

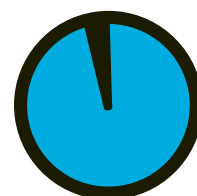
NORDIC ENERGY WAYS IN EUROPE

Clean, Competitive
and Connected

“ *We urge Nordic Institutions, national governments and parliaments, business, banks and academia to join forces in creating a Nordic carbon neutral region with clean, competitive and connected energy.* ”

NORDIC ENERGY VISION
AND ACTION REPORT

For discussions among stakeholders
in the Nordic region and in Europe



PREFACE

The Nordic Action Group on Climate and Energy is a Nordic business and NGO platform established in 2012. Its members wish to contribute to the Nordic policy process with a vision as well as proposals for concrete action. The work is based on business experience, academic research and expert analysis.

The Action Group was created one year ago by the Swedish think-tank Global Utmaning. In its first stage the group will work for two years and during this time present ideas and suggestions for how the Nordic countries can become leaders in creating favourable conditions for sustainable development and thus promote the long-term competitiveness of the region. The aim is to engage in a dialogue about the proposals with governments and other important decision-makers in the Nordic countries and in Europe.

Stockholm, November 2013

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SUMMARY

The Nordic countries can by acting together establish the Nordic region as a European and global model for cross-border cooperation and create an efficient energy system with very low greenhouse gas emissions. The region has a unique potential to lead the way towards clean, competitive and connected energy. This would not only counteract climate change and increase energy security. Such a strategy can strengthen the competitiveness of Nordic industries on global markets – creating growth and new employment. To achieve it there is a need for a stronger, more visible leadership of the Nordic governments joining hands with industry and academia.

1. A Nordic Energy Road Map

A Nordic Road Map would define smart ways to reach a Nordic, carbon free energy system with interim targets and policies that support this goal. The roadmap should incentivise the markets to pick the best available technologies at the lowest costs to ensure a competitive environment for our industry.

High Efficiency Economy

For the Nordic region to become a leader in energy efficiency, we need a framework of public policies making it logical to invest in efficiency improvement measures and new technologies. Public initiatives and harmonised rules are vital to spread know-how and to show the way forward.

A “Nordic Battery” and Renewable Energy Hub

The Nordic region has a capacity of both storage and surplus generation of renewable energy at a lower price than continental Europe. All the prerequisites are there to become a vital balancing factor, a “battery”, on the emerging European electricity market, in dire need of stable and renewable energy. Extension of interconnecting grids and smart technologies will make increased exports from the Nordic region possible and contribute to European climate and energy targets.

Nord Pool version 3.0

Nord Pool, the Nordic electricity market, should be upgraded to a smart grid able to balance supply and demand in real time for both industry and

households. This will create stronger incentives for energy savings in the Nordic region, reduce electricity prices as well as provide a market model that could work for Europe as a whole.

2. A Nordic voice

Nordic countries need to develop a strong voice in support of an open, single European energy market, a wider EU use of carbon taxation and stricter application of the EU-ETS, combating the tendencies of creating costly national capacity mechanisms. A stronger Nordic voice should promote Nordic market design solutions across Europe. Governments and business, academia and non-governmental organizations should join forces in carrying these arguments forward.

3. A Nordic Energy Funding and Incentives Model

Since the price of carbon is absolutely vital for achieving climate goals, the Nordic countries should take the lead in pursuing a gradual shift from other taxes towards taxes on carbon emissions and other polluting activities or limited resources, to create incentives for green energy investments.

To increase access to finance a strong umbrella function will be needed, a “Nordic Energy Financing Facility” to coordinate and facilitate large investments. Governments must act to avoid the present financial crises thwarting investments that are in fact profitable, urgent and beneficial for the Nordic economies as well as for Europe and the global climate.

4. Nordic Green Industrial Cluster

The Nordic countries already have a well-developed industrial base in the green energy sector with examples such as wind power in Denmark, offshore technology in Norway, transmission technology in Sweden and bioenergy in Finland.

A Nordic Road Map, providing a stable and predictable business climate, can further strengthen such industries in developing new innovative solutions for the Nordic market as well as international export.

Background – a Nordic Energy Way

The global energy markets are in massive upheaval. In less than five years the global energy and climate perspectives have undergone fundamental changes. Investment in nuclear energy is in sharp decline in the West (Finland being an exception). Renewables are making good progress thanks to a substantial reduction in production costs and various incentive schemes. This in turn creates new challenges in balancing supply and demand on the electricity markets.

In the short term the most important change has been shale gas entering the markets which is having a great impact on the international scene. Shale gas has in a short period of time permitted the United States to radically reduce the use of coal as well as imports of oil and gas. This weakens the position of traditional oil and gas exporters such as the OPEC countries and Russia. An indirect effect has been lower coal prices in Europe leading to an increased use of coal, since European gas contracts tend to be linked to the oil price. This has also led to increasing greenhouse gas emissions in some European countries. The future development of shale gas, as well as the full environmental impact of the production, is still uncertain.

Following the global financial crises, climate concerns seem to have become less important on the global political agenda. Nonetheless, climate change is still there. The challenge for the world to meet climate change becomes even tougher with each year of delayed action.

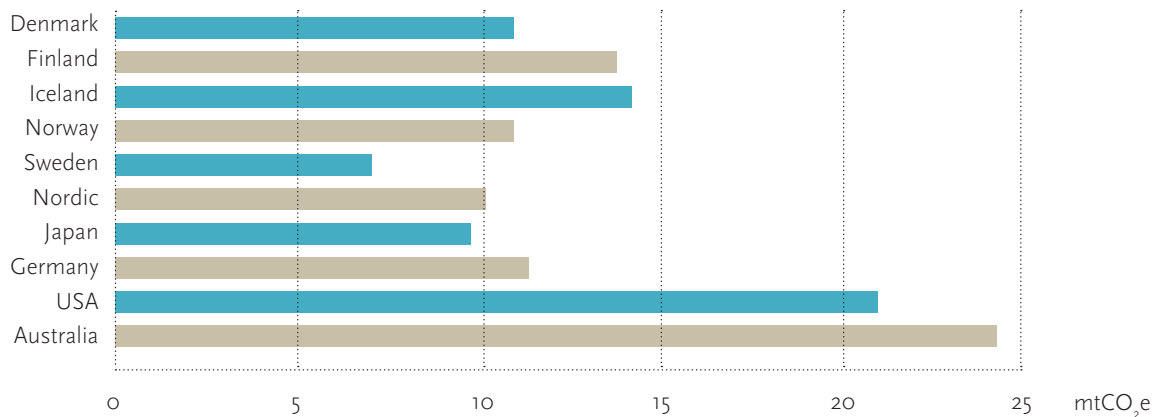
The dramatic changes in the energy markets have a profound impact on the global geopolitical balance. As a result long term public and business strategies are now being recon-

sidered everywhere. **The Nordic countries are deeply affected by the fundamental global changes taking place. At the same time, we are better placed than many others. In this rapidly changing world, the Nordic countries have a golden opportunity to make important contributions for the climate as well as for our own good.**

The Nordic Countries has a unique set-up of conditions that makes the region well positioned to play an important role in the development of the European energy system and at the same time increase the strength of its own industry and economies.

- » The Nordic countries are all listed among the top 20 economies of the world.
- » The Nordic countries have demonstrated to be leaders in developing and implementing clean energy policies and all Nordic countries have strong ambitions for carbon emissions reduction.
- » The Nordic region already has a high share of renewable energy production with a considerable potential to grow with lower production costs than continental Europe.
- » The Nordic countries have developed the world's first and best functioning multinational electricity market.
- » The electricity production in the region has great flexibility and the different production profiles of the countries are complementary.
- » There are green industry clusters in the Nordic region that can grow and thrive in

Greenhouse gas emissions per capita 2010



© Nordic Energy Research 2012. Source: EEA/WRI/GOI/Government of Australia

a society set out on a course for competitiveness and sustainability.

There are several possible pathways for the Nordic region to reach the climate and energy objectives, but in all cases regional cooperation can reduce costs and increase output. A common market of 25 million people and a combined GDP of about USD 1 trillion create a critical mass for change that can have an impact and inspire followers also at a European and global scale.

An illustration of the magnitude of both challenges and possibilities can be found in the assessment made of the Nordic countries in 2013 by the International Energy Agency (IEA) together with Nordic Energy Research, detailing a possible scenario for a carbon-neutral Nordic region by 2050.¹ The Carbon-Neutral scenario operationalises present energy and climate objectives of the Nordic countries for the year 2050, and includes for example:²

- » A complete decarbonisation of Nordic electricity generation.

¹ "Nordic Energy Technology Perspectives", IEA, Jan 2013.

² The Carbon-Neutral Scenario reduces energy related CO₂ emissions by 85%. The remaining 15% are assumed to be offset by international carbon credits. The scenario illustrates one out of many possible paths to reach such results.

- » An increase of the share of wind electricity production from 3% today to 25% in 2050.

- » Reducing emissions associated with buildings from 45 million tons CO₂ in 2010 to less than 10 million, mainly through energy efficiency improvement.

- » Transport emission reductions down to an eighth of its current level. This could mean having nine out of ten vehicles powered by electricity in 2050.

This highlights the need to secure the potential for Nordic technology development in the area. The IEA/Nordic Energy Research report emphasises that regional cooperation is critical in reducing the costs of achieving a carbon neutral energy system. Significant benefits are pointed out in areas such as infrastructure development, industrial research, development and deployment, and in strategies for transport and CCS in the industry sector.

1. The Nordic Energy Roadmap

To achieve the ambitious objectives set out by the Nordic governments, large investments and clear, robust policies are needed. The challenges are great and they are global. However, the Nordic countries have a head start in meeting those challenges and it can be done more efficiently and at a lower cost by working together. In addition, this report suggests that it can be done in a way that actually benefits Nordic industry and strengthens the economy.

The Nordic Prime Ministers Green Growth Initiative, started in 2011, took a first step in identifying the Nordic opportunity and a few areas suitable for cooperation. What we have seen so far though, is not enough to drive the fundamental changes needed or to unleash the industrial potential. A stronger, more visible leadership is needed from the Nordic governments. They also need to work more closely with industry and other stakeholders that can contribute in realizing political visions.

The Nordic Action Program for Energy Cooperation 2010-2013, developed by the Nordic Council of Ministers and the Nordic Council, is about to expire and will be followed by a new program for the coming years – most likely a period of more upheaval and uncertainty. A common Nordic Road Map for **clean, competitive and connected energy** can lay the ground for reducing costs for companies and households, for job creation and industrial development, and at the same time reducing climate change and negative environmental impact.

The IEA/Nordic Energy Research scenarios assessing the Nordic region serve as a good starting point for developing a Nordic Road Map towards a carbon neutral Nordic energy system in 2050. The goals should be based on the most ambitious level among the Nordic countries and relatively higher than the European targets. They should take into account the comparative advantages and specifics of our energy system and also be flexible – new technologies will most likely emerge on the way to 2050.

Clear, unambiguous goals will help the business community plan its investments to facilitate the transition towards a more sustainable society.

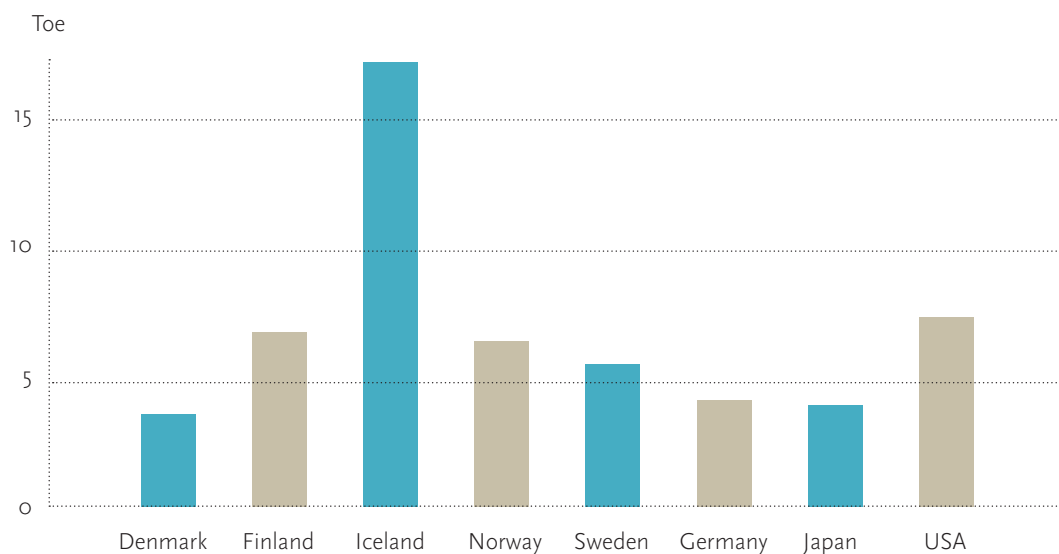
1.1 HIGH EFFICIENCY ECONOMY

The key area for action - be it at a national, Nordic or European level - is energy efficiency improvements. According to recent IEA estimates as much as 60% of future energy needs can be gained by improving energy efficiency in buildings, transport systems and industry, while at the same time reducing the cost of energy. It also reduces the need for investment in new capacity.

Improving energy efficiency is a win-win strategy; good for business, good for consumers and good for the environment.

In Sweden, the power consumption of the industrial sector was unchanged from 1985 to 2005, while economic output doubled in the same time period. It is evident that

Energy consumption per capita 2010



© Nordic Energy Research 2012. Source: World Bank 2010.

efficiency as such is the key to sustainable development, not the reduction of the absolute power consumption. It is output relative to input that really makes the difference.

Of the three big energy consuming sectors, the industrial one has been the most successful in improving energy efficiency - by about 2% a year since 1990. Households/housing has had less success with around 1% a year. Transport has been the least successful with less than 1% a year, and the gain has been more than offset by a shift to larger cars. All the Nordic countries take part in the EU strategy to improve energy efficiency by 20 per cent by 2020. In spite of good profitability, progress has been slow. At the current pace, the improvement of energy efficiency in EU27 will hardly exceed 9% by 2020 according to EU estimates.

The Nordic countries have the opportunity to take a lead in this vital work for the cli-

mate by building on and sharing experience gained in each of the countries, strengthening the Nordic trademark and opening up for new business opportunities.

Renewing the transport sector

All the Nordic countries have a multi-sectorial approach to transport and have introduced a number of initiatives. A stronger coordination of initiatives would greatly benefit the region. A bigger Nordic market increases the interest from vehicle and fuel producers to pilot new innovative technologies. A Nordic Road Map for further efforts towards Clean Transport should be developed, incorporating different technologies for climate efficient fuels, electrification and increased efficiency for transports on road, rails, water and air. It should include for example:

- » A clearly stated ambition to take the lead in the field of electric cars by promoting policies that make such cars equivalent to

traditional cars in terms of costs for consumers, by introducing necessary infrastructure and by setting standards which will help phasing out the most energy-intensive cars in the next ten years.

- » Endorsement and support for a high speed train connecting Norway, Sweden, Denmark and Finland such as the “Scandinavian 8 million City Initiative” that would link Oslo, Gothenburg, Malmö and Copenhagen, an initiative supported by the EU.
- » A feasibility study for connected Nordic electrical highways and a pilot trail to test the e-highway concept for electric and hybrid trucks, as well as a plan for complementing and connecting the different national and pan-European “Green Corridors” being set up across the Nordic countries. Piloting of e-highways needs to be combined with focused efforts in developing non-fossil fuels for heavy transport, such as DME, biogas, fuel cells or other.
- » An initiative to within the next ten years replace inner city buses with electric/plug-in-buses, driving three times the distance on the same amount of energy and reducing emission and noise by 60 to 70%. Copenhagen, Helsinki, Stockholm and Oslo should be global leaders in clean public transport.
- » Continued efforts to develop climate efficient second generation biofuels.
- » Also in the transport sector, incentives should as far as possible be general and market based, even if they need to be combined with some focused investments in private-public partnerships.

Renewing the housing sector

There is no reason buildings should need any special heating systems if designed and built properly. Combined with the use of renewable energy, most newly built houses should be near zero energy. With the introduction of building integrated solar technologies many houses may in fact become net suppliers of energy to the rest of society. Equally important, the housing sector has a potential to balance supply on the electricity market and store energy which can contribute greatly to sustainable and efficient energy systems.

The main challenge however, will be the existing buildings where energy use has remained constant at around 200 kWh per square metre a year. In the Nordic countries approximately 5 million apartments will be renovated in the coming decades. Provided that skilled labour will be available, the result of this could be that energy use is cut in half by 2050. In this context the advantage of the extensive district heating systems in the Nordic countries should be fully utilised.

An extra challenge in the housing sector is the great number of actors (house owners), which makes the spreading of know-how and new technology more difficult, as well as a split-incentive structure: Those who take decisions on energy efficiency are not the same people who later will pay the energy bills. This justifies significant market interventions from policy makers, including education efforts for house owners as well as the construction industries.

The Nordic countries could base their action on the EU compulsory energy declaration for buildings. By setting energy efficiency targets, for example 100 kWh per square metres

per year, local energy efficiency actions could speed up. New business models are available to support this transformation. Using the “Nordic Built Charter” as a stepping stone, common building standards should be introduced and gradually sharpened. This is only one area where using “best practice” in the Nordic countries could have significant potential.

Renewing the industry and service sector

According to the IEA, Nordic industry will need to cut in half the share of fossil fuel in its energy use to below 20% if Nordic climate goals are to be achieved. Industries in the Nordic countries are among the most energy-intensive in the world, even though the forest industry has a high level of self-sufficiency (heat and electricity production from biomass). The IEA has identified large scope for expanding use of solar energy in the industrial sector in the Nordic countries – more specifically in industrial processes of

low- and medium-temperature heat. IEA estimates that solar heating technologies could supply up to 20% of total global industrial demand for low temperature heat by 2050.

The EU is preparing a new directive that will introduce mandatory energy audits every third year from 2014, which could form the basis for focusing on further energy efficiency improvements.

In the Nordic countries, efforts to enhance industry energy efficiency have gone via voluntary agreements, and have proved to work well. There are strong arguments for taking new steps along this road. A Nordic “Program for Energy Efficiency” should be designed with focus on technological progress and innovation. The program would offer tax incentives for developing new technology and include a system for sharing know-how and technology advances among the Nordic industries.³

OUR POLICY RECOMMENDATIONS:

The Nordic countries should take the lead in creating a Nordic Road Map for Clean Transport with a broad approach on infrastructure development, piloting new technologies and creating early markets for e.g. electrical cars, to become a global model for clean transport.

New building standards for low energy buildings on a Nordic level should be introduced and gradually strengthened towards the goal of an average zero energy and zero emission housing sector.

The EU compulsory energy declaration for every building should form the basis for energy efficiency targets in the housing sector based on best practice within the Nordic countries.

A Nordic voluntary scheme for Energy Efficiency Improvements for Businesses should be designed with tax incentives for those participating and a system for sharing of know-how and best practices.

³ “Nordic Energy Technologies Perspectives”, IEA, Jan 2013. The EU Commission. “Nordic Solution for Sustainable Transports”, Global Utmaning, 2013. “Energieffektivisering av Sveriges flerbostadshus – Hinder och möjligheter att nå en halverad energianvändning till 2050”, IVA, 2012.

1.2 ESTABLISHING THE “NORDIC BATTERY” AND A RENEWABLE ENERGY HUB

In the Nordic countries, renewable energy constitutes over 30% (>500 TWh) of the total energy mix.⁴

This energy is both hydropower and biomass established since decades, as well as new technologies like photovoltaics and wind currently installed at a rapid pace.

Biomass is the largest source of renewable energy in the Nordic region (in terms of primary energy supply), predominantly used for heating, followed by generation of electricity and transportation. In total, about 250 TWh/yr is used in the Nordic region. Biomass has the potential to develop further in the Nordic energy system also as a transport fuel. In Denmark a switch from coal to biomass is ongoing. In Finland, where 20% of the electricity comes from coal, biomass could also play an important role in decarbonisation. The most cost-effective way to achieve short-term transition – as indicated by the IEA⁵ – is “co-firing”, to substitute part of the coal in the existing power plants by thermally upgraded biomass.

Hydropower is a dominant source of electricity in Norway, Iceland and Sweden. In addition Norway and Sweden has a unique storage capacity holding almost 70% of hydro storage capacity in Europe, with an added significant potential to build pump

storage capacity particularly in Norway.

Wind power was early developed in Denmark but is now being increasingly deployed in Sweden, to be followed also by Norway and Finland. At the end of 2012, installed capacity in the Nordics was 8900 MW, dominated by Denmark (47%) and Sweden (42%). Technology development has significantly increased the competitiveness of wind power in the Nordic countries, for example turbines optimised for forested areas. The potential is even greater, e.g. by developing technology for “in-land sea” conditions (Baltic Sea).

Solar power is at a nascent stage of development in the Nordic region. However, recent developments in Denmark added a few hundred MW in 2012, and in Sweden policy support has doubled the capacity (25 MW) in only two years. Interesting development of next generation of building integrated solar panels is underway. Such improvements and the continuous price drop may bring the cost of household systems to become competitive when compared to grid supply.

Wave power. The ocean is still a power source with untapped potential, also in the Nordic region. Theoretically, this potential is big – along the Norwegian coast it exceeds the total electricity use of all the Nordic countries together. The potential around Iceland is also great, but much more limited in Sweden or Denmark. Promising pilot projects are ongoing.

⁴ Considering only electricity 63% of the production in the Nordics comes from renewables and 83% is fossil neutral when including the nuclear power in Sweden and Finland.(IEA, 2013)

⁵ “Technology roadmap Bioenergy for heat and power”, IEA, 2012.

Geothermal energy production is a major source of energy in Iceland, accompanied by strong technological know-how and related services.

Sweden has by far the highest penetration of heat pumps in the world offering significant energy savings. The technology development includes improvements in supporting technologies, such as efficient low cost drilling, lean installation technologies and IT support. Heat pumps also offer significant potential for local energy storage.

Nuclear power constitutes 40% of the electricity supply in Sweden and 25% in Finland. It has for a long time been an important source of non-fossil electricity supply. The future of nuclear production in Sweden and Finland will be an important factor for the long term development of the energy system of the Nordic region. There are many possible scenarios to reach the target of zero climate emissions. This report however, is not discussing the future of nuclear electricity production.

The Nordic mix of renewable energy capacity is capable of responding at short notice to system balancing, in particular due to its substantial hydropower input. Centralised energy storage in distributed heating systems, together with local storage in heat pumps, offers further benefits. Given increased interconnection with continental Europe, the Nordic resources in renewable energy are extremely valuable in a European context, being able to serve as a balancing

power with the added benefit of contributing to the European climate change targets. This is why the Nordic region has the potential to serve as a “battery” for the electricity markets in northern Europe, balancing peaks in supply and demand.

The export opportunities would, at the same time, make new investment in renewable energy viable in the Nordic region. In addition, the Nordics would of course gain access to excess European power in times of oversupply which will help keep prices down.

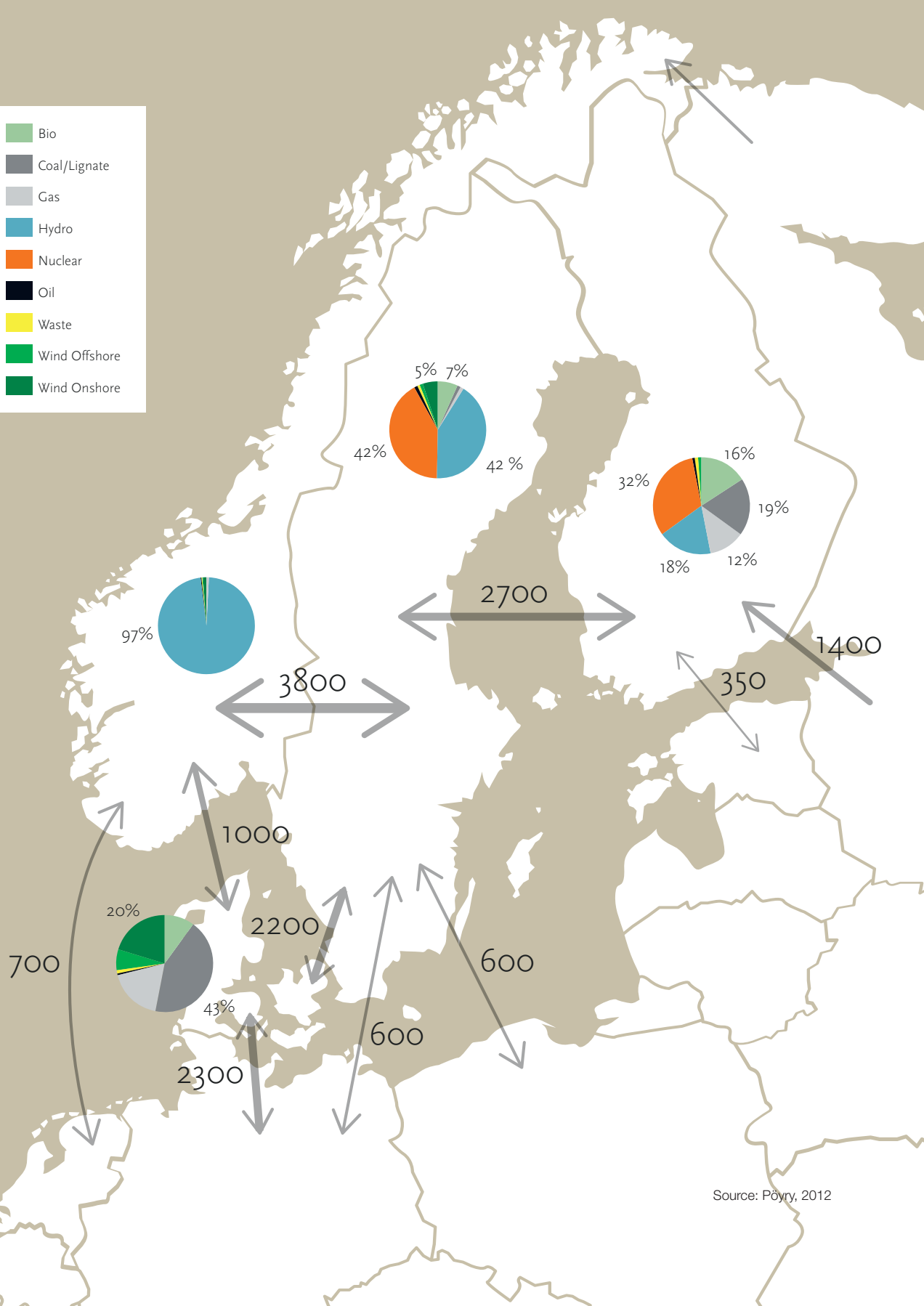
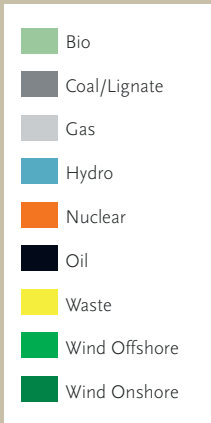
The investments needed in transmission grids are large and planning processes complex, which calls for a firm public strategy and Nordic coordination so as to allocate resources optimally. Long distance transmission investments, however, have a limited impact on the final cost of electricity.⁶

The below figure (*Electricity generation portfolios of the Nordic countries in 2012*) shows the difference in national electricity mix, which together with the large variation in yearly generation by hydro and nuclear power makes the value of exchange capacity obvious, even before significant wind and solar capacities are considered. For an efficient planning of transmission capacity and investments it would be beneficial to create a joint Nordic Transmission Systems Operator, merging the present national transmission grid operators.

Within the EU Renewable Energy Directive, member states may pursue their renewable

⁶For example in Sweden the total cost of the transmission grid is about 0,3 €/kWh or less than one tenth of the cost of production of electricity. The effects of ongoing and planned investment for connecting large scale wind energy farms is estimated to add only about 0,03 €/kWh. However, the electrical grid includes the regional and local distribution networks which all together constitutes a substantial part of the cost of electricity for end consumers. Especially considering the In the transition to smart grids investments are needed also in the distribution network.

An interconnected market with stable power sources



Source: Pöyry, 2012

targets together with other member states or choose to jointly finance specific projects, for example in offshore wind or wave energy. This means that other European countries with less favourable conditions for renewable energy production may have an interest in co-financing projects in the Nordic region. Such cooperation will of course strengthen the reasons to also extend the transmission capacity. Thorough analysis of the Nordic possibilities in this latter regard has already been carried out within the “Nordic Testing Ground Project”. The results should now be put into practice.

The impact of Nordic export of renewable energy, i.e. market off take, price implica-

tions, and climate consequences, will very much depend on the degree of integration across the European market.

With the right pricing in place, the Nordic region could achieve annual electricity exports of 50 to 100 TWh or more in the long term. In today’s export electricity prices that corresponds to a value of roughly EUR 2,5-5 billion, or in expected future export prices twice as much.⁷

The economic implications of such export for the Nordic economies, however, will be much greater in terms of industrial development, job creation and reduced electricity prices in the Nordic region.

OUR POLICY RECOMMENDATIONS:

The co-operation mechanisms in the EU RES directive should be utilised fully to the benefit of both economic development and climate goals.

Export opportunities are a precondition for more substantial renewable energy investments in the Nordic region. As a consequence, governments have a huge responsibility to initiate new transmission grid projects. These investments will make the Nordic region more attractive for investments in renewable energy also from non-Nordic countries.

⁷ Based on an IEA given electricity export price from the Nordics of USD 65 per kWh in 2009 and expected price of USD 136 per kWh in 2050.

1.3 NORD POOL VERSION 3.0

The Nordic countries, with their long history of cooperation, are well placed to act as first movers in defining Europe's future energy policy, thereby maximizing the value of the Nordic assets: Energy, capacity, flexibility and market design know-how.

The Nordic region enjoys strong natural advantages. High wind levels (both speed and consistency of wind) in large available areas on land and in the Baltic Sea provide opportunities for much of the cheapest wind power in Europe.

The landscape and access to fuel stocks (for biomass) offer the Nordics two other prominent non-emitting, dispatchable and renewable sources of primary energy: hydro and biomass. In addition, offshore technologies currently developed and deployed for the petroleum industry in Norway may have important spillover potential to offshore wind development. Through Nord Pool, the Nordic countries have established the world's first and most successful multinational power market. In the context of a Europe still struggling to align one unified transboundary electricity market, this first-mover regulatory experience of the Nordics may become an export good of significant value.

One of the most important goals for the Nordic power market in the future will be to retain and increase its flexibility. This flexibility is composed by four elements: Transmission capacity, dispatchable power, storage capacity and Demand Side Management (DSM)

Transmission: Due to the geographical situ-

ation with electricity generation from hydro in the north and consumption centres in the south, the Nordic countries were early in developing technologies for transmission of electricity. As a consequence public acceptance of transmission is high. Investments in transmission will be crucial, and have limited impact on the final electricity price. A main problem, however, is long lead times.

Dispatchable power is abundant (hydro in Norway and Sweden, biomass in Sweden and Finland).

Dispatchable power has huge practical significance as a flexibility mechanism. It already exists, i.e. no new investment costs will be necessary for taking advantage of this mechanism. Operational expenditures, however, will be affected as frequent ramping up and down may increase the wear of turbines and generators.

Storage: Chemically stored energy in the form of biomass is the cheapest form of renewable, dispatchable energy for heat and power. As mentioned earlier, Norway and Sweden also have a unique short-term storage capacity in hydropower dams. However, there is a potential conflict between the EU targets on renewable energy and the water directive. It is important that the implementation of the water directive still allows for a high regulating capacity in hydro power so as to not reduce the potential of wind and solar power in the Nordic electricity system.

Demand Side Management, DSM: DSM has a very strong potential, especially in industry, housing and transport (electric cars), and should be given increased attention. An increased role of DSM in the "flexibility tool box" will benefit all and has the potential to

WHY EXTENDED AND SMART GRIDS CAN SAVE THE PLANET AND REDUCE THE ELECTRICITY BILL

Electricity normally needs to be consumed at the same time it is produced. This is a challenge since the amount of water in hydropower plants varies during the year, nuclear reactors have to be closed down for checkup or renovation, the sun only shines in daytime and the wind is not always blowing everywhere. Also, the use of electricity varies between summer and winter, weekdays and weekends, and even during the day because of industries starting up or families making dinner.

The good news is that these changes do not occur at the same time everywhere. When the wind is weak in Denmark it can be very windy in northern Finland, household patterns or industry working hours are different in different regions or time zones etc. That is why connecting regions through efficient grids is so important to solve the global energy and climate equation.

Further, with good transmission capacity we can put wind power where the wind is at its strongest, solar panels where the sun is shining, etc., and transport the electricity to where it is needed at every single moment in time. With cross-border electricity grids there is no need for each country to have its own huge, expensive and often polluting capacity for backup production.

If “smart grids” - which can read the exact electricity demand and supply in real time and adjust the use to low cost periods and storage capacity – centrally in hydropower dams or locally in electric vehicles or buildings – are added to the picture, we can use our primary energy sources much more efficiently and build less expensive power plants.

The Nordic region has a great opportunity right now to take the lead in this development. This way we can utilise enormous resources of renewable energy at lower costs, export clean energy to the continent and at the same time ensure that the power price is always lower in the Nordic region while we efficiently combat climate change and drive green innovation industries and green jobs.

both change electricity markets and increase efficiency fundamentally. Also the power producers will benefit from the fact that someone else is setting a price.

Today price signals emanate from producers; if consumers come along there will be clearer price signals and more stable price levels. This will facilitate forecast of prices, which will enable more reliable calculations for investments. This will be to the benefit of all actors on the market.

Another crucial goal for the market design process is to ensure the necessary level of long-term investments in the system. In a system based on marginal price setting and an increasing share of VRE (variable renewable energy) this is not an easy task. New models with modified roles for the state, municipalities, banks, consumers and operators will have to be developed.

Many parts of the European Target Model design (scheduled to be implemented by the

end of 2014) stem from the Nord Pool arrangements for price coupling. Nordic energy companies have benefited from Europe's use of the Nordic trading arrangements as the design for Europe. The Nordics can easily adapt to changes in the wider European markets – given that the future balancing 'smart energy' renewable support and retail regimes are developed in a harmonised manner.

On this note, the Nordic business community and in particular Nordic authorities should work proactively to help hinder the spread of national protectionist energy policies leading to the emerging of national capacity mechanism. Such national solutions would mean new high costs for keeping excessive power capacity in each country and threaten to undermine the idea of a common power market and the incentives to invest in efficiency and demand side management.

Plans are being developed for common Nordic retail arrangements. The European Com-

mission has recently announced the "EU Single Market Act II" which also allows EU citizens to choose their power supply from the whole EU region. If, in response to this, the Nordic region is the first to design effective cross-border retail arrangements, there is a good chance that this can become a template for the wider EU model.

The Nordic electricity spot market and ongoing installation of modern meters provide a more mature infrastructure for demand side adoption to price fluctuations than other countries in the world. Adapting to the emerging energy scene, the Nordic countries should pioneer an even more flexible model. A "Nord Pool 3.0" could encompass a real time energy market allowing flexible supply and export of oversupply, as well as flexible demand – i.e. demand-based pricing. In such a model, businesses – and later households – could be connected to the grid via monitoring control centres to allow for consciously optimised ('intelligent') energy use.

OUR POLICY RECOMMENDATIONS:

The market model design and regulatory framework must reflect the vital importance of retaining and developing the flexibility of the Nordic power system; a stable and predictable market framework is vital as incentive for long-term investments.

The Nordic community of governments and energy industry players should both work proactively to promote the adoption of Nordic market design solutions across Europe with the aim to pioneer the design of cross-border retail arrangements.

NAG urges the Nordic community to strengthen R&D efforts towards exploring a more flexible Nord Pool set-up so as to adapt to the emerging energy scene.

2. A Nordic Voice

The Nordic countries have what it takes to shape the Nordic region into a **clean, competitive and connected** energy market – creating business opportunities and jobs while contributing to the global and European struggle against climate change. This will demand acting in concert and stepping up the Nordic cooperation already taking place in many areas.

For the achievement of this objective it is of paramount importance to carry a strong Nordic voice to the global scene but most of all, of course, to the European scene.

The Nordics have strong and common interests in promoting an open, single and interconnected European energy market. The European Commission is working actively towards this, but in some countries national politics seem to be moving in the opposite direction. Here, the Nordic region can serve as a showcase to demonstrate the benefits of

opening up their markets, being an example of how economic growth and climate policies are not a contradiction.

The Nordics have a common interest – for climate as well as competitiveness reasons - in promoting and strengthening the arguments for carbon taxation, which is already being introduced in many countries across the world. Also, the case for stricter targets and implementation of the EU carbon trade market (the EU-ETS) should be put forward by the Nordics in concert.

The Nordic region should argue for using the Nordic market model design, tested and proven to work, when shaping a truly connected European electricity market. By offering to take the lead in uncharted waters – for example in opening up the Nordic market power supply to all households – the Nordics could gain valuable experience and know-how.

OUR POLICY RECOMMENDATIONS:

A coordinated Nordic Voice should work...

- » ...towards an open, single, interconnected European electricity market,
- » ...to present the significant economic benefits for all in avoiding building isolated, national capacity markets,
- » ...towards a broader use of taxation on carbon and stricter application of the EU-ETS,
- » ...to promote the Nordic market model design for use in the EU.

3. A Nordic Energy Funding and Incentives Model

A substantial increase in investment will be necessary for the transformation into a Nordic Carbon Neutral region by 2050. This calls for measures to increase access to finance as well as providing clear and stable incentives for sustainable investments.

3.1 INVESTMENTS OPPORTUNITIES AND CHALLENGES

All the right conditions are in place, presenting the Nordic countries with a golden opportunity to invest in renewables, market design, transmission and energy efficiency: industrial capacity is available, interest rates are low and the need for growth initiatives is big. In its 2013 Green Paper⁸ the EU Commission pointed out that energy and climate policies can drive demand and growth in the low-carbon economy. Some 5 million European jobs are expected to be generated in energy efficient technologies, products and services, as well as eco-technologies.

An estimate of potential annual energy investments in the Nordic area would be:

The total potential investments in the Nordic countries together amount to between EUR 60 and 80 billion annually. The growth-creating potential for such investment is high, but the need for financing is also huge. With Europe not yet out of its deepest crisis for many decades and with capital markets still not functioning at normal speed, it is a challenge in itself to raise capital.⁹

There are currently several obstacles when turning to traditional sources for infrastructure financing. The main domestic clients - regional government - are currently cautious in committing to new infrastructure investment. Also, regulatory constraints have made Nordic pension funds and other long-term institutional investors unable to invest substantial amounts in infrastructure assets. Finally, banks, due to the global financial crisis and the following regulations introduced, have reduced their long-term lending.

For energy and CleanTech, only partial funding capacity is available today. A very generous estimate would be that around 50% of the total annual borrowing need, here esti-

Estimates of potential annual investments (EUR)⁹

Grids and electricity production	4-5 billion
Renewables	10-20 billion
Energy efficiency/buildings	24-33 billion
CleanTech	10-12 billion
Transport	10-12 billion

⁸ Green Paper on a 2030 framework for climate and energy policies, EU Commission, March 2013.

⁹ "Proposal on a Nordic Energy and Clean Tech Financing", NAG, 2012. "Nordic Market Report", NordREG, 2012. "Energieeffektivisering av Sveriges bebyggelse", 2012, IVA. "Nordic Energy Technologies Perspectives", IEA, Jan 2013.

mated to EUR 60-80 billion, is available at present. Especially for SME's in the renewable sector, this means a reduction in the availability of funding.

Investment in energy capacity and the transmission grid entails financing on a large scale and requires co-ordination in a much more consistent manner across the whole of the Nordic region than is the case today. To this end, new sources of finance must also be activated on a pan-Nordic basis from institutional investors.

To facilitate investments, a vehicle for feasibility studies of the highest standards needs

to be established for all major projects so as to reassure financial institutions that it would be good business activating and developing different sources of finances.

However, especially in this field, the Nordic countries have a very large number of financial institutions operating with small volumes and high costs. A more efficient structure with greater resources would speed up transformation and integration of energy systems better. This could be in form of a Nordic 'umbrella' that brings together and matches financial institutions with investment opportunities.

OUR POLICY RECOMMENDATIONS:

The great challenge of financing could be met if the large number of different national and Nordic entities dealing with energy and climate financing were brought together under an 'umbrella' and strengthened.

To this end we recommend the establishment of a 'Nordic Energy Financing Facility', not to replace present institutions but to take a leading role in coordinating the present institutional set-up.

3.2 CARBON TAX AND EMISSIONS TRADING SYSTEM

To set a price on carbon is crucial if the world is to achieve its climate goals. Recognising this, the Nordic countries all have at least 20 years of national carbon taxation as well as almost 10 years with the EU emissions trading system (EU-ETS) – both being ways to promote the transition from fossil based economies to fossil independent economies. These experiences of active pricing policies have demonstrated that economic incentives are efficient and effective ways of reducing

emissions from important parts of the economy and most importantly, that it can be done without economic growth being hampered.

A great number of countries in Asia, Australia and Europe have introduced carbon taxation to drive the transition to renewables. In the EU, the Commission presented a tax proposal in 2011 for sectors not covered by the EU-ETS, based in equal parts on greenhouse gas emissions and energy content. There is no agreement so far on a European-wide carbon tax but there is a growing support for a carbon pricing strategy.

There are strong arguments for using the price of carbon further to contribute to the climate efforts and it would give the Nordic industry a head start on a development that is unfolding before our eyes.

The EU-ETS is the first and most ambitious institutional arrangement that has appeared, in terms of controlling greenhouse gas emissions at an international level. Between 2005 and 2012, the EU-ETS achieved a stronger result than hoped for: over 13% of emission reductions in the sectors concerned. This was done to a fraction of predicted costs and with no relocation of energy-intensive industries to other parts of the world where CO₂ emissions are free.

Other countries have been influenced. National or sub-national cap and trade systems are operating in Australia, which will join the European system in 2015, in Japan, New Zealand and in several states in the US. China recently started its first carbon cap and trade system in Shenzhen. New Emission Trading Systems are planned in Canada, South Korea and Switzerland. The EU-ETS could be the initiative which paves the way for a linking of several regional ETS's so as to achieve a global mechanism.

However, it is well known that the EU-ETS has lost its momentum. The price of EUA's is currently so low that it does not provide expected return on investment for those who have invested to reduce emissions.

That does not mean that the ETS is an inadequate instrument to reduce emissions. Par-

ticularly two of the proposals put forward by the Commission would contribute to solving these challenges: bringing more sectors into the EU-ETS and increasing the EU's greenhouse gas emissions reduction target for 2020.

Still, emission trading is only covering and mostly suited for large-scale point polluters, thus the need to complement the trading scheme with carbon taxation. The Nordic countries could do more to incentivise businesses and citizens to choose climate friendly solutions, including a continued tax shift towards carbon emissions allowing for reduction of other taxes.

A policy built on carbon pricing still needs to be complemented in some cases by other instruments like standards, regulations or investment subsidies. Nordic countries have chosen different support schemes for renewable energy. Norway and Sweden have established a joint certificate market primarily promoting cost-efficient onshore wind technologies whilst other Nordic countries have implemented feed-in tariffs. In Finland and Denmark, discussions concerning a change in support schemes are ongoing, including the option to join the Norwegian-Swedish certificate market. While Sweden so far appears to be overachieving in renewable energy use, the opposite is the case in Finland.

The Nordic markets should align and integrate their approach towards renewable targets compliance more effectively. Given the positive development, targets for 2020 and beyond should be reconsidered upwards.

OUR POLICY RECOMMENDATIONS:

A common Nordic drive should promote a wider use of carbon taxation within the EU as well as a stricter application of the EU ETS in order to raise the end price for using fossil fuel and emitting greenhouse gases. This argument could be carried forward by businesses as well as governments.

Nordic countries can show the way by pursuing a further shift to taxes on energy and carbon emissions.

Increased integration across the Nordic renewable schemes would ensure better utilisation of renewable resources and provide greater opportunities to achieve the overall Nordic and European renewable generation targets.

Onshore wind and biomass for electricity production or heat are today mature technologies and therefore not in need of technology-specific support, but are instead deployed in certificate systems, as proven in Sweden. Technologies that are less mature, e.g. photovoltaics, offshore wind and wave power, are still in need of technology-specific support.

3.3 FOCUSING NORDIC ENERGY RESEARCH

Research on energy and climate is a top priority in all Nordic countries. Nordic researchers and research institutions hold a strong position internationally in the fields of energy and climate research and are well connected within the Nordic region.

At the Nordic level, Nordic Energy Research is the common funding institution for energy research but is underfunded. Together with other related Nordic actors, such as

Nordforsk, Nordic Built, Nordic Innovations, etc., resources need to increase and coordination be strengthened to serve the task more effectively.

The uptake of new technologies should be much better promoted than it is today. While basic research is already producing new knowledge, there is an urgent need for better distribution and sharing of knowledge that can underpin public policies, business initiatives and funding decisions towards creating a low-carbon society. To maximise the benefits of such an effort, this should be done at a Nordic level.

4. Nordic Green Energy Industrial Cluster

The Nordic Council has recently published a report on a follow-up of the Green Growth initiative by the prime ministers.¹⁰ The report takes stock of the progress among the eight specific areas defined at the start of the initiative in 2011:

1. Test Centre for green solutions
2. Education and Research for green growth
3. Support demand response in the Nordic Electricity Market
4. Green technical norms and standards.
5. Green public procurement.
6. Technologies and methods for treatment of garbage
7. Integration of environment and climate in research cooperation.
8. Financing of green investments and companies.

A separate report presents an evaluation of definitions and statistics concerning "Green Jobs" in the Nordic countries.¹¹ The areas identified are all relevant to the Road Map suggested in this report. However, they lack a strong overall structure and a more visible

leadership, despite being an initiative from the Prime Ministers themselves. It is also clear from the status report that the progress so far is in many cases limited.

There is a need to make a joint analysis to identify other technology areas of specific relevance for the Nordic countries in terms of reaching policy goals and building on industrial strengths. The Green Growth initiative should be complemented with an industrial strategy. Examples of such areas could be:

- » Wind power, with specific focus on solutions for cold climate, off shore and forested areas.
- » Climate efficient biofuels from indigenous sources.
- » Electrification of transport including vehicles, charging infrastructure and electrification of roads.
- » Combined operation of heat and electric power systems, including efficient use of heat pumps.
- » Smart electrical grids combining IT with power.
- » Solar power solutions.

¹⁰ "Norden – ledande i grön tillväxt, Status om de nordiska statsministrarnas initiativ om grön tillväxt, maj 2013

¹¹ Measuring green jobs? An evaluation of definitions and statistics for green activities. <http://www.norden.org/sv/publikationer/publikationer/2012-534>

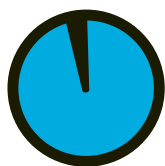
The market for green technologies is global. A joint Nordic strategy could form a strong “home ground” for development of innovative solutions with a global potential. Nordic companies will also be attractive as partners for leading companies from other parts of the world.

A joint approach among the Nordic countries would increase the possibilities of utilising considerable available EU funds for innovative projects within the energy, transport and building sectors.

OUR POLICY RECOMMENDATIONS:

The transformation of the energy system in the Nordic Countries, with huge investments needed should be used to strengthen a “Nordic Green Energy Industrial Cluster”.

To complement the Prime Ministers’ Green Growth initiative with an industrialisation strategy including identified focus areas to utilise unique strengths in Nordic industries and to develop solutions that can be relevant and used worldwide.



The Nordic Action Group on Climate and Energy is a Nordic business and NGO platform established in 2012. Its members wish to contribute to the Nordic policy process with a vision as well as proposals for concrete action. The work is based on business experience, academic research and expert analysis.

The Action Group was created one year ago by the Swedish think-tank Global Utmaning. In its first stage the group will work for two years and during this time present ideas and suggestions for how the Nordic countries can become leaders in creating favourable conditions for sustainable development and thus promote the long-term competitiveness of the region. The aim is to engage in a dialogue about the proposals with governments and other important decision-makers in the Nordic countries and in Europe.