Advent Valley, Svalbard. Photo: Terje Heiestad. Design: jnd.no

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Top-level Research Initiative

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The Top-level Research Initiative

A major Nordic venture for climate, energy and the environment

At their summer meeting in Finland in 2007, the five Nordic prime ministers decided to strengthen efforts related to Nordic research and innovation. They asked the Nordic Council of Ministers to draw up a proposal that would promote Nordic top-level research in close cooperation with trade and industry. The Nordic prime ministers met again in April 2008 at the Riksgränsen ski resort in Sweden, where they drew up the Riksgränsen Declaration which laid the foundation for the largest joint Nordic effort to promote research and innovation ever undertaken, focusing on climate, energy and the environment.

The Top-level Research Initiative
A major Nordic venture for climate, energy and the environment

Photo: Terje Heiestad

"I think we should be very satisfied with the results because we have enabled researchers to work more closely together...
I think that as politicians, we cannot give you all the technologies, but we can facilitate research, we can provide support, and we can organise activities so that researchers are able to do their job.
And that is to expand our understanding, develop technology and thereby increase our capacity to combat global warming."

– Former Prime Minister of Norway and previous UN Special Envoy for Climate Change

Establishment and funding

In October 2008 the Nordic ministers of education and research established Nordic cooperation on top-level research. The areas of research involved major global challenges and were addressed at the United Nations Climate Change Conference COP 15 to be held in Copenhagen in 2009. The budget was DKK 400 million over five years, and participating institutions and companies were also expected to contribute financing. By involving knowledge environments and trade and industry and by bringing the foremost Nordic talents together, the Nordic countries sought to develop solutions to the global climate challenges.

High performance

The Top-level Research Initiative (TRI) has produced important scientific results and provided a major contribution to the Nordic research effort in the areas of climate, energy and the environment. This is the main conclusion in the final evaluation by the independent consultancy firm DAMVAD. The objectives of the programme have been achieved in most areas. The TRI has created a new Nordic and international platform for cooperation on research and innovation. The evaluation shows that the number of scientific publications by the participating researchers has risen in the past four years, and a large percentage of the articles have been published in the most influential journals.

Cooperation between research and trade and industry

The evaluation shows that the interaction between the research community and trade and industry has worked well. Both participating researchers and businesspeople point to the new, beneficial experience they have gained. Commercial results from several projects are expected to be realised in the near future.

Interdisciplinary research

One of the primary objectives of the TRI was to support or stimulate interdisciplinary research, and this has been achieved.

Participating researchers emphasise that they have benefited greatly from dialogue and cooperation with TRI researchers across the Nordic region who study climate issues from a variety of scientific perspectives. Long-term networks in which researchers can view their own research in a larger, interdisciplinary context have been established. The TRI has helped to train a new generation of researchers with an interdisciplinary focus, and a large number of younger researchers have got more opportunities and new international contacts.

Productive cooperation

One of the lessons learned from the TRI is that the Nordic countries have the ability to reach consensus and establish a large-scale programme in a relatively short period of time. The TRI was regarded as extremely important, and the joint decision taken at the highest political level facilitated a relatively quick launch of the programme which involved participation from all of the countries.

Social sciences

An objective of the TRI was to incorporate a cross-cutting social science dimension in the projects.

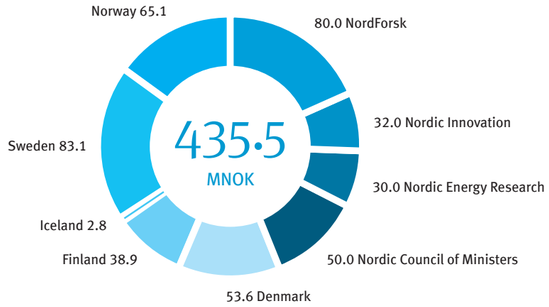
“The idea is that the social sciences must be an important element in all parts of the programme. We have not been 100 percent successful in achieving this, but the social sciences are nonetheless integrated into the programme in a way which is rather unusual and difficult to accomplish.”

– *Chair of TRI Management Board, Rolf Annerberg*

Rolf Annerberg, Photo: Terje Heiestad

A book by **Gudmund Hernes**, former minister at several Norwegian ministries, was published under the TRI umbrella in 2012, and is the most significant contribution to the social sciences under the TRI.

The **graph** below shows the distribution of financing by country and institution in MNOK. The evaluation shows that participating institutions and companies have contributed in-kind financing (e.g. cash financing, office space, infrastructure, salary) which more than doubles the overall budget.



The TRI organisation consists of a Management Board, six Programme Committees (nominated for each sub-programme) and a secretariat for day-to-day activities. The TRI secretariat is jointly administered by three Nordic organisations; NordForsk, Nordic Energy Research and Nordic Innovation. The TRI has a large portfolio of projects, 40 in total.

40

Included in this figure are six Nordic Centres of Excellence (NCoE), a Nordic Competence Centre and a number of networks and studies.

The first activities and calls were initiated in 2009, and the first projects started in 2010. Some of the grants run until 2017. Throughout the programme period many of the participating researchers and business partners have engaged in dialogue across sub-programmes and projects and established new, beneficial cooperation, as well as networks of new contacts within and outside the Nordic region.

SVALI 1

Research aircraft, measuring the volume and thickness of ice in glaciers in Svalbard.
Photos: Terje Heiestad

Sine Munk Hvidegaard in a research aircraft, measuring the volume and thickness of ice in glaciers in Svalbard.

SVALI Global warming has led to changes in the cryosphere, that is, the part of the Earth System where water occurs in its frozen form. This has caused an increased flux of meltwater and icebergs from glaciers and a rising sea level. Greater freshwater discharge to the oceans also has an impact on ocean circulation as well as on the Arctic Hydrological Cycle. These changes are occurring more rapidly than predicted. In order to foresee future sea level rise, more knowledge and insight is needed. SVALI spends a portion of its budget on a graduate school.

"All the graduate students should receive supervision from at least two different partners and countries in SVALI to enhance mobility and build contacts between the various partners and countries in the project."
– Professor Jon Ove Hagen, University of Oslo

DEFROST 2

DEFROST The aim is to understand how climate change-induced changes in the cryosphere influence the ecosystem which in turn directly affects climate.

"It's like an engine that we do not understand. Here we are turning knobs if you like, in terms of warming an ecosystem that has important interactions with climate and we do not understand how the motor works very well. We are trying to give a complete picture of how the climate interacts with this tundra ecosystem. And we are trying to do so in a way that can provide a complete answer. The TRI has been fantastic in providing a platform for us to establish cross-disciplinary cooperation between experts in marine, terrestrial, atmospheric and climate issues."

– Professor Torben Christensen, Lund University

Torben Christensen en route to a research stations in Svalbard
Photo: Terje Heiestad

CRAICC 3

Michael H. Boy and Juho Aalto (above) study measurements taken from close to ground-level at the SMEAR II field station in Hyytiälä, Finland. Photos: Terje Heiestad

CRAICC Extensive measurements of aerosols are being taken in forest areas, such as at the SMEAR II field station in Hyytiälä, Finland. Aerosols are very small particles or liquid droplets in the air or other gases. "The forest is very complex. A lot of gases are released from the soil, from the trees, from the stems, from the roots and from the needles. These contribute significantly to the global budget of aerosols." – Dr Dosent Michael H Boy

"The boreal Northern forests are even more effective than the rain forest, especially in producing new aerosol particles."
– Professor Markku Kulmala, University of Helsinki

TUNDRA 4

TUNDRA Increasing vegetation in tundra areas means absorbing warmth into the soil, whereas large areas of white snow cover will reflect the heat from the sun. Three types of animals influence the amount of vegetation: reindeer, mammals such as lemmings and a certain type of leaf-eating moth.

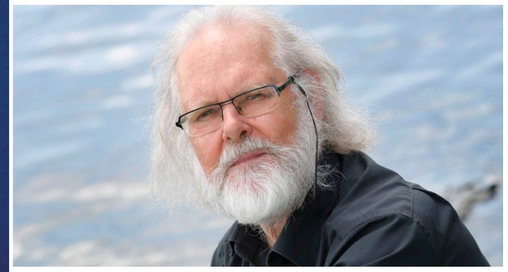
"On the tundra we have the ecosystem – and we have reindeer husbandry as a form of livelihood. A main goal is to combine these into a system that supports both the ecosystem and the livelihood of those reindeer herders in the North, so that both can co-exist in an optimal state."
– Professor Jukka Käyhkö, University of Turku

Grazing reindeer photographed by an automatic camera placed at a test site on the tundra, Kevo in Finland.

Professor Jukka Käyhkö, University of Turku. Photo: Terje Heiestad

NorMer 5

Climate change has a direct impact on the life cycle of cod.
Photo: Per Eide, Samfoto/NTB scanpix



Professor Nils Christian Stenseth, University of Oslo. Photo: Terje Heiestad

NorMer Marine ecosystems are under pressure from both anthropogenic climate change and high exploitation rates. A major challenge is to identify ways that oceans can provide food and other services in a sustainable way under changing climatic and socio-economic conditions.

"Our research focuses primarily on how climate change affects cod. On the direct impact this has on the individual cod and the cod stock, as well as on the entire food chain. Plankton and other fish species that cod depend on through various phases of the life cycle are also affected and influenced by climate change – and cod reproduction is directly affected as well."
– Professor Nils Christian Stenseth, University of Oslo

NORD-STAR 6

NORD-STAR Research at the centre will form a basis for decision-making and policy and strategy development related to climate change. “There are three areas our centres focuses on: science, societal dialogue and communication.” – Professor Michael Goodsite.

The centre, in cooperation with Nordic insurance companies, has developed a portal, VisAdapt, which can be used by homeowners and municipalities to plan climate adaptation measures and gain an overview of where it is safe to live.

“The goal of the project is to help our customers, the homeowners, to see what kind of climate-related risks they are facing and to give them very concrete, practical advice on how they can reduce their own vulnerability.”
– Tom Anders Stenbro, Tryg Insurance Company

ENESCA 7

ENESCA Battery technology is the Achilles heel of alternative energy. We use batteries practically everywhere, but compared to technological development in other areas, very few advancements have been made since Alessandro Volta invented the first battery 213 years ago. The green alga known as Cladophora is best known for fouling our beaches, but a TRI project made a discovery.

"We found that it was possible to coat each individual nanofibre in the Cladophora cellulose with a conducting polymer and retain the material's large surface at the same time! Then we started thinking. With this surface it should be possible to transport a large number of ions in and out of the polymer in a short period of time. Could this be used to make a new kind of battery?"

– Professor Maria Strømme, Uppsala University

Professor Maria Strømme.
Photos: Terje Heiestad

NORDICCS 8

NORDICCS "What we have developed here in the NORDICCS is an understanding of how the Nordic countries can work together... If you look at our Icelandic neighbours, they do not have large emissions, but they have huge storage potential. A very special way of storing CO_2 in basalt." – Direktør Nils A. Røkke, SINTEF

Photo: Terje Heiestad

"We dissolve the CO_2, either during or prior to injection, and we do this in such a way that the geyser CO_2 is released into a water stream in very small bubbles. This allows rapid dissolution of the gas, which then is injected into the storage reservoir. On this particular site the storage reservoir is located at between 400 and 800 metres depth. We have another reservoir which lies below 1000 metres depth... The acidic fluid that is being injected interacts with the basalt, and will turn the CO_2 into rock pretty much within a year."
– Reservoir engineer Edda Sif Pind Aradóttir, Reykjavik Energy

IceWind 9

From left Niels-Erik Clausen og Neil Davis (phd), ICEWIND Risø Campus Roskile Danmark
Photos: Terje Heiestad

IceWind Wind turbines in the Nordic countries can become covered with ice, with the potential to reduce the power output or damage the turbines. Researchers have now developed new tools for better forecasts of both icing, wind and waves.

"In the IceWind project, we have studied some of the main challenges in the Nordic offshore wind sector. We have developed a wind atlas and an icing atlas for Iceland and an icing atlas for Sweden, developed software that can help us predict icing, and studied integration of wind energy with the hydroelectric power system of Iceland. Another outcome is a set of recommendations on procedures and tools for the maintenance of offshore wind farms."

– Niels Erik Clausen, senior advisor, DTU

BioEng 10

Azhar Malik, post.doc and Professor Terese Løvås, NTNU.

BioEng First-generation biofuels have been criticised because they are made from sugars and vegetable oils found in food crops, and as such can be seen as competing with global food production. Second-generation biofuels bypass this problem, but create new ones which a group of TRI researchers have been working hard to solve.

"In this project we have studied the effect of second generation biofuels in state-of-the-art engines. We have both conducted experiments in a test facility, and matched them with simulations of the combustion and emissions. This has led to a greater understanding of how we can reduce emissions of particles and nitrous oxides from engines running on different kinds of biofuels in particular."

– Professor Terese Løvås, NTNU

Professor Terese Løvås and Engineer Stein Kristian Skånøy. Photos: Terje Heiestad

“I think that the research being conducted here is extremely important in terms of helping us to understand climate change. One of the biggest issues in climate change is what is happening to our cryosphere: ice sheets, glaciers, permafrost, snow. The Nordic countries are really playing a global leadership role here in understanding what is happening to the cryosphere.”

– Mark Serreze, Professor at the University of Colorado and Head of one of the scientific advisory boards