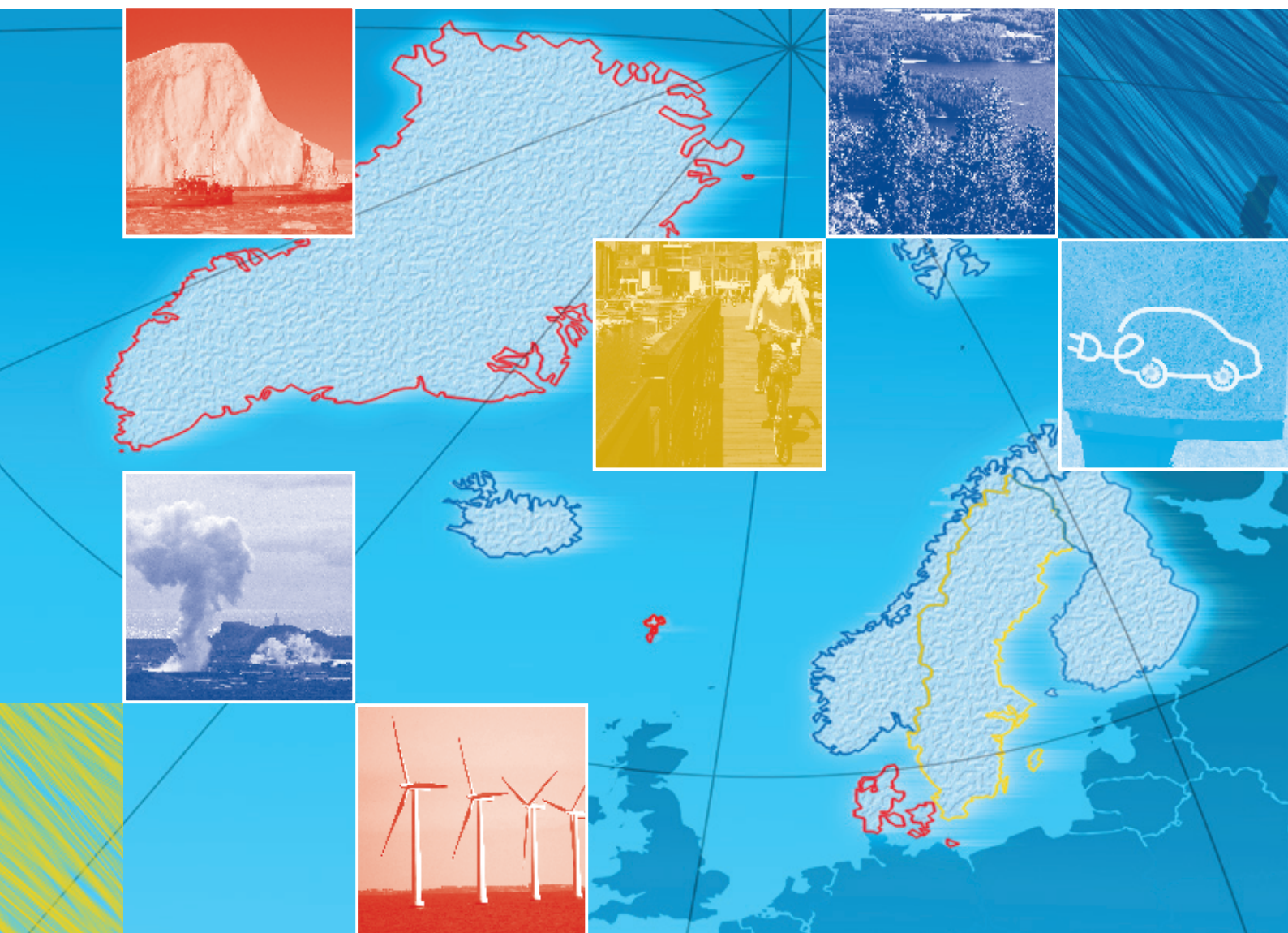


Nordic action on climate change



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Nordic co-operation

Nordic co-operation is one of the world's most extensive forms of regional collaboration, involving Denmark, Finland, Iceland, Norway, Sweden, and the Faroe Islands, Greenland, and Åland.

Nordic co-operation has firm traditions in politics, the economy, and culture. It plays an important role in European and international collaboration, and aims at creating a strong Nordic community in a strong Europe.

Nordic co-operation seeks to safeguard Nordic and regional interests and principles in the global community. Common Nordic values help the region solidify its position as one of the world's most innovative and competitive.

Nordic action on climate change

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Nordic vital statistics

	Population	GDP per capita 2013	Human Development Index 2013	Greenhouse gas emissions, Mt CO ₂ e, excl. LULUCF 2012 (with 1990 figs.)	Net GG emissions/ removals from LULUCF, Mt CO ₂ e 2011	Renewable energy as % of total energy supply 2012
Denmark	5.7 million	€44,400	0.90	51.6 (68.7)	-2.7	22.6%
Finland	5.5 million	€35,600	0.88	61.0 (70.3)	-24.1	28.2%
Greenland	56,000	€27,500 ¹	0.87 ³	0.8 ² (0.7)	0.0	13.3%
Iceland	329,000	€34,000	0.89	4.4 ² (3.5)	+0.7	85.8% ²
Norway	5.2 million	€75,700	0.94	53.4 ² (50.4)	-27.6	42.3% ²
Sweden	9.8 million	€43,800	0.90	57.6 (72.7)	-35.6	31.6%

Mt CO₂e = million tonnes CO₂ equivalent

LULUCF = Land use, land use change and forestry

1: 2012

2: 2011

3: 2008

The 26 million inhabitants of the Nordic region enjoy high living standards. Their governments are working concertedly to preserve and enhance Nordic economic well-being while radically reducing the region's greenhouse gas emissions.

Foreword

The latest report of the UN Intergovernmental Panel on Climate Change (IPCC) clearly shows that to limit average global warming to below 2°C relative to pre-industrial levels emissions of greenhouse gases must be substantially reduced over the next few decades, and decline to a level of near zero by the end of the century.

The IPCC report also highlights opportunities to combine climate change mitigation, adaptation and the pursuit of other societal

objectives through integrated responses. A growing body of evidence indicates that effective mitigation actions can also improve economic performance, spur investment, create jobs and have positive impacts in other areas such as health and energy security in all types of economies.

This booklet presents actions taken by the Nordic countries to speed the transition to a sustainable low-carbon society. It shows how sustainable development is possible, with strong climate

policies contributing to economic growth and job creation as well as environmental improvements. The Nordic countries successfully demonstrate how ambitious climate change mitigation targets and policies can be combined with high levels of human development.

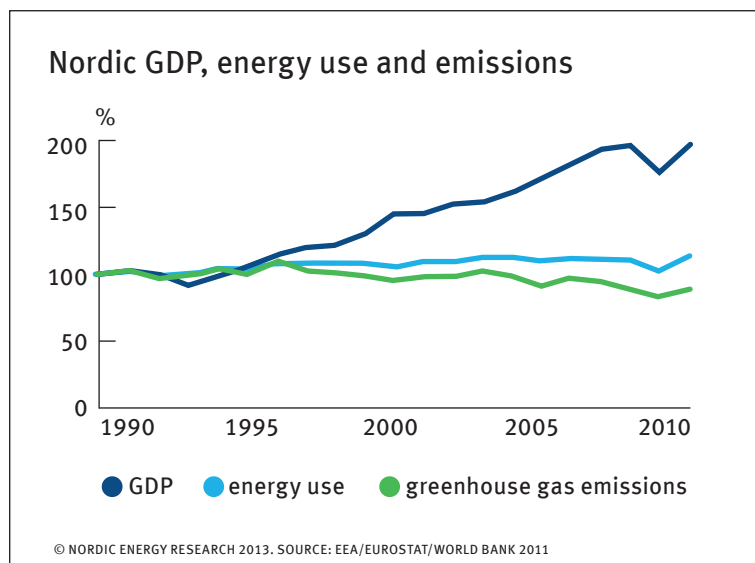
We hope that our experiences will encourage others to instigate ambitious climate actions and realise opportunities to achieve green, climate-resilient growth around the world.

Peer Stiansen

Chair of the Nordic Working
Group for Global Climate
Negotiations (NOAK)

Progressive policies to combat climate change

The Nordic countries' forward-looking climate and energy policies have been designed on the basis that well-planned efforts to reduce greenhouse gas emissions can mitigate climate change while also promoting sustainable economic growth and employment. This decoupling of emissions from economic growth has already begun in the Nordic region. Fossil greenhouse gas emissions across the region were successfully reduced by 9% between 1990 and 2011, while total Nordic GDP rose by 55% over the same period.



Energy efficiency – a hot issue in the cold north

Energy consumption and greenhouse gas emission rates per capita are relatively high by global standards in the Nordic region, due to factors including the long, cold winters, long transportation distances in sparsely populated regions, high levels of material consumption, and the prevalence of energy-intensive industries.

These factors have long made energy efficiency a crucial issue. When it comes to heating Nordic homes, innovations including low-energy construction and district heating systems have cut annual carbon dioxide emissions from household heating systems to just 0.2 tonnes of CO₂ per capita, compared to an average of 0.8 tonnes for OECD Europe.

The urgent need to reduce the use of fossil fuels has compounded efforts to improve the energy efficiency of industrial processes, buildings and transportation. At the same time all of the Nordic countries run wide-ranging clean energy research programmes, and Nordic governments support industrial investments in energy-saving and low-carbon technologies.

Social acceptability for green policies

In addition to mitigating climate change, promoting local renewable energy sources also enhances energy security and reduces import dependency. Policies with such goals have gained widespread social acceptance. Nordic citizens

are well aware of the related environmental issues, and municipalities are widely striving to promote green energy by setting their own targets and launching local initiatives.

The Nordic countries apply few energy subsidies, even for low-income households, who

are instead supported through social welfare policies that enable them to meet their heating needs, while preserving incentives that encourage everyone to use less energy. The use of fossil fuels such as heating oil is declining, while biofuels, heat pumps and other greener alternatives are on the rise.

Today a third of the energy used across the region is renewable, and half is fossil-carbon-free. Ambitious emission reduction targets have also been set for future decades, with each country defining ambitious targets and visions for 2050 (see table, page 8).

The Nordic countries are already making good progress in the transition towards a more sustainable low-carbon society. Many successful Nordic climate policies and practical projects could be beneficially adapted for application in other regions, including example actions highlighted in this booklet.

The Nordic countries are also working actively to foster an ambitious, binding agreement under the UNFCCC, and to promote global action and increased cooperation through other international climate policy forums.

Making the most of renewable assets

The Nordic countries are variously blessed with plentiful renewable energy resources including hydropower, wind power, geothermal energy and forest biomass. Each country is striving to make the most of the renewable resources available locally.

In 2011 these energy sources accounted for about 65% of the region's electricity generation and more than 30% of total energy consumption. This is largely due to the widespread use of hydropower in Norway and Sweden, and the effective use of biomass in combined heat and power plants in Finland and Sweden. Meanwhile Denmark has the highest share of wind power in the world, and Iceland is blessed with abundant geothermal energy.

National policies have favoured the use of renewable energy

sources even when they are not the cheapest option in the short term. The Nordic countries' advanced cross-border electricity market facilitates the greater use of renewable energy, since fluctuations in production often even out between regions, and can be balanced by flexible hydropower production.

The Nordic countries have historically pioneered energy and carbon taxes, providing further incentives to save energy and switch to renewable sources. Taxes on energy and fossil fuels generally remain significantly higher in the Nordic region than elsewhere in Europe.

National targets for reducing greenhouse gas emissions have been defined across the region together with related action plans and initiatives. Individual countries' emission reduction targets for 2020 vary between 15% and 40% of 1990 benchmark figures. Each country has also mapped out far-sighted

policies designed to work towards a shared Nordic vision for the decarbonisation of energy systems by 2050.

Progress towards these targets is carefully monitored at national level, and policies will be adjusted and expanded as necessary to keep on track.

In the transport sector national policies including tax frameworks aim to increase the use of renewable energy and promote low emission vehicles. All the Nordic countries aim to increase the market share of vehicle biofuels to 10% or more by 2020 in line with EU targets.

At the same time wastes and organic materials such as logging

residues have increasingly been used as an energy source in the Nordic countries in recent times, particularly in efficient combined heat and power systems. Biogas is increasingly being produced from agricultural residues and organic household waste, while wastes that cannot be recovered and recycled can today be safely incinerated to generate energy instead of being dumped in landfill sites.

Green technology forerunners

Nordic national policies have actively promoted R&D investments related to clean energy sources and energy-saving technologies. Building up local markets for green technologies helps new businesses to create new, green jobs and build up a base for exports that can be

expected to boom as other regions seek ways to respond to the global climate challenge.

The Nordic countries have resolved to promote the spread of climate-friendly best available techniques. Their governments aim to support green technologies by encouraging public sector purchasers to serve as role models and help to build markets by favouring low-carbon options in areas such as transport, buildings and catering.

The Nordic countries and their shared financing institutions like Nordic Environment Finance Corporation (NEFCO) and the Nordic Development Fund (NDF) are at the same time continuing to identify and support climate-friendly renewable energy and energy-saving schemes in neighbouring European countries (NEFCO) and developing countries (NDF).

Ambitious emission reduction targets

	2020	2050
Denmark	40%	100% fossil-free
Finland	n.a. ³	80%
Iceland	15%	50–75% ¹
Norway	30% ¹	100% (net) ¹
Sweden	40% ^{1,2}	100% (net) ¹

- 1 = Offsets may be used to achieve targets
- 2 = For sectors not covered by EU emissions trading
- 3 = Finland participates in the EU ETS. The national target for sectors outside the ETS is for a 16% reduction from 2005.

The Nordic countries have set ambitious national targets for emission reductions for 2020 and 2050 compared to 1990 benchmark figures.

Ambitious Nordic aims

The Nordic countries have worked together for decades to make economic growth and welfare improvements compatible with ambitious environmental policies, while actively contributing to environmental improvements in the Nordic Region and beyond.

The Nordic Council of Ministers’ environmental action plan for 2013–2018 aims to reduce greenhouse gas emissions to help achieve the goal of restricting global warming

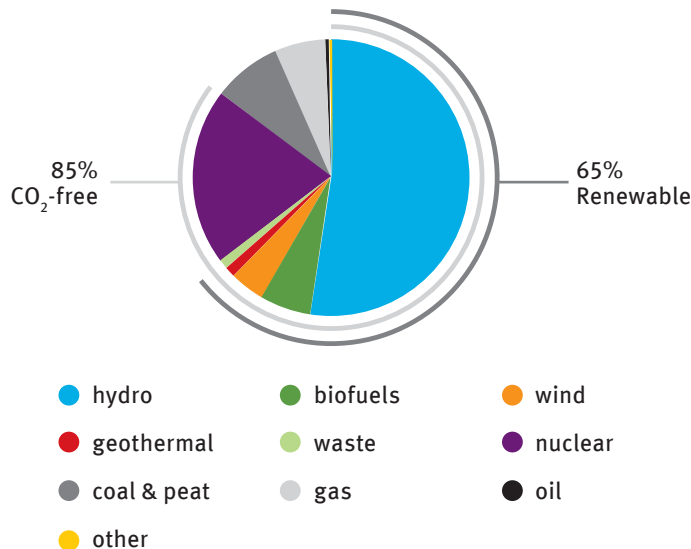
to an average of less than 2°C, and thus limiting the consequent environmental and socioeconomic impacts.

The action plan emphasises the need to support innovative funding mechanisms such as the Green Climate Fund, as well as market-based mechanisms that can stimulate cost-effective emission reductions.

There have inevitably been fears that such ambitious policies could lead to “carbon leakage” in the private sector, if industries chose to shift location to countries with less stringent climate and energy policies; but the continued strong economic performance of the Nordic countries suggests that their progressive policies have not harmed business or welfare.

The Arctic region is particularly vulnerable to the impacts of climate change. The joint Nordic action plan prioritises the work of the Arctic Council and the Barents Council on climate change and its effects on northern ecosystems.

Nordic electricity production 2011



© NORDIC ENERGY RESEARCH 2012. SOURCE: IEA 2011

The Nordic countries have also resolved to support the International Maritime Organization’s efforts to reduce emissions from shipping.

Within wider international forums the Nordic countries will continue to work towards the finalisation in 2015 of a global climate agree-

ment with legally binding commitments for all countries, to come into force in 2020. By pro-actively setting their own ambitious targets the Nordics aim to both fulfil their own international obligations, and demonstrate how it is possible to reduce emissions sustainably and cost-effectively.

Nordic forests as carbon sinks

Forests cover large areas of Northern Europe. The growing forest biomass and forest soils constitute a vast carbon sink that is important on a global scale.

Figures for the net impacts of land use, land use change and forestry (LULUCF) show that these factors result in negative greenhouse gas emissions in all the Nordic countries except Iceland. This is primarily because the region’s forests are growing more rapidly than their biomass

is being utilised. This kind of carbon sequestration has increased considerably over the past 24 years, meaning that the Nordic region’s net carbon emissions including LULUCF are now 25% lower than in 1990.

DENMARK – World leader in wind power

Denmark has cut its greenhouse gas emissions by more than 25% since 1990, and targeted a 40% reduction by 2020. Thanks to improved energy efficiency, 33% less energy was needed to produce each unit of Denmark's GDP in 2013 compared to 1990. About 46% of the electricity consumed in Denmark today comes from renewable sources, including a world record of 33% from wind power in 2013.

To build on these achievements, a groundbreaking Energy Agreement (2012) has set key targets for the next phases of Denmark's green transition. Planned investments in energy efficiency, renewable energy and the energy system mean that by 2020 more than 35% of Denmark's total energy consumption should come from renewable sources.

Focus areas in addition to the further expansion of wind power capacity include energy taxes, targeted subsidies, more improvements in the electricity grid, and the wider use of biofuels,

district heating and surplus heat from industry.

New legislation on climate change

Denmark's new Climate Change Act (June 2014) forms the strategic framework for Denmark's efforts to become a low-emission society by 2050. An independent Climate Council, consisting of experts from key fields, will regularly recommend policy initiatives. The Minister for Climate, Energy and Building will annually report on progress towards strategic emission reduction targets.

Denmark's ambitious goal of phasing out fossil fuels by 2050 will place huge demands on society. But the government's *Climate Policy Plan – Towards a Low Carbon Society* (2013) emphasises how Denmark aims to demonstrate to other countries that emissions can be reduced while enabling continued growth and welfare.

Danish lessons on energy efficient buildings

Thanks to the imposition of ever stricter energy efficiency standards the energy demand of Denmark's new buildings has dropped by 80% since the 1970s. Buildings' life-time costs have also fallen, since savings due to improved energy performance exceed the related investment costs. Future requirements are announced well in advance to help the building industry adapt. Key factors include thermal insulation, air-tightness, use of daylight, optimisation of windows' heat loss/gain, and the energy efficiency of heating, lighting and ventilation.

- Energy policy toolkits covering topics including energy efficiency in new buildings are available from the Danish Low Carbon Transition Unit: www.ens.dk/LCTU.



Putting wind power at the centre of the electricity supply

Denmark is blessed with favourable conditions for utilising wind power, including frequent moderate winds and shallow coastal waters. The wind power industry has become a major employer, accounting for some 10% of Danish exports.

More than 5,000 wind turbines today account for over a third of Danish electricity consumption. Major ongoing offshore and on-shore wind power developments will raise this share to 50% by 2020. The large-scale deployment of wind power would not be possible without government backing including support for research and innovation, and economic incentives such as feed-in tariffs to guarantee developers a return on investments.

As a wind power pioneer Denmark has learnt many valuable lessons. Turbines should always be sited with due regard to environmental, economic and social impacts. Transparent public consultation processes are vital. The bureau-

cracy encountered by developers must be streamlined. Regulations governing wind-friendly grid investments must effectively share costs between investors and consumers.

Denmark has a one-stop-shop planning process for offshore schemes, and onshore developments benefit from assistance provided to local authorities by the Wind Turbine Secretariat.

Samsø – an island showcase for green energy

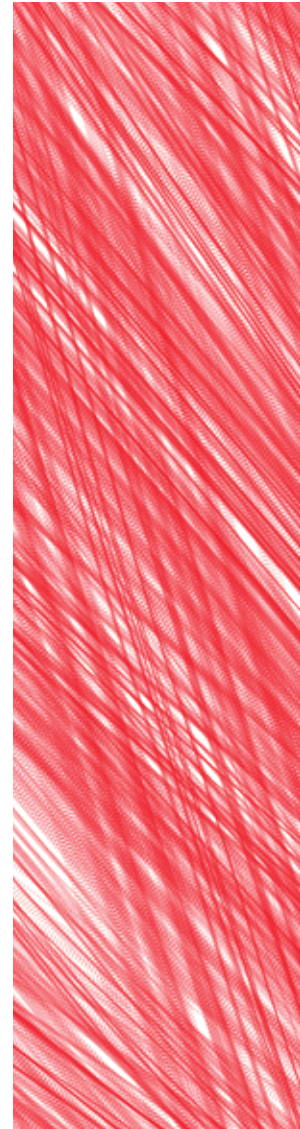
The island of Samsø, with its farming community of about 4,000 inhabitants, has become a showcase for Danish efforts to switch to green energy using local resources. Community-owned wind turbines today produce more than enough electricity to meet the islanders' annual needs. About 70% of the island's heating needs are met by renewable sources, since most homes are connected to district heating systems

Since wind power is by nature variable, Denmark has needed to reshape its energy supply system accordingly. Strong grid interconnectors guarantee flexibility and security of supply. A well-functioning "power exchange" market encourages producers to adapt to fluctuating demand. An independent transmission system operator plays a vital role in the successful integration of wind power into the national energy system.

fuelled by surplus straw, while other households are increasingly using solar panels, heat pumps and wood pellet boilers.

Samsø's Energy Academy aims to make the island totally fossil-fuel-free by 2030, following further heating conversions and a switch to electric cars and biofuel-powered vehicles. The academy is frequently visited by environmental and energy experts from around the world.

- Samsø: energiakadami.dk



FINLAND – Building a bioeconomy

In March 2015 Finland passed a new Climate Change Act to facilitate systematic, cost-effective measures designed to ensure that by 2050 domestic greenhouse gas emissions should be at least 80% lower than in 1990. This will build on measures that have already enabled Finland to meet its Kyoto Protocol commitments by cutting emissions to below 1990 levels. A low carbon roadmap for 2050 has also been recently produced.

Over the same timescale a farsighted Bioeconomy Strategy aims to make Finland into a sustainable low carbon society based on the use of renewable biomass. This strategy particularly focuses on Finland's extensive forests, and the great potential for technological innovations related to bioenergy and wood-based materials.

Wood-based fuels, which are widely used in the forest industries and for combined heat and power and district heating schemes, already account for

almost a quarter of Finland's total energy use.

Finland's forests also act as a considerable carbon sink, since their total annual growth greatly exceeds total fellings. Over the years 1990–2012 the annual net sinks calculated for Finland's land use, land use change and forestry sector (LULUCF) amounted to 20–60% of the country's annual greenhouse gas emissions.

Ambitious but achievable targets

Key goals and measures are set out in Finland's national energy and climate strategy, which was updated in 2013. Targets for 2020 include an increase in the share of renewable energy sources to 38% of total energy use, and a rise in the share of transport biofuels to 20% - double the EU target. To reach these goals, the use of forest chips made from logging residues in multi-fuel boilers instead of fossil fuels will be further expanded, while Finnish companies are rapidly developing second generation biofuels.

A national climate panel set up in 2011 supports policy-makers by providing scientific expertise on climate change. The government meanwhile provides wide-ranging support for Finland's clean technology sector. The Cleantech Finland network strives to promote and export Finnish innovations in key technical fields including energy efficiency and renewable energy.

Finland's national Programme to Promote Sustainable Consumption and Production particularly focuses on innovative projects designed to reduce climate impacts in three key sectors: housing, food and transportation. Finland has also pioneered the systematic national-level planning of measures to facilitate adaptation to the expected impacts of climate change. Drawn up in 2005 and currently under revision, the National Strategy for Adaptation to Climate Change assesses related challenges and allocates responsibility for anticipatory measures in key sectors.



PHOTO: SIGNELEMENTS

Pioneering Finnish municipalities

Twenty-four Finnish municipalities and their local private sector partners are working collaboratively to create local solutions that will make them forerunners in reducing greenhouse gas emissions ahead of scheduled commitments.

The towns participating in the Carbon Neutral Municipalities Project (HINKU) are committed to cut emissions by 80%

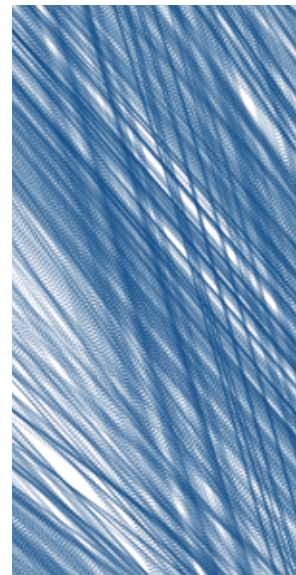
of 2007-levels by 2030. The first municipalities joined the scheme in 2008. Several have already achieved impressive reductions of 20–30% or more thanks to improvements in sectors including energy production, energy efficiency in buildings, waste management, transport and agriculture.

One imaginative collaborative project in the town of Uusikaupunki combines waste-to-energy, greenhouse cultivation, fish farming and the production of biodiesel in

a closed system that effectively recycles wastes, energy and nutrients.

The HINKU scheme is based on the idea that emission-saving investments invariably lead to cost savings in the longer term, and that local businesses that pioneer such developments put themselves in a good position to exploit growing future markets.

- Carbon Neutral Municipalities Project: www.hinku-foorumi.fi



Energy-smart built environments

The built environment accounts for 42% of Finland's energy use and 38% of carbon dioxide emissions. The ERA17 for an Energy-Smart Built Environment 2017 programme, a public-private partnership launched in 2010, will systematically enhance the energy efficiency of buildings and built-up areas – aiming to mark the centenary of Finland's independence by meeting related EU 2020

targets three years ahead of schedule.

Both new-build and renovation schemes increasingly focus on reducing heating needs, steered by tough building regulations and energy certification rules. More buildings and local facilities will soon themselves generate more of the energy they need using distributed forms of energy production like solar panels, wind turbines and small-scale biomass-fuelled heating systems.

Planners are meanwhile shaping Finland's built-up areas to encourage residents to abandon private cars in favour of public transport, cycling and walking. ERA17's ultimate goal is that in 2050 Finland will be able to offer the world's best living and operating environment for people and businesses.

- www.era17.fi

GREENLAND, THE FAROE ISLANDS and arctic issues

Climate change is naturally a major concern for Greenland's 56,000 inhabitants, since 85% of their country is covered by a vast ice cap. The impacts of climate change are already visible here in receding glaciers and flotillas of icebergs.

Greenland's towns and villages are scattered along the coasts, connected only by air or sea, with no national electricity grid. Though levels of economic development are low by Nordic standards, energy consumption levels and greenhouse gas emissions per capita are high, not least due to the great need for heating, which has largely been met using oil and gas.

In 2013 Greenland's autonomous government launched an extensive campaign to raise public

awareness of the links between climate change and fossil fuel use. The Climate Greenland website (www.climategreenland.gl) provides a wealth of information on climate impacts, mitigation actions and research in Greenlandic, Danish and English.

Groundbreaking hydropower expansion

Through an initiative designed to reduce dependency on imported fossil fuels, governments since the early 1990s have invested about 1% of Greenland's GDP annually to expand hydropower production. Hydroelectricity today provides 70% of Greenland's electricity and is also used in several district heating schemes.

Greenland's newest hydro plant, at Paakitsoq, has been a literally groundbreaking scheme, built

in tunnels in the permafrost. Its turbines, driven by water from two natural lakes, generate electricity for the town of Ilulissat 50 km away.

Ongoing hydrological surveys aim to find ways to increase the capacity of existing hydropower plants. Greenland also aims to exploit untapped hydro potential to attract energy-intensive industries and boost economic development while minimising emissions.

At the same time Greenland is assessing the potential for other renewable energy sources such as solar power, micro-hydropower and wind turbines, especially in isolated settlements.

Shaping electricity use through smart metering

Greenland has set up the first remote smart metering system to cover an entire country. The consumption of electricity, water and heat in residential, commercial and administrative buildings

across Greenland is now monitored by some 43,000 meters.

Bills produced through the radio-based system by the national energy company Nukissiorfiit give consumers clear and detailed information spotlighting any excep-

tional energy usage patterns, to help energy-users cut their consumption and costs. The system also provides detailed data that can be used to plan emission-reducing improvements in Greenland's energy supply.



PHOTO: NIKOLAJ BOCK/NORDEN.ORG

Renewable options for the Faroes

The Faroe Islands' Climate Policy, defined in 2009, aims to reduce domestic emissions of greenhouse gases by at least 20% of 2005-benchmark levels over the period 2010-2020; and progress towards this target is on track. Some 45% of the islands' electricity already comes from renewable energy sources – mainly hydropower

and wind power – though the Faroes' 50,000 residents are still quite dependent on imported oil for heating and transport.

The government is now promoting electricity instead of oil for heating and road vehicles, and striving to further increase the share of renewable electricity production by obtaining more energy from reliable maritime winds and the surrounding ocean.

Investments have been made to increase the share of wind power from 5% of total electricity use to 24% over the next year. Hydro-pumping energy storage schemes are planned, and power suppliers are also seeking sustainable ways to obtain renewable tidal energy from the powerful currents that flow around the islands.

Nordic-Arctic cooperation

The Nordic countries' territories encompass extensive Arctic lands and waters, including the islands of Greenland and Svalbard. To address issues of wider arctic interest the Nordic countries are actively involved

in circumpolar and regional organisations including the Arctic Council and the Barents Euro-Arctic Council.

The impacts of climate change are a key issue throughout such co-operation, especially since these

impacts threaten both the traditional lifestyles of Arctic indigenous peoples, and the region's fragile biodiversity. Climate issues are also a key theme in the Nordic Council of Ministers' own programme of Arctic cooperation and research initiatives.

ICELAND – Utilising rich reserves of renewable energy

Iceland's greenhouse gas emissions profile is exceptional by international standards. Energy consumption levels per capita are the highest of all the OECD countries, largely due to the prevalence of power-intensive industries, but renewable geothermal heat and hydropower together accounted in 2012 for 86% of total energy consumption and 96% of electricity production.

Oil is no longer used for heating, and renewable energy has widely replaced fossil fuels in industry. The production of aluminium and other metals accounts for 77% of total electricity consumption. Fossil fuel consumption rates outside the transport sector are very low. In 2011 Iceland's fishing fleet accounted for about a quarter of total oil consumption, road transport for 44%, and aviation for more than a fifth.

The government's long-term Climate Change Strategy defines five key goals with respect to climate change, relating to meeting Iceland's international obligations, reducing fossil fuel use,

increasing carbon sequestration from the atmosphere through land use changes, fostering research and innovation, and preparing for adaptation to climate change.

Key strategic actions

The strategy aims to reduce net emissions of greenhouse gases by 50–75% from 1990-levels by 2050. Though total emissions have been declining since 2008 this is a challenging target, since emissions in 2011 were 25.8% above 1990-levels, largely due to the expansion of metal production. Industrial processes including metal production accounted for about 41% of Iceland's emissions in 2011, since such processes generate greenhouse gases even if they use renewable electricity.

The national Climate Change Action Plan, approved in 2010, defines mitigation actions to be realised in all sectors of the national economy, overseen by a government climate committee.

Iceland is not a member of the European Union, but the EU

emissions trading system has been integrated into Icelandic legislation. Fossil fuels have been subjected to carbon taxes since 2010, and road vehicle taxes are based on emission levels. These measures together mean that 90% of Iceland's CO₂ emissions are controlled by economic instruments.

The action plan also aims to reduce emissions from transportation by obliging national and local authorities to procure low-emission vehicles, and by encouraging Icelanders to abandon their cars and use public transport, cycle or walk to work or school. The *Reykjavik the bike city* programme aims to increase the total length of bike paths in the city from 10 km in 2010 to 100 km in 2020.

Fishing and afforestation

Emissions from Iceland's key fishing industry have been declining for more than a decade largely due to continuous improvements in fuel efficiency. The action plan now aims to promote the use of biofuels in the fishing fleet, and to electrify the fishmeal processing industry.



PHOTO: HUGI ÓLAFSSON

In the land-use, land-use change and forestry (LULUCF) sector, Iceland aims to establish significant carbon sinks through major

revegetation schemes including extensive 40-year regional afforestation plans to be realised in low-lying areas around the

country. Such measures should considerably increase Iceland's net LULUCF carbon removals over the coming years.

Heat from the ground

Iceland has uniquely extensive and accessible reserves of geothermal energy in the form of underground reservoirs of hot water and steam, due to constant volcanic activity along the Mid-Atlantic Ridge, which runs across the country from the south-west to the north-east.

Iceland has long pioneered the use of geothermal energy for local and district heating.

Government agencies including the National Energy Authority have actively fostered related research and technological developments.

Around 90% of homes are today heated geothermally, as well as many greenhouse cultivation facilities, fish farms and public swimming pools. In recent years the amounts of electricity generated using geothermal energy have risen to about 25% of Iceland's total electricity supply.

The national Climate Change Strategy aims to continue to promote both further innovation and the export of Icelandic expertise to countries with relatively untapped reserves of geothermal energy. The UN University Geothermal Training Programme in Iceland has provided valuable technical training for many specialists from developing and transitional countries.

NORWAY – Committed to global action

Norway is committed to become carbon neutral by 2050 by becoming a low-emission society and by financing emission reductions abroad that are equivalent to Norway's own remaining emissions. Key interim targets are to reduce global greenhouse gas emissions by an amount equal to 30% of Norway's 1990 emissions by 2020, and at least 40% by 2030.

This will be achieved by combining domestic reductions with the financing of emission cuts abroad in collaboration with the EU and through the Kyoto Protocol's flexible mechanisms. If other developed countries also commit to an ambitious global climate agreement, Norway has promised to go carbon neutral by 2030.

In September 2014 Norway reinforced commitments to international actions including the Green Climate Fund and the World Bank's carbon pricing initiative, as well as global efforts to combat deforestation, which Norway funds through a uniquely extensive climate and forest initiative.

Norway has also led the UN-backed Energy+ initiative, which aims to reduce greenhouse gas emissions by increasing access to sustainable energy services in developing countries. This initiative uses public finances to leverage private commercial investments in the energy sectors of developing countries.

Limiting domestic emissions

Domestic greenhouse gas emissions from the use of fossil fuels are fairly low by western standards, since almost all of Norway's electricity is generated using hydropower. The energy supply only accounted for about 3% of national greenhouse gas emissions in 2013, compared to 27% for the oil and gas extraction industry, 22% for manufacturing and mining, and 19% for road traffic.

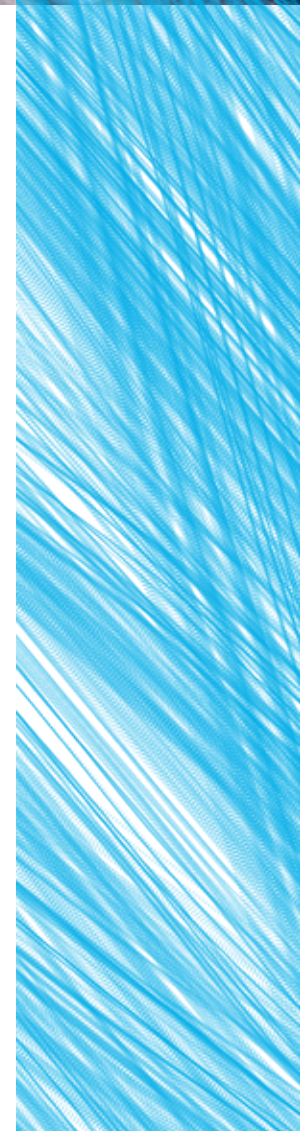
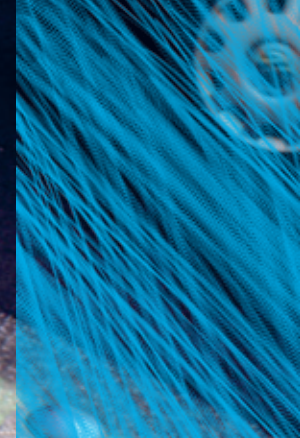
Though not a member of the European Union, Norway is a member of the EU Emission Trading System (ETS), and is also committed to meet the EU's 2020 targets on renewable energy. This will mean further increasing the share of re-

newables to 67.5% of total energy consumption, from about 64.5% in 2012. Wind power is one area for expansion: concessions are rapidly being granted for major new onshore wind farms that should increase national capacity to 2 gigawatts by 2020.

Norway's advanced environmental and energy taxation system includes taxes on mineral oil, oil-based vehicle fuels and the petrochemical industry. Carbon taxes have been imposed since 1991. Emissions from Norway's extensive offshore oil and gas industry are included in the EU ETS to encourage the industry to limit emissions. A Green Tax Commission is currently examining further ways to encourage emission reductions.



PHOTO: SIGURÐUR ÓLAFSSON/NORDEN.ORG



Electric cars appearing on the roads

To reduce emissions in the transport sector Norway has been actively promoting zero emission cars. More than 50,000 electric cars are today registered to run on Norway's roads, and electric models accounted for 13% of new car sales in Norway in 2014 – a higher share than any other country in the world.

An impressive publicly funded network of more than 1,000 re-charging stations has already been built up. The scheme benefits from Norway's relatively inexpensive renewably generated electricity. Further incentives for drivers of zero emission cars include substantial tax breaks, free parking schemes, access to bus lanes in urban areas, and exemptions from road tolls and car ferry charges.

Norway's successes in introducing electric vehicles indicate that if government backing and purposeful policies make them competitive to purchase and use, they can take over a large share of the market from conventional models that run on fossil fuels.

A groundbreaking climate and forest initiative

Norway's International Climate and Forest Initiative supports global efforts to reduce greenhouse gas emissions resulting from deforestation and forest degradation in developing countries (REDD+). Forest and land use emissions are estimated to account for about 10% of global anthropogenic net greenhouse gas emissions. Reducing such emissions by curbing deforestation and restoring forests is

among the most cost-effective ways to mitigate climate change.

Since 2007 Norway has been the largest single country contributor to REDD+ efforts globally, allocating NOK 3 billion (350 million euros) a year. These funds are used to pay for emission reductions achieved in Norway's partner countries, and to finance related research, efforts to build up global and national REDD frameworks, and practical measures to combat deforestation in developing coun-

tries with extensive tropical forests.

Norway's REDD+ partner countries include Indonesia, Brazil, Guyana, Ethiopia, Liberia, Peru and Tanzania. A recent evaluation credited Norwegian involvement in Indonesia for helping to achieve a significant logging moratorium and prepare for wider REDD+ schemes. Emissions from deforestation in Brazil have also been radically reduced since 2007.

SWEDEN – Using economic instruments to reduce emissions

Since 1990 Sweden's CO₂ emissions have declined by approximately 23%, while GDP has increased by over 60%. Sweden is now speeding up its transition to a fossil-free society. A new climate policy framework designed to make this possible by 2050 is under preparation.

Detailed action plans are in place aiming to reduce greenhouse gas emissions outside the scope of EU emissions trading to 40% below

their 1990-level by 2020. Other existing targets for 2020 include a 20% rise in energy efficiency, and the use of renewable energy sources to meet 50% of all energy needs.

In combating climate change Sweden emphasises the importance of making polluters pay, by putting a price on carbon emissions. The key economic instrument, in addition to the EU emissions trading scheme, has been Sweden's pioneering carbon tax on fossil fuel use, which

was first introduced in the early 1990s and has been successively tightened. Carbon taxation levels in Sweden today are the highest in the world, at 150 USD/tonne of CO₂ for households and services.

To facilitate Sweden's transformation to a low-carbon society, an extensive new support programme has also been launched to encourage local and regional climate investments.

Efficient district heating – and cooling

Sweden's progressive electricity certification and energy and carbon taxation policies have favoured combined heat and power production (CHP) and alternatives to fossil fuels for heating schemes, leading to radical reductions in emissions from the heating of buildings. In CHP plants 80–90% of the primary energy in the fuel may be converted to energy, compared to about 50% when only heat is generated.

District heating schemes today meet 58% of Sweden's heating

needs. Such schemes exist in all communities with more than 10,000 inhabitants, as well as many smaller settlements. Since the 1980s Sweden's total district heating supply has doubled, while the fuel mix has switched from about 90% fossil fuels to 90% non-fossil fuels today. Sweden's growing district heating networks currently have a total of 20,000 km of heating pipes.

Many schemes exploit readily available surplus heat from industrial processes or power plants. Residual biomass and other wastes are also increasingly used to fuel district heating systems,

or to produce biogas, instead of being sent to landfill. Many district heating plants are able to use various fuels flexibly. Sizeable district heating systems are much more efficient and less polluting than having many boilers in individual buildings.

Technologies developed for district heating are also increasingly being used for district cooling in many Swedish towns. Perhaps surprisingly, Stockholm is among the world's leading cities in the use of district cooling, together with Abu Dhabi and Paris.



PHOTO: MILJÖFÖRVALTNINGEN MALMÖ

Green energy on the rise

Renewable energy sources, especially hydropower and biofuels, already account for 52% of total energy use, so Sweden's renewables target for 2020 has already been achieved. This success is partly thanks to a market-based electricity certification scheme

introduced in 2003. This scheme obliges electricity suppliers to obtain a certain quota of their power from renewable sources, which will be increased every year until 2020. At the same time, subsidies are provided to encourage climate-friendly investments and innovations.

Most of the future increase in renewable energy will come from a steadily expanding wind power programme, the spread of transport biofuels, and the increased use of heat pumps and renewable energy for heating.

Low-emission cars

Emissions from transportation still make up roughly a third of Sweden's total greenhouse gas emissions, though they have been declining since around 2007. Emissions from private cars have fallen to 8% below their 1990-level in spite of growth in the vehicle fleet. Sweden has already exceeded the EU target of 10% renewable energy in the transport sector by 2020, since the share in 2013 was 16.7%.

These emission reductions can largely be attributed to various EU and national policies such

as progressively raised carbon tax on fuels, which have encouraged improvements in cars' fuel efficiency.

Transport biofuels are partly exempt from energy taxes and not subject to carbon taxes. Larger petrol stations are obliged to offer renewable fuels, while generous funding supports the development of climate-friendly biofuels. Owners of electric, hybrid and low-emission "eco-car" models pay no vehicle tax for the first five years, while purchasers of the lowest-emission vehicles receive a sizeable "super bonus" incentive.

Such measures have promoted the manufacture and sales of increasingly fuel-efficient car models, and also encouraged more people to switch to greener vehicles or greener modes of transportation. A new system for rewarding cars with low emissions while raising taxes for cars with high emissions is also currently being planned.

Joint Nordic actions

In addition to realising their national strategies and measures, the Nordic countries also pool their resources to combat climate change through various joint Nordic institutions.

The Nordic Council of Ministers (NCM) is the official inter-governmental body overseeing Nordic cooperation. Climate issues are prominent in the Nordic prime ministers' Green Growth Initiative, which is realised by the NCM. Cooperation on green growth aims to make Nordic energy infrastructures smarter, create larger markets for favourable solutions, and give a political lead to promote green growth within the EU and globally.

The Green Growth Initiative particularly aims to build on Nordic strengths in climate-friendly technologies by setting up shared test and demonstration centres, by defining common standards in key areas including public sector procurement, and by promoting collaboration on education, training and research.

Nordic finance for climate-friendly development

Nordic development ministers coordinate the Nordic countries' aid and development financing schemes to ensure they prioritise climate considerations. The key Nordic bodies working in this area are financed jointly by Denmark, Finland, Iceland, Norway and Sweden.

The Nordic Development Fund (NDF) provides funds to help low-income countries in Africa, Asia and Latin America directly address the causes and consequences of climate change. Funds are used for both mitigation and adaptation activities, typically through co-financing cooperation with multilateral development banks and Nordic development agencies. The climate impacts of NDF-backed projects in other areas such as infrastructure and natural resources are also carefully screened.

NDF seeks to utilise innovative funding mechanisms, particularly in relation to private sector

developments including energy efficiency improvements. NDF's contribution typically amounts to 2–5 million euros per project. NDF's capital is allocated from the development budgets of the Nordic countries. The fund's assets currently amount to some €880 million

Technology transfer partnerships

NDF also finances the Nordic Climate Facility (NCF), which is administered by the Nordic Environment Finance Corporation (NEFCO), to build partnerships between Nordic organisations and their partners in developing countries. The NCF promotes innovations in sectors including energy, transport, water, health, agriculture and forestry. Grants of up to 500,000 euros may be provided for projects that meet NCF's co-financing requirements.

Nordic governments and NEFCO are also funding the NCM's Nordic Partnership Initiative on Up-scaled Mitigation Action, a pilot emission reduction programme in Peru. NDF is meanwhile funding a similar pilot initiative in Vietnam. These

Nordic support for projects in low-income countries

The Nordic Development Fund (NDF) provides co-financing for projects that contribute to

climate change mitigation and adaptation in 24 low-income countries.

Sustainable charcoal for rural Tanzania

In Tanzania traditional charcoal burning results in serious environmental problems. NDF's Nordic Climate Facility (NCF) has funded a project designed to reduce deforestation and greenhouse gas emissions by promoting the use of sustainably produced charcoal briquettes in homes. The project is providing 120 charcoal kilns and training 770 rural entrepreneurs to adopt

a business model that should be widely replicable in other parts of Africa.

Deforestation and land use changes account for about 90% of Tanzania's greenhouse gas emissions. The current sustainable charcoal project, run by Gaia Consulting and ARTI Tanzania, should reduce emissions by some 50,000 tonnes while preserving about 13,000 hectares of native forest.

Sustainable charcoal production in Tanzania



PHOTO: DENNIS HAMRO-DROTZ

Sustainable water projects for a changing climate

The NCF has also been co-financing a project designed to improve access to safe, clean water in nine villages in Kenya. The project's LIFELINK systems use Grundfos submersible water pumps driven by renewable energy from solar panels.

The LIFELINK pumps are remotely monitored using a satellite communication system that will alert local service partners when

repairs are needed. Villagers use mobile phones to pay a small fee for their water. NDF and the World

Bank are already planning to back 30 further LIFELINK systems elsewhere in East Africa.



PHOTO: GRUNDFOS LIFELINK

Sustainable water projects in Kenya

pilot programmes aim to serve as forerunners for the international financing of nationally appropriate mitigation actions (NAMAs).

In Peru the goal is to cut emissions from waste management by finding sustainable uses for wastes, aided by increasing private sector involvement. In Vietnam the focus is on the energy-intensive cement production sector, which is the largest emitter of industrial greenhouse gases in this rapidly developing country.

Nordic funding for actions closer to home

NEFCO provides loans and investments primarily in Central and Eastern Europe, for cost-effective developments whose environmental impacts will also benefit the Nordic region by reducing emissions of pollutants including greenhouse gas emissions, and by improving the state of the Baltic Sea.

NEFCO's 32 separate funds have managed assets with a total value of 501 million euros. Their



PHOTO: JENNA HYTTE, GREENSTREAM

Recycling centre in Lima, Peru

combined investment portfolio comprises over 500 projects in sectors ranging from energy production and industry to waste management and agriculture. Significant climate-related funds managed by NEFCO include the Norwegian Carbon Procurement Facility (NorCaP) and the NEFCO Carbon Fund (NeCF).

Carbon financing schemes realised through the Kyoto Protocol's Joint Implementation (JI) and

Clean Development Mechanism (CDM) schemes provide additional revenue for emission reduction projects.

Carbon credits can be utilized in EU Emissions Trading Scheme by companies or by governments to help meet Kyoto targets. Many of NEFCO's investments apply public private partnership models. NEFCO has supported many renewable energy and energy efficiency projects in Asia and Latin America



as well as Eastern Europe by providing carbon finance.

Through a separate Energy Saving Credit scheme NEFCO offers small-scale loans for energy-saving measures realised in municipal buildings such as schools, hospitals and sports halls in Ukraine. Loan repayments are directly tied to the resulting savings.

Backing for green Nordic and Baltic projects

Another financial institution that supports emission-reducing schemes, the Nordic Investment Bank (NIB), is owned jointly by the Nordic and Baltic Countries. NIB provides long-term loans to private and public sector partners in the Nordic and Baltic regions

for projects that improve competitiveness and the environment.

Many NIB-backed projects aim to increase the use of renewable energy, including geothermal power in Iceland, wind power in Denmark and Sweden, and wood energy in Finland. NIB has also financed climate-friendly infrastructure and public transport schemes including improvements to rail transport systems in Sweden and Finland.

Coordinated action on key issues

Nordic inter-governmental co-operation on environmental issues including climate change is overseen by the Nordic Council of Ministers for the Environment (MR-M). The MR-M's members, who come

from the five Nordic countries and three autonomous regions, meet regularly to coordinate strategic issues, activities, funding and practical cooperation. This collaboration helps the Nordic countries pull their collective weight in international forums.

Several of the MR-M's key activities relate to climate issues. The Nordic Working Group for Global Climate Negotiations (NOAK) coordinates Nordic efforts to promote the adoption of a binding global climate agreement incorporating ambitious commitments.

NOAK regularly organises related meetings, side events and workshops, as well as projects on issues of current interest with regard to negotiations, ranging

from international initiatives and land use issues to equity and accounting.

The Nordic Council of Ministers' cross-sectoral Working Group on Environment and Economy (MEG) funds Nordic projects that review how economic instruments can be used to help mitigate climate change and promote sustainable green growth.

Reviews of urgent climate topics

The MR-M's Climate and Air Pollution Group (KOL) runs projects designed to combat climate change and limit the harmful impacts of transboundary air pollution in the Nordic and Arctic regions. Recent KOL reports have focused on issues including Nordic climate policies, carbon budgets, and the causes and consequences of climate change in Nordic-Arctic regions, including laser-mapped changes in glaciers and ice caps in Greenland, Iceland and Norway.

Another important priority for KOL is emissions of short-lived

climate pollutants (SLCPs) such as methane, tropospheric ozone and black carbon in the form of soot. Such pollutants contribute considerably to warming in sensitive regions like the Arctic. The Nordic bloc is pro-actively driving international initiatives to reduce SLCP emissions through organisations including the Arctic Council and UNEP's Climate and Clean Air Coalition to Reduce Short-lived Climate Pollutants

(CCAC). Related Nordic initiatives have been launched to help control emissions of soot and other SLCPs, and spread knowhow on cost-effective measures.

Such efforts illustrate how the Nordic Countries are effectively pooling their resources to contribute to urgent global action, while also collaborating to shape their own forward-looking climate policies at home.



PHOTO: SILJE BERGUM KINSTEN

Key Nordic organisations and initiatives

- **The Nordic Council of Ministers** coordinates progress on climate-friendly development across the region through its **Green Growth Initiative**.
www.norden.org/greengrowth
- **The Nordic Way** web magazine features examples of Nordic Green Growth: www.nordicway.org
- **The Nordic Development Fund (NDF)** co-finances climate-friendly developments in Africa, Asia and Latin America. www.ndf.fi
- **The Nordic Environment Finance Corporation (NEFCO)** invests in developments with positive climate and environmental impacts in neighbouring regions of Central and Eastern Europe, and in climate projects globally. www.nefco.org
- **The Nordic Climate Facility** provides co-financing for the transfer of Nordic climate-related knowhow to developing countries.
www.ndf.fi and www.nefco.org
- **The Nordic Investment Bank (NIB)** supports investments with favourable climate impacts in the Nordic and Baltic regions. www.nib.int
- **Nordic Energy Research** is a platform for cooperative energy research and policy development under the Nordic Council of Ministers. www.nordicenergy.org



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Nordic action on climate change

This booklet presents actions taken by the Nordic countries to speed the transition to a sustainable low-carbon society. It shows how sustainable development is possible, with strong climate policies contributing to economic growth and job creation as well as environmental improvements. The Nordic countries successfully demonstrate how ambitious climate change mitigation targets and policies can be combined with high levels of human development.

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