Wicken it has allowed Norway to indirectly transport "solidified energy" to the rest world through materials and products that were created as a result of Norwegian hydropower. In addition to industry, production of hydropower covers nearly all of Norway's energy needs on land (offshore activities are not covered) at a low price.



Energirikdommens paradokser - Innovasjon som klimapolitikk og næringsutvikling
Editors: Jens Hanson, Sjur Kaasa and Olav Wicken
Published: 2011
Publisher: Universitetsforlaget AS
ISBN: 9788215018348

In the 1970s Norway struck oil and quickly became the third largest oil exporting nation in the world, as well as a significant supplier of natural gas. Much of the industry operating on the Norwegian continental shelf is under national control, and the rest is heavily taxed. In this respect it has close similarities to the hydropower sector, and is the reason for Norway's very considerable sovereign wealth fund (The Norwegian Pension Fund – Global)

Investments into new renewable energies (as opposed to old ones such as hydropower) are, in addition to being associated with high risk, costly. As such, it might seem contrary to sound judgement to implement these, as they will lead directly to increased energy prices in the domestic market whether the energy is exported or not. If it is not exported, energy prices will be driven up by the increased cost of production associated with energy sources such as wind, wave, and biomass power. If it is exported, the prices will increase as a result of the relatively higher prices on the European market.

"New renewable energy sources is both costly and risky, why should we concern ourselves with this at all?"

If Norway is already self-sufficient with regards to clean hydropower and the transition to new renewable energy sources is both costly and risky, why should we concern ourselves with this at all? It comes down to a discrepancy between environmental and energy policies. Norwegian oil production is already weaning and will at some point come to an end. Norway has made a commitment to reduce its carbon emissions significantly by 2012 and finally reach carbon neutrality by 2030. In addition, clean energy export could be a future source of revenue when Norwegian oil production is a matter of the past. The future of Norwegian industry, and by extension, the future of energy demands, is filled with uncertainty. This, coupled with a lack of clear framework conditions and incentives has impeded the transition from what is largely a petroleum and hydropower-based system to one of new renewable energies .

This book sets the ambitious target of laying down a framework for understanding how such transitions could come about. While mainly dealing with the Norwegian challenges in transition to new renewable energy, it draws extensively on experiences from other European countries. In addition to the three editors Keith Smith, Anna Bergek, Steffan Jackobsson, Andreas Tjernshaugen and Oluf Langhelle, who are all leading experts in their fields, have made contributions.

One strength of this book is that it offers the reader an opportunity to pick and choose from a wide variety of topics, while it at the same time paints a broad picture of the conditions for establishing new renewable energies in Norway.

The framework is firmly based in the tradition of innovation studies and evolutionary economics. Concepts and categories, which should be well known to those in the field, should undoubtedly be useful and interesting to policymakers, the business sector, researchers and scientists.

This book represents a noteworthy and arguably overdue departure from neo-classical economic thinking in the debate about Norwegian energy policies, and will hopefully serve as a catalyst for further research as well as renewed discussion.

What's in your Wrap?

Have you ever considered what the protective case your fresh fruit and vegetables come in are made of? Or if you even need it?

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From the earliest of times, humans have consumed food where it was found. Families and villages made or caught what they used and were self-sufficient. There was thus little need for the packaging of goods, nor storage or transportation. When containers were needed, nature provided gourds, shells, and leaves. Later, containers were fashioned from natural materials, such as hollowed logs, woven grasses and animal organs. As ores and chemical compounds were discovered, metals and pottery were developed, leading to other packaging forms. Today, we mainly use packaging for preservation needs, and plastic has taken over as the main packaging material due to qualities like flexibility and low weight. The use of plastic is problematic however, due to its potentially severe effects on the environment.[1]

Puma's "Clever Little Bag" demands 65 % less material than before, thus reducing costs in production, storage and shipment. Photo: Puma Nordic.

PACKAGE OPTIMIZING

Too much package or the inclusion of hazardous toxins in the package is damaging on the environment. Too little packaging however is even more harmful due to various forms of breakage. As a consequence, optimizing is about using enough package to save the product from breakage without unnecessary damaging the environment with the inclusion of excessive and/or hazardous materials. Package optimizing is also related to cost savings in storage and transportation on behalf of the producer.

The unspoken challenges of package production

Because of the manufactured materials used in packaging, recycling has become an important societal issue. This has resulted in an impressing 84 % sorting rate on plastic packaging stemming from Norwegian households in 2010. Recycling contributes to the rationalization of natural resources and energy. However, it is desirable to increase the positive benefits from recycling to an even greater extent. Imagine for example that you could purchase your new toothbrush or cell phone in a bag ready with postage for you to return it when it was time to change. Or better still, if you could fill your car's windshield fluid directly at the gas station, leaving out the issue of packaging altogether.

Innovations in the packaging industry lead to great possibilities like these. Still, one of the many central issues to address now is the consequence of hazardous toxins like PCB (polychloriated biphenyl) circulating in the cycle of package production. These toxins have a long period of decay and are added to the packaging in the very first stages of production, and continue to exist when the products are being recycled and made into new products. Producers now focus on banning these toxins – to make them disappear from the cycle in total – but designers also have to think "joint circle", and that every small substance should be recyclable. That is to say; designers need to avoid materials containing toxins when planning new packaging in the first place.[2]

THE JOINT CIRCLE OF PACKAGE PRODUCTION

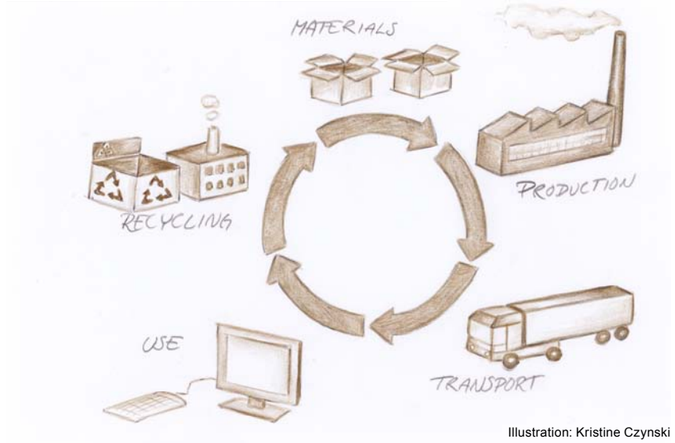

Illustration: Kristine Czynski

It's the economy, stupid!

Of course, in the age of globalization, innovation processes in the packaging industry are faced with an international component. How are we to encounter the environmental threats stemming from the production cycles of powerful manufacturers that often operate at an international level? One point of entry may be to argue the economical incentives: Big companies that give low priority to the recycling ability of their products run the risk of decreasing their income in the long run. If we assume that income correlates with reputation, then given the increased awareness on environmental issues among consumers, bad environmental reputation means bad business. Given this insight, innovation in recycling may in fact be profitable for large-scale producing firms over time.

This is evident even when it comes to transnational giants such as Coca-Cola. Their newly designed Bonaqua bottle consists of 50 per cent recycled plastic and 15 per cent plant-based materials. Or consider Puma's "Clever Little Bag" witch demand much less material than before, thus reducing costs in production, storage and shipment. The bag is also completely recyclable and equipped with a handle, leaving the extra bag superfluous and Puma with a better environmental reputation.

The windshield fluid pump at Statoil's gas station in Asker, Norway, at the trial stage. Photo: Statoil.

The newly designed Bonaqua bottle by Coca-Cola consists of 50 per cent recycled plastic and 15 per cent plant-based materials. Photo: Coca-Cola Norway.

Package Optimizing

So – businesses care about business, and successful business correlates with environmental reputation. In Norway, the privately owned non-profit company Green Dot (or "Grønt Punkt") is responsible for financing the recovery and recycling of used packaging on behalf of the industrial sector. In return the companies have to pay a compensation determined by their packaging quanta. By doing this they get the right to use the Green Dot symbol on their products as a signal of their commitment in package recycling.

A central point at Green Dot is the concept of optimizing the packaging of its members' products. The production designer is urged to consider the environmental strain stemming from the entire life cycle of the product: from the use of material and production, through transportation, usage, sorting and recycling. Apart from reducing environmental damage, the design guide of package optimizing is also presumed to reduce costs. So it shouldn't really be a question.

1. Kenneth R. Berger, reviewed by B. Welt (2002/2005). Institute of Food an Agricultural Sciences, University of Florida.
2. Grønt Punkt.

Confessions of a Lecturer

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Technoscience and the Power of Experts

Today's society is often called the knowledge society, and sometimes even the expert society. The obvious reason for this is that knowledge has become more important, not only for increasing what we know about the world, but for all types of societal development. Knowledge is not only about understanding the world, but also about changing it. This leads to the implication that science often is understood as technology; instead of biology we talk about biotechnology and instead of materials science we talk about nanotechnology. Applications have become of great importance even for basic research, which poses the need to talk about technoscience instead of science and technology.

At the TIK-Centre we do not in a naïve way support the increased power of experts or the merger of science and technology, but critically study these kinds of processes, and also try to reflect on what kind of power we want experts to have. Expert power varies to a great extent. Some experts seems to have a lot of power while others has much less. Hence, detailed case studies on the role of experts are of great importance to better understand today's knowledge society.

Taking the example of climate research, we agree that there are many climate researchers around the world and that climate change is one of our most important public issues. But what about the power of climate experts? Many of us should say that they don't have enough power. The United Nation's Intergovernmental Panel on Climate Change (IPCC) has not succeeded in influencing politicians to agree on a new international protocol replacing the Kyoto protocol that ends its commitment in 2012. The research syntheses presented by IPCC are not transformed into policy and practice.

However, in 2008 the Government in the United Kingdom set up a national scientific Committee on Climate Change (CCC) in connection to the new UK Climate Change Act. If the Government is not following the advice given by the Committee it has to clarify the reasons why this has not been done. By this the UK Government try to bridge the gap between scientific advice and political decision-making and to give more power to climate experts.

This seems to be a good idea. Most of us want climate politics to be based on scientific knowledge. On the other hand we don't want experts to make political decisions. Experts should not alone design solutions to complicated societal issues – technocracy is never a good option in a democracy.

The power or lack of power of climate experts could be considered in connection to the notion of technoscience. Why are we not talking about climate technology when we talk about biotechnology and nanotechnology? A tentative answer is that the latter two are strongly connected to industrial development aiming to transform the world, while the former is just about producing knowledge for politicians to consider or not. But if the UK example is a sign of a stronger connection between research and political decision-making in the climate field, it could be fruitful to start talking also about climate technology, implying that climate researchers consider applications, what politicians should decide on and what policy measures to design, already in the laboratory.

The strong power of experts and the establishment of fields of technoscience is something that we should critically study, and not naively support. Although the gap between science and politics may be too big in the climate field, it is perhaps too small in the case of biotechnology. Nevertheless it could be of interest for climate researchers, and for all of us, to start thinking about what it could mean to transform climate research into something called climate technology.

Innovation in Aviation

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Photo: Nasirkhan, Morguefile

The restructuring of business models is maybe the only way to make the air travel industry more profitable. But can this be done in compliance with environmental considerations?

Probably not...

Peter Drucker wrote in 1985 that changes in demographics are the most important source for innovation outside the firm. The airline industry saw this a long time ago. There are several trends which forces an airline to innovate:

- The growing income inequality in the world.
- The partial liberalization of the world economy.
- A new market in flying people between Asia and the rest of the world. The internal Chinese and Indian markets are still tightly regulated.
- A near perfectively competitive market with the rise of internet search engines which provides price and options within seconds.

The reason why more tourists travel longer is in my opinion a result of falling prices, not changing consumer preferences. In combination with the complete deregulation and ever rising oil prices this poses a number of dilemmas:

1. How does an airline attract the high-end clientele who seeks quality, not low prices?
2. How is it possible to make money on economy class when monopoly profits are no longer available for national flag carriers?
3. How to increase your share of intercontinental travel?

Why premium seating is profitable

To make profits on a flight, the real question is not how many passengers, but how much you can persuade passengers to pay per square meter. The reason for this is quite simpel. An airplanes weight consists mostly of the structure and the amount of fuel it is carrying. The amount of fuel is determined by number of passengers and the journeys length. Boeing 777-300ER as an example, probably the most fuel efficient airliner today. Notice that the plane's own weight constitutes over 50% of the total weight. Fuel consumption is therefore not only a question of passengers, but is heavily influenced by other factors as well. The trick is therefore to make the number of passengers more per square meter. Business class and first class seating takes more room, but they pay 60-100% (business) or 300-500% (first) more per square meter than economy class passengers.[2]

A profitable business model will seek to maximize the number of premium seats, and try to minimize the space taken by economy class passengers as they are assumed to be price sensitive.

Maximum take-off weight	51 500 kg
Empty weight	167 800 kg
Fuel capacity	181 283 liter

Best case and worst case, the environment loses either way.

Best case: Emirates

Emirates is the world's fastest growing airline and about the only one which is profitable. It is based in Dubai, and specializes in flying from Asia through Dubai to the rest of the world. Emirates have figured out what I believe to be the two components of success: A lavish business class and branding. The fact of the matter is this: Emirates is known for having the best business class and first class in the world, so they can charge whatever they like in that segment. They are also good at branding themselves. Economy class passengers believe that service will be much better than on their national airline. The truth is that most of the Emirate's planes have tighter economy sections than Ryanair. They fly mostly new planes, but they are still major pollutants since the space occupied by premium seating reduces the number of passengers in each plane.

Photo: Dantada, Morguefile

Worst case: SAS

Scandinavian Airlines is quite possibly the most mismanaged airline in aviation history.[3] To name a few problems facing SAS which they are solely responsible for:

– They have based their long haul fleet on the plane with the worst fuel economics (A340).

– They have possibly the oldest fleet of any European carrier, using massive amounts of fuel.

– They have a bad business class product.

– They insist on using Copenhagen as a transfer point thereby leaving offering other airlines massive opportunities in offering direct flights from Oslo and Stockholm.

– They operate no less than 12 types of aircrafts which causes a huge economic loss.

This business model also ensures massive pollution. Other business models produce the same results: Delta/Lufthansa, use planes which are depreciated. Thai Airways: Old planes, but lots of room in Economy. Cathay Pacific: Show the cargo hold full of cargo. All of these business models ensures pollution.

Is there a planet friendly business model for airlines?

The answer is no. The airline industry is one of the most unprofitable in the world, and the only chance to make money is to provide premium products which reduce the number of persons on each plane, and therefore increases emissions per passenger. The trend towards "greener" air planes is offset by the massive increase in air travel. And here is the simple reason: A new generation of planes (15-20 years span) can have a 10% fuel decrease per passenger, but demographics is crushing the benefit. The increase shown here can never be matched by any incremental improvement in aircraft technology, and in the last years the improvements have indeed been incremental. The 787 which Boeing points to as a green plane only produces 20% less emissions than a 767, a plane which first rolled out in 1982. The reduction in fuel consumption usually only produce more air travel. If you add the fact that there is more business travelers and more people seeking premium products you are approaching a dangerous situation with regards to emissions.

"This business model also ensures massive pollution"

A two-pronged attack

The innovative abilities of the airlines are a correct response to changing trends in income and business. The airline has an obligation to innovate and to be profitable; society has an obligation to reduce green house gas emissions. The real challenge is therefore to design a system which reduces emissions and is considered fair. I therefore propose two quite simple regulations. Airlines themselves are quite adept at reducing emissions on each flight; it is just that they consider it per flight, not per passenger:

1. Fill up planes to the fullest. This means reducing the size of business class seating and increasing the number of seats in each plane. Ban first class seating. It is something wrong when All Nippon Airlines can have a capacity of 215 in a plane with a max capacity of 550.

2. Carbon emission fees on jet fuel. Jet fuel is tax free. Increase the price of jet fuel, increase the price of air travel, and thereby decrease air travel.

Freeedom for who?

Air travel faces the same problems as car pollution. It is associated with personal freedom. A successful campaign against air travel pollution requires a sense of fairness. A massive increase in ticket prices will seem unfair when everyone knows that someone is able to pay for the freedom of air travel. It is therefore important to first tackle the problem of premium travel, and then reduce air travel.

Air travel is a major pollutant no matter what, but much can be done to remove the most unnecessary waste from the industry. Today freedom of the skies is the wealthy's freedom to bask in luxury at the price of our planet.

Singapore Airlines a340-500. All Business class, 100 passengers max. Uses 200 000 liters of fuel between Singapore and New York. A return ticket: 4000 liters of fuel per passenger. Typical example of problem with premium seating (Photo: Propfreak, Creative Commons).

1. The movement of capital and commodities are liberalized, but as long as the movement of labor is still highly regulated I will call it a partial liberalization.
2. See for example http://www.guardian.co.uk/environment/blog/2010/feb/17/business-class-carbon-footprint or http://www.co2offsetresearch.org/aviation/Class.html.
3. http://www.dagbladet.no/2011/02/09/nyheter/samferdsel/sas/15367139/

Photo: Mcconnors, Morguefile

Your Future Home is Passive

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"Building a passive house will increase the property value as it will end up with the highest energy classification".

The Norwegian government has announced that by 2020 all new buildings should follow the passive house standard. But is this really the best solution for energy efficient buildings?

The passive house is already well established in Germany and Austria, and worldwide we find nearly 40.000 of them. The "passive house" label comes from using passive measures to reduce energy demands for extra isolation, extra density and heating. The total energy use for a passive house is only a quarter of the energy needed in regular buildings. To be honored with the passive house title, the building has to meet two main criteria:

– Estimated annual energy demand for room heating must not exceed 15 kWh/ m² per year.

– Maximum power demand for room heating must not exceed 10 W/m².

The total energy demand for a passive house will be around 60 kWh/m² per year, but in Germany many houses measure to only half of this. This represents 4-5 tanks of fuel used in a mid-size car.

A passive house is well insulated and often use solar cells as a source of energy.
Photo: Essential Habitat.

The best solution?

The reasons to support passive houses in Norway are many. Operating buildings accounts for 40 % of the total energy use. Furthermore, energy consumption in private homes is increasing more than in any other sector in Norway with 2/3 of the total energy use. The passive home standard will make us less dependent on fossil fuels and the solutions are robust with very little construction errors. It is also cost efficient – even if it costs more to build than a traditional house, long-term savings on electricity bills are significant. Stressing good thermal comfort, the passive house provides a good indoor climate, good air quality, as well as user-friendly installations and technical solutions. Experiences from other countries indicate that residents are very pleased with the indoor climate. Building a passive house will also increase the property value as the house will receive the highest energy classification – a classification that has proven to be an important factor for buyers and re-sell value.

The only solution?

There are many good reasons to fully support the building of passive houses. But one question remains; should this be the only solution offered?

The architect group Gaia is critical to give the passive house a dominating role as the "best practice" way of building environmentally friendly. They have 20 years of experience in engineering and research on eco-friendly buildings and specialize in ecological building methods, indoor environment, and natural ventilation. Architect Rolf Jacobsen says that "only focusing on passive houses will make the regulations for the construction industry rigid and authoritarian, which can eliminate other ways of thinking low-energy building".

Gaia indicates that there are still some uncertainties around the passive house standards in regards to the quality of the indoor climate. A Swedish study comparing passive houses and traditional houses find that the passive house may be more energy efficient than traditional buildings, but the findings on environmental impacts were unexpected as the passive house on average was no better than the traditional house in terms of electricity consumption.

In 2007 the Swedish building industry compared CO_2 emissions from the traditional house and the passive house, concluding that they are both emitting the same level of CO_2. A study conducted for Energy Norway (Energi Norge) on passive houses and low-energy buildings in Norway, Sweden, Germany, Austria and Switzerland found that two out of three buildings use more energy on heating than first assumed. Some of the passive houses use less energy, but the majority use more, and private houses have the biggest discrepancy between expected use and actual use. The reason for this increased energy consumption can be divided into five main categories: errors in construction, errors in technical facilitation, higher indoor temperature than expected, errors in building designs and finally improper use of the building.

A good innovation?

We are not fully knowledgeable in the field of passive houses yet, but it seems to be both an energy efficient and healthy standard to follow. However, critique has been raised, and though the critique is scarce it should be investigated further in order to make sure that we are making the right choice. Maybe we should let the construction business continue to develop and improve the passive house standard, and still keep an open mind for other possibilities? Maybe a better solution will appear in the future? We will probably never know if we lock into the passive house standard as the "one and only" way to go.

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Exploring Public Policy for the Norwegian Defence Industry

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A new EU Directive intends to reform the European defence market towards a higher degree of openness and liberalization. The impacts of this directive must be explored in order for the Norwegian Government and defence authority to determine new possible strategies for the future.

The international defence industry has traditionally been a heavily regulated and protected market. This is also the case for Norway. The current Norwegian policy regime regulates sales and export in the defence industry, but this in turn influence firms' innovative capabilities. What type of R&D, the resources spent on R&D and who firms can co-operate with are determined indirectly through the current policy regime on sales and exports.

Current offset policy

Norway is a small nation and the defence industry relies heavily on export to other countries. If Norway buys defence materials from another country, the selling firm is obligated to buy something in return from Norway. This is called offset agreements, and Norway use it as a policy tool to direct investments into strategic defence companies. The past couple of decades have seen a need for the defence industry in Europe to consolidate. Budget cuts and higher production costs is the reasons for this. In order to address the situation a directive in the EU has been passed and enters into effect this year. It will change the framework conditions for firms in the defence market, and therefore a new governmental policy must be implemented.

This article is a brief summary based on a scientific publication associated with the project *Innovation and Defence Industrial Policy: Creating a Common Strategy for Institutions with Different Goals and Approaches to Policy-making* (INNDEF) at The Norwegian Institute of International Affairs (NUPI).

Source: Blom, M., F. Castellacci, and A. Fevolden. 2011. *Defence Firms Facing Liberalization: Innovation and Export in an Agent-based Model of the Defence Industry.* NUPI working paper, forthcoming.

The EU Directive

The aim of the Directive[1] is to create an open defence market in the European Economic Area (EEA) and abolish in whole, or at least parts of the offset regime practiced today. Competition is seen by the EU commission as the best policy tool to provide cheaper defence materials. Since it has not been taken into real use yet, there are many uncertainties related to the directive and how it should be practiced. However Norway can no longer direct investments through offset agreements and in this way help strategically important Norwegian firms. They will have to win contracts in open competition with other European companies to prosper in the future.

Exploring possible public policies

To implement a new policy regime means to change strategy. The effects of possible strategies, within the context of the EU Directive, on firms' innovative capabilities affect their economic performance. In order to determine what type of policy regime would have the optimal effect on Norwegian firms, it is of interest to investigate the relationship between firms' innovative capabilities and economic performance, in different possible future policy scenarios.

This relationship has been analyzed by constructing a computational model of the Norwegian defence industry. Based on theory from sectoral innovation systems and evolutionary economics the model is designed to simulate the relationship between innovation and economic performance in an artificial market. Parameters relevant to innovation include the level of competition in the market and the degree of co-operation between firms. The model is set up with different possible future policy scenarios, which shape firms' innovative capabilities, and is used to analyze their performance in the market.

Photo: Lars Christensen | Dreamstime.com

The policy scenarios and their outcomes

The model is set up to simulate six different policy scenarios. The first is the current policy scenario in Norway. This scenario is characterized by a low degree of competition and co-operation amongst firms, i.e. a protected market. In addition R&D subsidies are granted by public authorities to mainly large firms with complex products. Presently 38% of the defence firms are considered exporters. All the subsequent scenarios are measured against this scenario in terms of export propensity (i.e. share of firms who are considered exporters).

The second scenario is one where the EU Directive is implemented, but the public authorities remain passive. They do not take an active part in shaping a new policy. However, the level of competition in the Norwegian market will rise, since foreign firms from the EU will have direct access to the Norwegian defence market. To address this new competition, firms innovate and produce better products. The effect is products of higher quality, increased profits and export propensity.

The third scenario investigate the effects if public authorities were to take advantage of a loophole in the EU Directive. If nations decide to co-operate on R&D of a new product, they are allowed to choose which firms from their domestic industry which will participate in the project. This represents increased co-operation amongst firms with subsequent knowledge spillover effects, and allow public authorities to strategically direct investments into the industry as with offset agreements. The effects of this scenario include a significant increase in export propensity, and as they share knowledge, the industry becomes more homogenous and the industry concentration decreases.

The fourth and fifth scenario envisages the effects of a changed public policy pertaining to allocation of R&D funds. The former scenario concentrate on what happens if firms were to receive R&D funding based on a more restrictive product quality criterion. The latter scenario analyzes the effects of funneling money for R&D to the big firms only (i.e. promoting 'national champions'). Results indicate that to award firms with products of higher quality is positive for the export propensity in the industry, whereas promoting 'national champions' has no, or even perhaps a slight negative effect, compared to the current situation in the industry.

The final scenario considers a combination of scenarios 2 – 5, and is considered a swift move towards full market liberalization. The combined effects result in the highest export propensity, and are marked by a clearly superior economic performance compared to the present offset regime.

Increased Competition

Empirical findings relayed here indicate that more competition and co-operation in an open market is preferable to the current offset policy employed by national authorities. An important side note is that socio-economic phenomena exploring policy, firm's innovative capabilities and strategies are possible to model using computer simulations.

1. The directive is called "The European Union's Defence and Security Procurement Directive 2009/81/EC".

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Even Simpler

Secretary of State, Erik Solheim, states that he now will be easier to comprehend than before. He plans to achieve this with the help of The Plain Language Project and a computerized readability index that counts words and sentences.

In March 2008, various political and scientific bodies initiated a project with the goal of rinsing public documents and press releases of complicated and bureaucratic language.This project has later been coined; *Plain Language in Norway's Civil Services.* The simplification of public language must not be understood as a retardation of the language, but as an adjustment to suit its audience. The project consists of several components in order to make the public language more user-friendly. This includes courses and lectures for civil servants, and funding projects towards language improvement. The project is not unique. Canada and the United Kingdom have also worked extensively with plain language projects.

The ''uniqueness'' of the Norwegian effort can be attributed to Erik Solheim and his advisers. In a 2010 press release titled ''Solheim will be even simpler'', he states that he is tired of advanced language in governmental press releases and documents intended for citizens.

> *”I am certain that this will lead to a broader public debate about Norwegian politics of development”*
>
> – Erik Solheim

Photo: Morguefile

– We have to become better at writing and speaking a language most people can understand. I am certain that this will lead to a broader public debate about Norwegian politics of development. We need this, says Solheim.

The Norwegian government spent approximately 27 billion NOK on assistance and developmental aid to foreign countries during 2010; therefore they need to ensure that the population understands their future spending. The tools used to achieve this shift in rhetoric include combining the guidelines from the Plain Language Project and a computerized linguistic tool, known as a readability index (LIKS).

The goal is that over 50 per cent of texts should be graded easily read (value below 40), and the remaining should not be graded above medium difficulty (value between 40-50). According to Ragnhild H. Simenstad, communications adviser at The Ministry of Foreign Affairs, over 90 per cent of published texts are at the level or below what would be categorized as reading a magazine.

> *“Over 90 per cent of the published texts are at the level or below what would be categorized as reading a magazine”*
>
> – Ragnhild H. Simenstad

LIKS and its effects

The readability index is a simple program that indicates how difficult a text might be to read. This index is based upon basic rules of word recognition, and was developed in the 1960s by the Swedish education researcher Carl Hugo Björnsson. LIKS is the most widely used index by the Scandinavian countries, although others are available. The computerized program has its limitations. It does not simplify or check the content of the text, but only counts number of words per sentence, and the number of sentences that contain more than six words. This results in a grading of the text in accordance with a pre-set scale. In other words, the meaning of the text needs to be checked by the author and cannot be left in trust to the readability index alone.

Has it had any effect? According to Simenstad, governmental news and press releases have become easier to comprehend. Has it contributed to increased public debate about politics and government spending? That remains unknown.

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According to the readability index (LIKS) this text scores a value of 50, which is categorized as difficult. This is the norm for government documents, albeit not their goal.

GRADING: READABILITY INDEX (LIKS)

< 30: Simple text, equivalent to children's books
30-40: Easily read, equivalent to magazines or fiction
40-50: Medium difficulty such as a normal newspaper article.
50-60: Difficult, often experienced in texts published by government
> 60: Very difficult and normal in most bureaucratic and academic texts.

The English version of this readability index is known as *Flesch-Kincaid index*.

3 *from* TIK

Huyen tran nguyen ho
ESST MA Student
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Name: Gunn Camilla Stang
Program: TIK
Graduation Year: 2008

1. What did you study before you started at TIK/ESST?
I had a BA in psychology, majoring in organisational psychology.

2. What was your thesis about?
I wrote about the stream of immigration workers from Poland coming to Norway, and explored how immigration workers affect and influence a firm's organisational structure and learning processes.

3. What is your current occupation?
I am currently working on the Idea Festival for the University of Oslo's 200-year anniversary, as well as the annual Researcher's Grand Prix.

4. Do we need TIK/ESST?
It is difficult to answer yes or no, since Science, Technology and Innovation studies are very broad subjects. However, I did learn a lot during my time at the University of Oslo and the TIK-Centre.

Name: Daniel Ras-Vidal
Programme: ESST
Graduation Year: 2006

1. What did study before you started at TIK/ESST?
I took a BA in Human Geography at UiO, and some philosophy courses at the University of Gothenburg.

2. What was your thesis about?
"Learning to Innovate: a comparative study on the role of learning in innovation processes within the emerging hydrogen technological systems in Denmark and Norway". It was about how innovation manifests itself within two related, but different industrial structures.

3. What is your current occupation?
I am an adviser on innovation policy at the Confederation of Norwegian Enterprise (NHO).

4. Do we need TIK/ESST?
I would say yes. A lot of the other faculties are too rigid, both methodically and politically, so there should definitely be room for a more open-ended master program within the field of social studies.

Name: Ina Jakobsen
Programme: ESST
Graduation Year: 2008

1. What did you study before you started at TIK/ESST?
I studied Journalism (BA) at the University of South Australia, and Development Studies (BA) at the University of Oslo.

2. What was your thesis about?
I wrote about social acceptance of wind power, and used Samsø Island in Denmark as a case study.

3. What is your current occupation?
I now work as an adviser at Nordic Energy Research, an organisation under the Nordic Council of Ministers.

4. Do we need TIK/ESST?
Yes, absolutely. The academic focus is very important; I believe, especially when it comes to implementing a renewable energy system, that we need people with knowledge about the relationship between society and technology.

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