



Annual Report 2016

Centre for Sustainable Energy Studies

Message from the Chair of the Board

As the chair of the board of CenSES and Pro-Rector for research at NTNU, I am delighted to observe the way CenSES continues to play a vital role in the Strategic Research Area Energy at NTNU and beyond.

To bring the best minds together in strategic interdisciplinary research is the main idea behind NTNU's strategic research areas. The interdisciplinary and cross-disciplinary research conducted within CenSES in cooperation with the more technological oriented energy research areas nationally and internationally is a remarkably good example of how this can be achieved.

Development and integration of a renewable and sustainable energy supply is a key challenge for the world community. Norway has a great potential to support both the production of environmentally friendly energy and to build up the knowledge base required for getting on with the transition to more sustainable energy production and energy use.

Research carried out in CenSES, on innovation and new ways of thinking to promote sustainable transformation of the Norwegian energy system, including design of effective political strategies, an extended knowledge base for innovation, commercialization in enterprises, knowledge transfers from research to business, and involvement of the public, is of utmost importance for such a development to happen – and probably more important today than ever before!

Thus, in the following years I look forward to see a steady number of publications coming out of CenSES that may create a better knowledge base for how we should proceed with the transformation from oil economy to low carbon society. I have great expectations that research carried out in CenSES will influence future political decisions and solutions through its results.

Research done in close cooperation with CenSES partners from industry, and private and public domains of society will be decisive to meet these ends and important for a broad audience.



Kari Melby
Chair of the Board, CenSES

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Report from the Centre Director

Most of the PhD students from the CenSES start-up has now graduated, and the second group of PhD students starting in 2015 and 2016, is well on their way. In our research areas, the remaining time until early 2019 will have a high focus on relevance for our user partners. That means we also will deliver a number of position papers coming out of our user cases, high focus on CenSES scenarios and transition pathways and of course excellent research publications. I give a brief summary of some of the highlights of 2016 below.

RA 1 Policy making and transition strategies: In 2016 Marius Korsnes and Marianne Ryghaug published several articles on China's development in the wind industry. A series of three papers contributes to an understanding of how China develops its wind industry and indicates for potential Norwegian partners, both market possibilities, pitfalls and new political approaches to develop renewable energy resources.

RA 2 Energy system and markets: Christian Skar defended his thesis on modelling low emission scenarios for the European power sector. The work shows strategies to approach 90% emission cuts using different technologies and resulting effects on costs. In addition, several support mechanisms were evaluated, in particular for early implementation of CCS. Skar has cooperated closely with the Technology platform ZEP on a number of reports going to the European Commission and Parliament. Markus Steen defended his work related to the growth of new industry with an empirical focus on the offshore wind industry in Norway.

RA 3 Economic analysis: The world conference for the International Association for Energy Economics was organized in Bergen with 800 participants, with support from CenSES and partners Statoil, Statkraft, BKK and Enova. It was the largest conference in IAEEs history. Important work on the low carbon transport system continued, and Yan and Eskeland have shown that emission reductions for person cars, comes equally distributed from substitution to cars with less emissions within the same class and substitution to smaller cars.

RA 4 Innovation and commercialization: Three PhD-candidates graduated: Tyson Weaver with the thesis "Strategic Management of Power Producers-implementing international renewable power production growth strategies", Øyvind Bjørgum with "New firms developing novel technology in a complex emerging industry - The road towards commercialization of renewable marine energy technologies" and Vegar Ausrød with "Commercialization of renewable energy in rural India: Entrepreneurial activities for building a profitable Venture at the Base of the Pyramid".

RA 5 Scenario development: The first step towards CenSES scenarios towards 2050 was finished, in terms of a report describing qualitatively the key pathways that will be analysed with models in 2017. The development process included a number of CenSES user partners. In addition we stated the related KPN project "Norwegian Energy Road Map 2050".

You can read about these results, and more, in this annual report.

Our focus for future research will be on relevance to the CenSES partners, as well as to society in general, and on high quality publications. To achieve these targets, interaction with our user partners is essential.

We look forward to the cooperation in the coming years.



Asgeir Tomasgard
Centre Director, CenSES

About CenSES

Centre for Sustainable Energy Studies (CenSES) was established in 2011 as a national Centre for Environment-friendly Energy Research (FME) by the Norwegian Research Council. The objective of the FME initiative is the establishment of time-limited research centres which conduct concentrated, focused and long-term research of high international calibre in order to solve specific challenges in the field.

FME CenSES will develop fact-based knowledge for strategic decisions, relevant both for government and industry. The focus is knowledge for a national energy policy, for national and international climate policy, and for strategies of innovation and commercialization.

CenSES research integrates the following disciplines: energy systems and markets, industrial ecology, economics, political science, sociology, innovation studies and science and technology studies.

The CenSES consortium includes research groups from Institute for Energy Technology (IFE), Institute for Research in Economics and Business Administration (SNF), Norwegian School of Economics (NHH), Norwegian University of Science and Technology (NTNU), SINTEF, Sogn og Fjordane University College, Vestlandsforskning and University of Oslo (UiO).

Research partners



Main Research Objective

CenSES' main research objective is to conduct research that supports public and private decision makers in strategic decisions and policies that will promote environment-friendly energy technologies and lead to a sustainable energy system.

The research will result in new policy recommendations, tools and models, strategies and scenarios supporting the transition to a sustainable energy system.

Key objectives

Objectives for education and recruitment

- Develop master courses and a PhD school in social scientific energy studies
- Educate 40 PhD candidates and post docs under the FME budget
- Supervise at least 20-30 master students every year

Relevance objectives

- CenSES will perform a number of scenario studies and user cases in cooperation with the user partners

Dissemination objectives

- Disseminate results to the public through:
 - Yearly conferences
 - Workshops and seminars
 - Quarterly newsletter
 - High visibility in the news media
- Establish Innovation Forum in cooperation with the technology-oriented FMEs
- Establish an Energy Strategy Board together with Technoport
- Establish a public website www.censes.no

Publication objectives

- Present 150 papers on international conferences
- Publish 120 articles in academic journals with peer review
- Write 3 scientific books and 40 book chapters in edited books

In addition to strictly academic dissemination through journals and scientific conferences, CenSES have high goals concerning publishing results that will be useful tools for energy policy making and can contribute to creating a better and broader energy discussion in society.



CenSES 2016

in numbers



Publications

42 articles published in academic journals

21 articles published in anthologies

7 reports



Presentations

56 conference presentations

42 presentations for project target groups

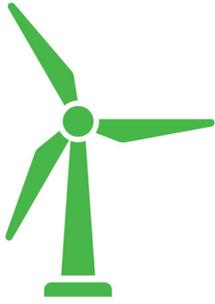


Partners

20 user partners

8 national research partners

10 international research partners



Research

12 new research projects

9 post docs funded by CenSES

27 PhD students funded by CenSES

4 post docs in additional projects

21 PhD students in additional projects

12 PhD Dissertations



Events

3 conferences arranged

8 workshops arranged



Leadership

CenSES Management Group



**Asgeir
Tomasgard**
NTNU



**Marianne
Ryghaug**
NTNU



**Knut H.
Sørensen**
NTNU



**Kari Aamodt
Espegren**
IFE



**Gunnar
Eskeland**
NHH



**Roger
Sørheim**
NTNU



**Erling
Holden**
HiSF



**Hans Jakob
Walnum**
Vestlands-
forskning



**Stefan
Jaehner**
SINTEF



Olav Wicken
UiO



**Kjetil
Midthun**
SINTEF



**Stine Mari
Skeide**
NTNU



**Tove
Svenning**
NTNU

CenSES Board



Kari Melby
Pro-Rector
for Research,
NTNU



**Andreas
Enge**
Head of
Strategy and
Analysis Unit,
Enova



Frode Rømo
Research
Director,
SINTEF



**Fulvio
Castellacci**
Centre
Director, UiO



**Lasse
Torgersen**
Head of
Department,
Norsk Hydro



**Mette
Bjørndal**
Professor,
NHH



Ola Lingaas
Vice President,
SFE

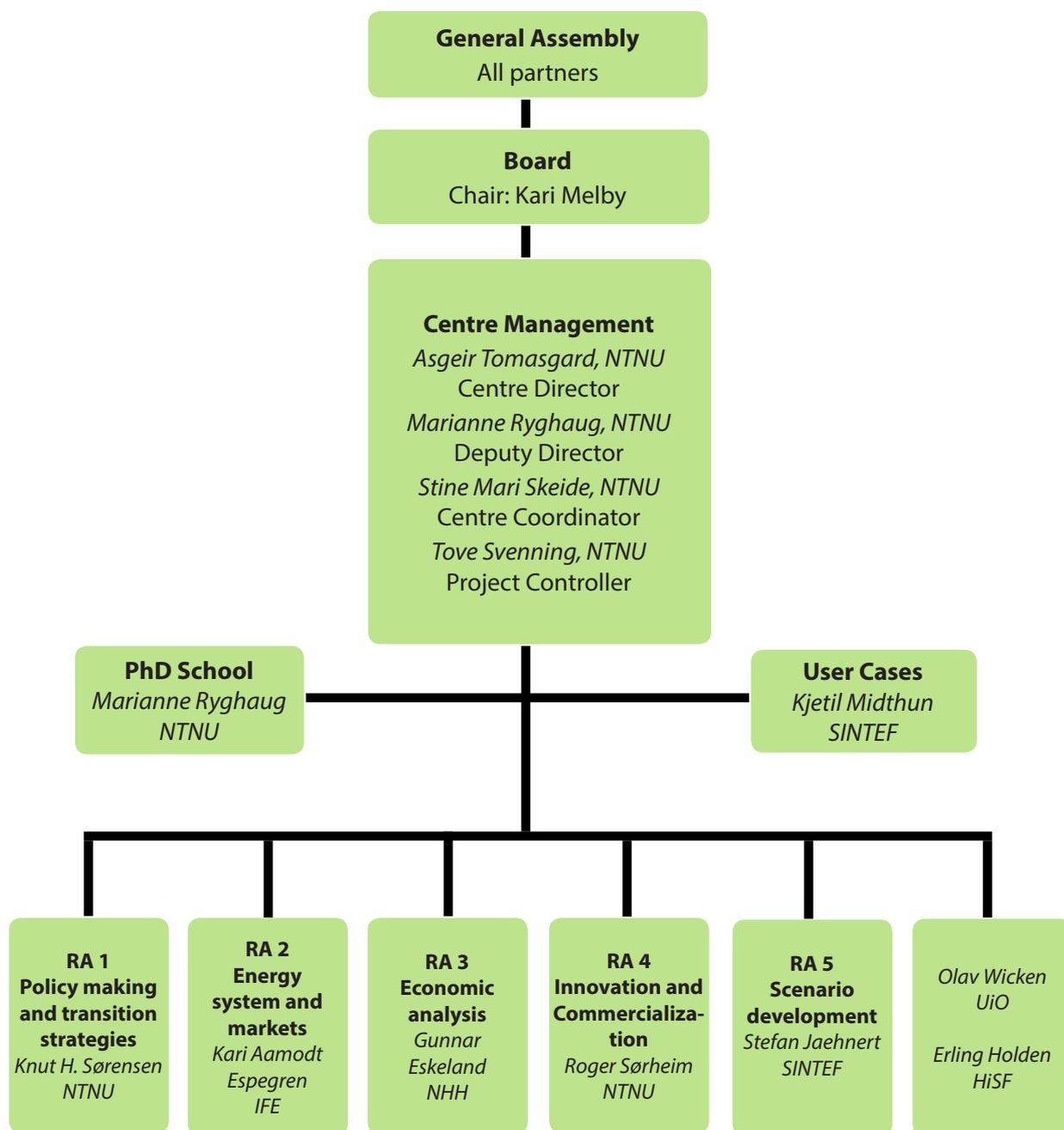


Hilde Strøm
Leading
Business
Developer,
Statoil



Arve Holt
Research
Director, IFE

Organisational chart





Partners

National research partners



User partners



International research partners



Main Research Areas

CenSES is divided in five major research areas, which includes policy recommendations, tools and models, strategies and scenarios. Each research area consist of several specific work packages.

Research Area 1: Policy making and transition strategies

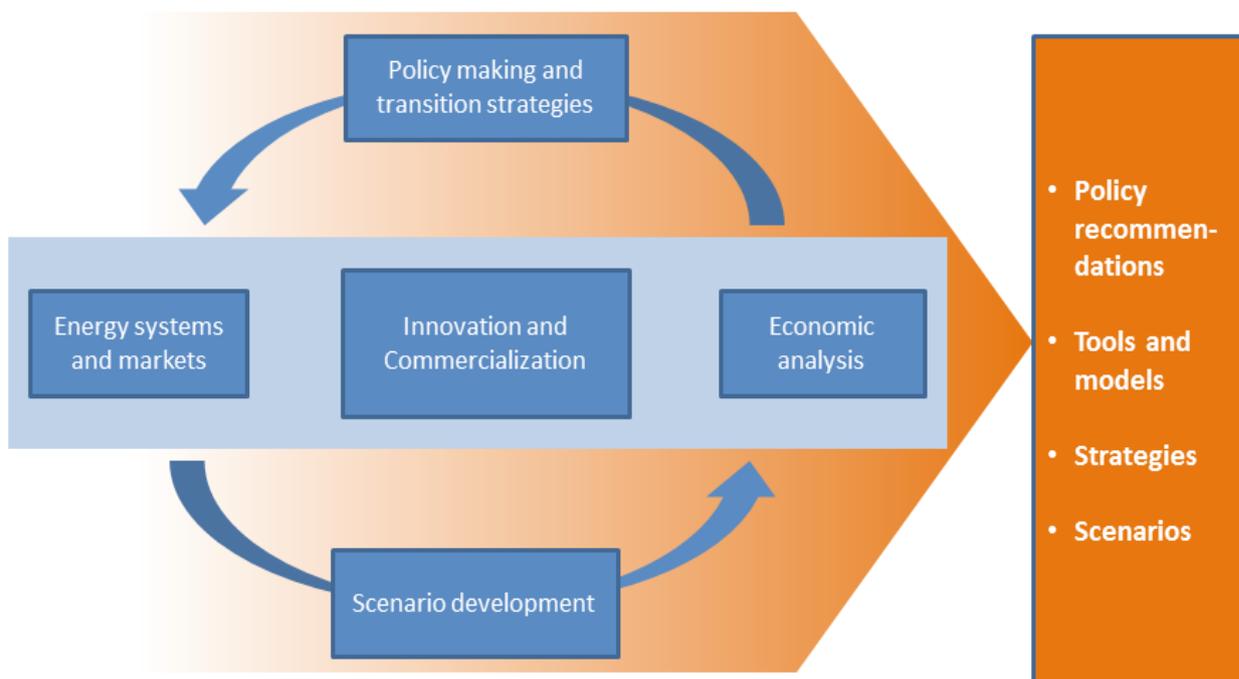
Research Area 2: Energy systems and markets

Research Area 3: Economic analysis

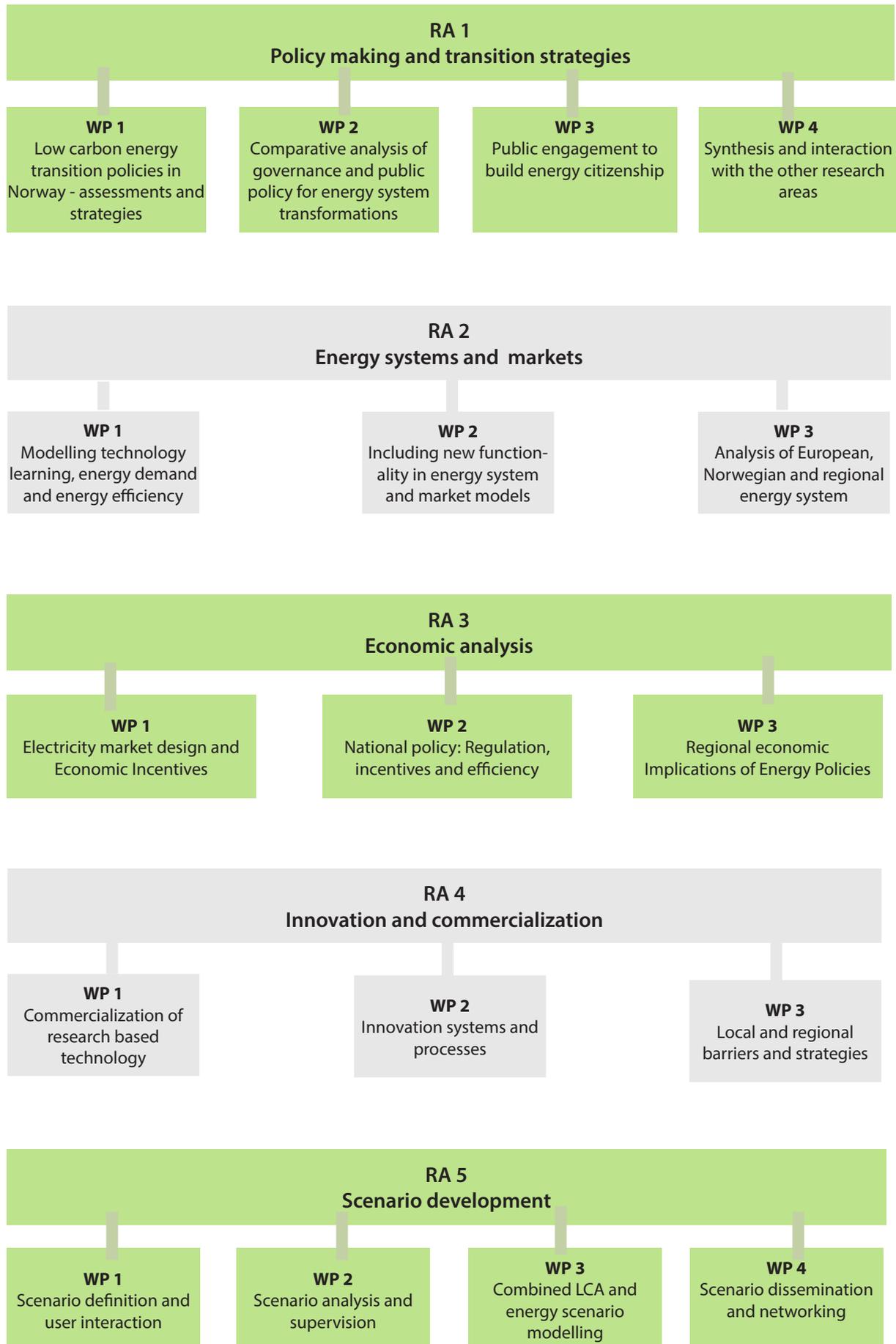
Research Area 4: Innovation and commercialization

Research Area 5: Scenario development

Scenario development is an arena of integration where policy and framework conditions, technology strategies, investment strategies and impacts are to be coupled in a consistent way. In addition, selected user cases are implemented across the research areas.



Research Areas and Work Packages



RA 1 Policy Making and Transition Strategies

RA 1's work packages:

- **WP 1.1.** Low carbon energy transition policies in Norway – assessments and strategies.
- **WP 1.2.** Comparative analysis of governance and public policy for energy system transformations.
- **WP 1.3.** Public engagement to build energy citizenship.
- **WP 1.4.** Synthesis and interaction with the other research areas.

Research in 2016

In 2016 one candidate successfully defended his thesis: William Throndsen: "Response and Responsibility: Smart meters, end use, and the possibility of a material public" (May 25, 2016).

14 papers (per November) were published, mainly in international journals. They cover a wide variety of topics within the RA1 portfolio. A couple of examples:

Margrethe Aune, Åsne Lund Godbolt and Knut H. Sørensen published a study in *Acta Sociologica* showing how economists engage in energy policy, and household consumer differ in their understanding of the electricity market. The interviewed economists argued theoretically, viewing electricity consumers as calculating agents. The interviewed consumers argued a more inclusive and complex understanding of the electricity market by also emphasising moral, social and political issues. This is not, argue Aune, Godbolt and Sørensen, a result of lack of knowledge among consumers but a mismatch regarding the underlying rationality of consumption. The mismatch may represent a stalemate in the need to improve energy efficiency in households. The three authors claim that policy-makers need to address more concerns than economic ones, like climate issues and fairness in the distribution of gains and strains, but also have to find ways to demonstrate that increased energy efficiency really is an option to most households.

Another paper on the topic of electricity consumption focuses on potential changes in the last two decades due to increased awareness of climate change. Margrethe Aune, Åsne Lund Godbolt, Knut H. Sørensen, Marianne Ryghaug, Henrik Karlstrøm and Robert Næss show in "Concerned consumption", published in *Energy Policy*, how increased concern for global warming has changed the domestication

of electricity in Norway. Studies done in the mid-1990s show that consumers saw electricity as clean and abundant. Studies done from 2006-2011 demonstrate a change. Consumers see electricity as related to global warming and tend to be much more concerned about their level of consumption. A main effect was feelings of guilt, tempered by arguments regarding why change is difficult and complaints about political inaction. Thus, public engagement with climate change issues may facilitate energy efficiency policy but to succeed, wider climate policy measures seem to be needed.

Some other achievements

In 2016 we finished the project "Integrating households in the smart grid" (IHSMAG). The project has shown how ideas about human rationality shape policy making and innovation, but that these ideas correspond poorly to the complex everyday lives of real users. A key challenge in the years ahead is to create technologies that allow for collective thinking about energy consumption, that are gender inclusive, and that open for action based on motivation beyond the economical.

In 2016, we also concluded the project "Peer-to-peer education for youths on smart use of Information and Communication Technology" (useITsmartly), which was a European project with partners in Austria, Germany, the Netherlands, Norway and Sweden. Sara Heidenreich and Robert Næss have conducted a large public engagement effort related to energy saving among young people through a large number of so-called creativity workshops with school classes and an extensive training of so-called IT-peers, who are young people being trained in energy-friendly ways of using ICT and in communication methods. Observed changes in practices that led to reduced energy consumption included extending the time before buying a new phone, reduced use of streaming services, turn off units rather than having them on stand-by, and recycling.

Finally, it should be mentioned that we in 2016 succeeded in becoming partners in four new European projects: INVADE (H2020), ECHOES (H2020), Shape-ENERGY (H2020), and MATCH (ERA Net +). ■

RA 1's highlights in 2016

During the spring of 2016 the Department of Interdisciplinary Studies of Culture (KULT) was commissioned by ENOVA (a Norwegian agency supporting clean energy solutions) to write a report about the Norwegian low emission society post 2050. The report entitled «Scenarios for the Norwegian Low Emission Society post-2050: Three different (Nor)ways to reach a low emission society in 2050 and beyond» was prepared by Marius Korsnes and Knut H. Sørensen, and was submitted to ENOVA in the end of September 2016 after a process of feedback from within KULT and with ENOVA. The report was one of five deliveries to ENOVA, with the purpose of «establishing structured knowledge about the long-term outcomes of potential societal development paths, and to make parallels between such future images and the choices society makes or should make today». The report from KULT describes three scenarios of Norway post 2050, that are outcomes of different political choices made within few years. The three scenarios are called 'Oil till you drop' (in short: oil-drop), 'Green taxation society' (in short: green-tax) and 'Collective engagement society' (in short collective).

Oil-drops looks at how the Norwegian post-2050 society is organised should politicians opt to fully exploit and expand the Norwegian oil and gas resource. Green-tax show how the Norwegian post-2050 society would look should politicians opt to emphasise market-based policy mechanisms, such as carbon pricing, (bio-energy with) carbon capture and storage (BECCS), and increased energy efficiency. Collective imagines the Norwegian post-2050 society should politicians make use of non-market based principles such as sufficiency, and the focus is on reduced material intensity and maintained personal and social wellbeing. Each scenario can be said to reflect existing positions in today's society. These voices are then magnified or scaled up in order to understand how they would impact the Norwegian society if they were singular or isolated voices in Norwegian politics. This is naturally

a simplification that would not come to be 'true' and this exercise in teasing out consequences of particular choices made should be understood as a starting point for discussion about possible and desirable futures. Korsnes and Sørensen are now continuing to work with the report in order to make wider use of it, and potentially publish the findings in a scientific journal. The experiences made with these qualitative scenarios may also be used in collaboration with Stefan Jaehnert in CenSES work package 5 that focuses on quantitative scenario development.

SHAPE-ENERGY

New H2020 project: SHAPE-ENERGY (Social Sciences and Humanities for Advancing Policy in European Energy) Energy-related social science and humanities (energy-SSH) has played less of a role to date in shaping European energy policy than Science, Technology, Engineering and Mathematics (STEM) disciplines. By establishing a platform for SSH energy research, the SHAPE-ENERGY project aims for a better integration of social science and humanities perspectives in policymaking, innovation and STEM-research on energy. SHAPE-ENERGY's platform activities involve, among others, to make an overview over SSH energy research in Europe, to identify knowledge needs among researchers, policymakers and Europe's citizens, and to develop a "2020-2030 energy research and innovation agenda".

Anglia Ruskin University (Cambridge, UK) coordinates the SHAPE-ENERGY project and several researchers from the Department of Interdisciplinary Studies of Culture, NTNU (KULT) are involved. Contact: **Sara Heidenreich** (sara.heidenreich@ntnu.no)

For more information: www.anglia.ac.uk/global-sustainability-institute-gsi/research/consumption-and-change/shape-energy. ■



The SHAPE-ENERGY consortium on the Kick-off meeting in Cambridge in February 2017.
Photo: Acento comunicación

RA 2 Energy Systems and Markets

Work related to the work packages in RA 2

The research in RA2 is ranging from analysis of details in the energy system or in the electricity market to analysis of global energy systems. Research groups from CenSES have been actively involved in the analysis performed by the European Energy Modelling Forum (EMF) and in IEAs Energy Technology Systems Analysis Program (ETSAP).

In WP 1 “Modelling of technology learning, energy demand and energy efficiency” has been related to how to incorporate modelling of energy efficiency in the energy system analyses. A global status review of methodologies used by other energy modellers has resulted in possible ideas, and also a joint application between social and technical scientists, but the project has not yet been funded. In WP 2 “Including new functionality in energy system and market models”, the research has focused on updating and improving various energy system and market models. The energy system models TIMES, EMPIRE and MultiMOD, have been further developed. The energy system model MultiMOD has been extended to now have a full multi-horizon stochastic representation. In the multi-horizon approach, the feedback from short-term operational decisions are decoupled from the long-term strategic decisions, allowing for a rich representation of uncertainty in both the short-term and the long-term while maintaining reasonable problem sizes and solution times. This representation of uncertainty was first developed for the natural gas model RAMONA that has been used in

analysis of large Norwegian infrastructure projects. Now it has been modified to better represent the investment decisions relevant for general energy system models. A study on options to include life cycle analysis (LCA) in energy system modelling has been performed. The work gives an introduction to LCA, and includes a description of different databases, methods and tools. Further work will be related to consequential LCA, and to study how the various sustainability indicators and parameters can be included in the energy system model TIMES.

In WP 3 “Analysis of European, Norwegian and regional energy systems” various analysis of the energy system has been performed. Analysis of the implications of limited (myopic) foresight on wind park investments in Norway was carried out by comparing results with perfect foresight and limited foresight. Models used were the energy system models; TIMES-Norway and NET-Model (Nordic TIMES model). Energy system models usually analyse with perfect foresight, however in reality, decision makers do not act with full information about the future. In practice, investors and decision makers have limited horizon for their decision making. From a market point of view, one can argue that it is not reasonable to use a perfect foresight planning horizon. The model results show that limited foresight had more impact on the energy production side than on the energy end-use side of the energy system. This is due to large and expensive investments with long life time on the production side (such as wind power,

RA 2's highlights in 2016

On July 29, Christian Skar defended his PhD thesis “Modeling low emission scenarios for the European power sector” at NTNU Gløshaugen. In his evaluation committee Reinhard Madlener (RWTH Aachen) acted as main opponent, Özge Özdemir (ECN) as second opponent and Hossien Farahmand (NTNU) as the organizer leading the committee's work. Skar's thesis comprised a collection of papers mainly covering topics related to decarbonization of the European power sector, and techno-economic modeling of measures to achieve this. The centerpiece of the PhD project is the development of the European Model of Power system Investments with Renewable Energy, EMPIRE. This model is designed to optimize investments in power generation technologies, cross-border

interconnectors and energy storage in the European countries. Simultaneously, EMPIRE computes an economic dispatch of the power system at an hourly resolution for a wide range of operational time-steps. It is important to capture this properly because of the variability of the wind and the solar power production, and the impact this has on system operation. A key differentiator separating EMPIRE from other models of similar scope is the application of multi-horizon stochastic programming (SP) to formulate the optimization problem. The use of this methodology allows to consider the uncertainty about operational conditions (e.g. load, wind and solar profiles), and how this affects the optimal investment decisions, while at the same time avoiding a prohibitively large optimization problem, as would have been the case

hydropower and export connections), while the end-use side has small and “inexpensive” investments, with shorter life time. The analysis also shows that the effects of limited foresight are reduced when using a higher discount rate. In the analysis with limited foresight, we observe a significant reduced computational time compared to analysis with perfect foresight.

There is considerable uncertainty with respect to the EU renewable energy and climate policy measures beyond 2020. Investors and policy makers in Norway and abroad need knowledge on how to make decisions under these uncertainties. In the CenSES related project RISKY-RES knowledge and insights that can assist such decisions have been developed. The project has also provided valuable theoretical and empirical contributions to real options theory. Real option theory is a convenient tool to translate climate policy uncertainty into investment risk. For example, a license to build a power plant is a real option, where the investor has the right, but not the obligation, to pay the investment cost to get the cash flow of the project. Faced with a risky irreversible decision, investors value the opportunity to gain additional information about likely future conditions affecting the project. This could mean delaying investment until uncertainty has been partly resolved. The project tested the validity of real option theory in predicting how investors respond to climate policy uncertainty.



At the center on the image you can see the intake dam to Sagevikelv power plant, a small power plant of only 5 MW. The mountain to the left is Kvam horse. Photo: Stein-Erik Fleten

The work with two position papers has been an important activity in the research area. Researchers in RA 2 have contributed with analysis in the position paper on the common Norwegian-Swedish tradable electricity certificate market, and in the position paper on decarbonisation of the transport sector. One joint workshop with CenSES research partners and user partners was arranged in spring 2016 to present and discuss recent research, and the final draft of the Position paper on electricity certificates was presented at the CenSES annual conference. ■

if using a traditional multi-stage SP formulation. One of the main contributions of Skar’s work are the analyses of decarbonization pathways applying EMPIRE, where the focus has been on optimal technology composition in the energy mix, system costs and emission reductions. In addition, EMPIRE has been used to evaluate effectiveness of various support mechanisms to help realize carbon capture and storage (CCS) demonstration projects. In his analysis Skar found that a cost-effective design of a low-carbon European power system involved a significant increase in wind power capacity, along with a substantial deployment of CCS. The results produced using EMPIRE showed it would be beneficial to build wind power where the wind resources are good, and then reinforce the transmission system to efficiently utilize and balance

the intermittent power production. Without these transmission investments less wind could be supported in the cost-optimal energy mix, and more CCS would be deployed.

In addition to these contributions, Skar’s thesis also included a paper on an improved algorithm for solving stochastic optimization problems, along with two multi-disciplinary papers: one where EMPIRE has been linked to an integrated assessment model, and one where power market modeling was included in a life cycle assessment study of the European power system. ■



PhD Christian Skar (now a CenSES postdoc)

RA 3 Economic Analysis

RA 3's work packages

- **WP1** Electricity market design and economic incentives
- **WP2** National policy: Regulation, incentives and efficiency
- **WP3** Regional economic implications of energy policies

The three work packages of RA 3 Economic Analysis, all proceeded well in 2016. WP1 Electricity market design and economic incentives, and INTREPED (Intermittent Renewables, Balancing Power and Electricity Market Design) did joined efforts. Some activities are also further pursued as sole CenSES activities.

In WP2, work on sectors such as transport and energy are still proceeding. In WP3 models with Regional Dimensions, work on urban, renewables, forestry, and transport has reached fruition, and new activities are initiated.

Research in 2016

RA3 has had important and inspiring mobility in and out, not least in the field of infrastructure and market design, and good representation at international conferences. Broader transport emission research has addressed maritime shipping (in cooperation with Marintek), inter alia making the following observations (Lindstad, Eskeland and others):

- Speed, size slenderness: more than new technologies, energy carriers etc: in maritime shipping, slower speeds, larger ships and slender hull designs have helped reduce carbon emissions per ton-mile. These emission reductions to a great extent represent capital substituting for energy

- (and emissions) and show potential also for the future.
- Globalization of locally motivated emission policies – Sox regulations and Nox regulations – represent trade-offs with climate policy, in part because those reductions are costly and raise energy consumption, in part because the sulfur removals eliminate the cooling aspects of maritime shipping, raising its warming potential from neutral presently.
- Hybridization in maritime shipping has its potential in two settings: first in port cities that are polluted, second for vessels with great variety in load, as for supply vessels, or for tramp vessels built for lower speed that need potential power for shorter intervals.

In the more general – across mode – work on transport, as in the user case position paper (p.25) , the points about capital substituting for energy, and speed, size, slenderness, prove to be more general. Size, as when larger ships or buses are compared to smaller ships, trucks or cars, often requires systemic changes in infrastructure: one example is that public transport in the commute requires density; another is that larger and slower ships require larger shipments, greater storage and lower frequencies.

For 2017 the BEEER conference (Bergen Economics of Energy, Environment and Resources Research) entails a CenSES focus on the electric power sector and markets, including a symposium in honor of Einar Hope, with presentations on electricity market changes since the pioneering energy law in Norway, resulting inter alia in markets without privatization, and in Norpool. ■



From the IAEE 2016 international conference at NHH; at the 'show and tell' for electric cars and charging. From the left: Professors Scott Barrett and Gunnar S. Eskeland, Gürkan Kumbaroğlu (IAEE President) and Ben Schlesinger (Ben Schlesinger Associates and IAEE USA). Photo: Private

RA 3's highlights in 2016

An important highlight in 2016 was the CenSES supported World Conference of international environmental economists, IAEE 2016. It entailed contributions and support from CenSES and CenSES users Statkraft, Statoil, BKK and Enova, in addition to DNB. With 600 attendees from all the planet's continents except Antarctica, it was the largest conference in IAEE's history and in NHH's history.

On the same occasion, the unveiling of the Pelton wheel from Evanger took place. This was a gift from BKK to NHH. Among the exciting academic presentations and discussions should be mentioned Hans Werner Sinn (The Green Paradox) about the challenges of further expansion of variable power. Statoil's Eldar Sætre spoke about how Statoil and the industry had met the challenges of change – cost reductions in particular – in the oil industry, and that Statoil is investing in renewables to be a broader energy provider. Changes in the transportation industry was another important topic at the conference, and a demonstration of vehicles and charging was amongst the more practical and spectacular highlights for foreign visitors. Professor Gunnar Eskeland served as chair of the academic program committee. Many other CenSES researchers were keynotes at the conference, and students in the ENE program served in many capacities.

Important academic highlights are for instance several publications in the area of emissions reductions in transport, as reflected in the user case report 2016 /2107. An analysis of new car purchases in Norway (Yan, Eskeland) shows that emissions reductions driven by the vehicle registration tax (engangsavgiften) come about equally divided from the substitution towards CO2 leaner car segments (from large to mid-size cars, for example) as within segments. The emission reductions are costly (tax reductions are matched by cars that are costlier to make) and hard to justify without giving Norway a role in changing the industry worldwide and demonstrate the change potential. Other analyses show that electricity, among others in hybrid solutions will prevail also in other transportation applications, but that hydrogen also has options, such as in the long and heavy road transport. ■

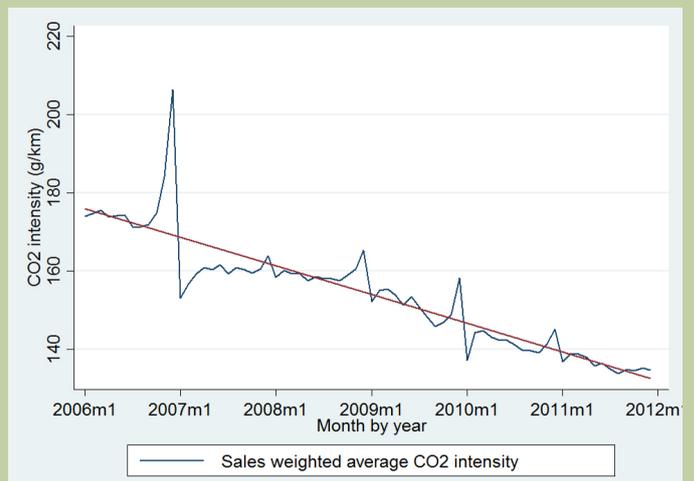
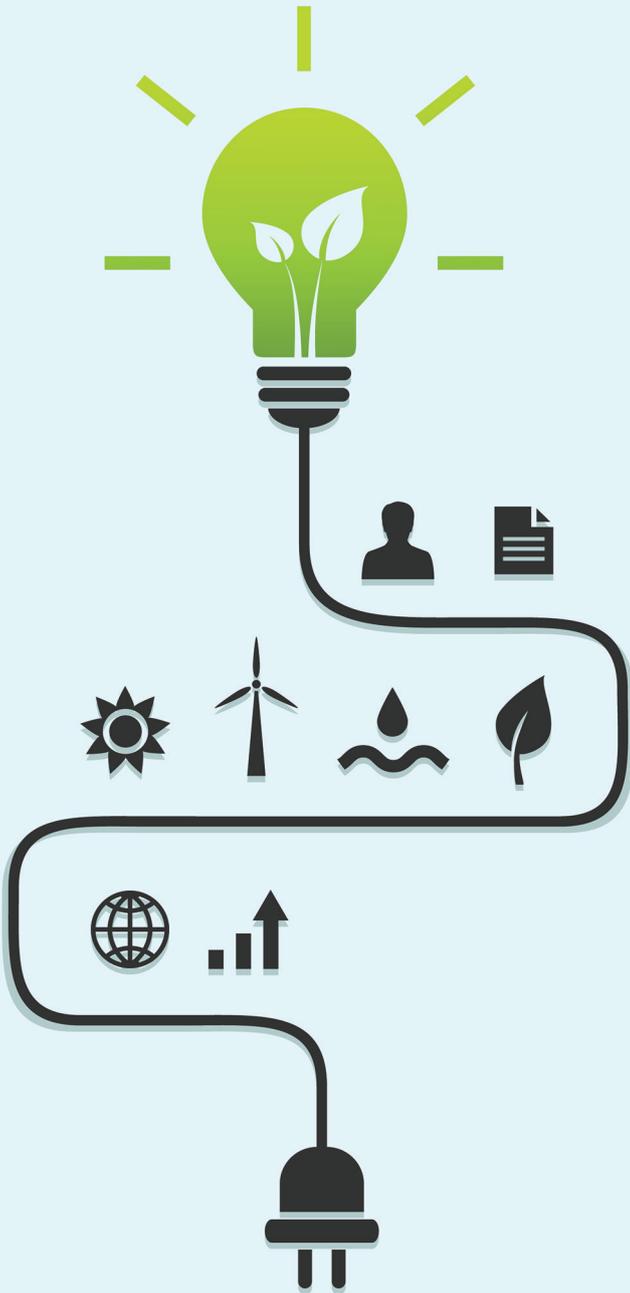


Fig 1: Homo Economicus squared: obeys, and strikes gently back: The tax drives down average CO2 intensity in new car sales, but the jumps show that before the tax rises every January, heavy vehicle purchases are timed for December. From Yan and Eskeland, 2016.



RA 4 Innovation and Commercialization

RA 4's work packages

- **WP1:** Commercialization of research
- **WP2:** Innovation processes and innovation systems
- **WP3:** Local and regional barriers and strategies

Research in 2016

CenSES RA4's overall aim is to create knowledge on the process of making a transition to sustainable and renewable energy sources. Such a process is complex and multifaceted, and implies the development of novel technologies and user practices, the introduction of policy measures and regulations, as well as the entry of new firms and industries that produce and adopt new technologies.

RA 4 uses insights from the field of innovation and entrepreneurship studies to examine how new technologies emerge; how they become commercialized, produced and marketed; and how they are used in Norway or internationally. We address questions such as:

- How do innovation processes in Norway contribute to the ongoing energy transition nationally and internationally?
- How does this open up new industrial opportunities?
- In which sectors are Norwegian research communities and industry internationally competitive?
- How can energy projects balance their impacts on local economies, local communities, and local environments

in pursuing a sustainable energy policy?

These questions relate to how multi-scalar energy transition processes involve change on several levels. These changes encompass the entry of new firms, formation of new industries and embedding new technologies in differing regional (local), national and supranational contexts.

Three PhD candidates financed from CenSES RA4 have defended their thesis in 2016:

- Tyson Weaver with the dissertation entitled "Strategic Management of Power Producers- implementing international renewable power production growth strategies". Public defence at NTNU in April 2016.
- Øyvind Bjørgum with the dissertation entitled "New firms developing novel technology in a complex emerging industry The road towards commercialization of renewable marine energy technologies". Public defence at NTNU in June 2016
- Vegar Lein Ausrød with the dissertation entitled "Commercialization of renewable energy in rural India: Entrepreneurial activities for building a profitable Venture at the Base of the Pyramid". Public defence at NTNU in December 2016

Furthermore, two candidates associated with RA 4 have also defended their thesis in 2016 (Markus Steen, NTNU and Siri Jakobsen, Nord University). ■

RA 4's highlights in 2016

RA 4 would like to highlight that the continuous work with getting published in leading innovation and policy journals pays off. Markus Steen and Tyson Weaver published the article entitled "Incumbents' Diversification and cross-sectoral energy industry dynamics" in the journal *Research Policy*. In this article, they suggest sustainability transitions literature, established, mature or incumbent firms have been stereotyped as 'locked-in' to socio-technical regimes. Steen and Weaver claim that regimes have been black-boxed, and few studies have explored incumbents' responses to transition processes. Their article provides an improved understanding of incumbents in established energy sectors and their extent of involvement in other (niche) energy sectors. The findings are based on data from a first-of-its-kind survey of 133 incumbent firms in Norway's two main energy sectors, namely oil/gas and hydropower. Providing

inter-temporal dimensions, their data cover incumbents' diversification activities beyond their primary sector both in the past (cancelled activities), present (ongoing activity in secondary sectors) and future (ambitions of diversification), and also distinguish between producers and product/service suppliers. By incorporating insights on firm diversification, they shed new light on the complex transformation processes associated with sustainability transitions. Empirical results show considerable heterogeneity in incumbents' responses to changing selection pressures, which can be explained by recognition that windows of opportunity are opening and some incumbents see potential to leverage their resources and capabilities to capture value in new niche energy sectors in both domestic and international markets. ■



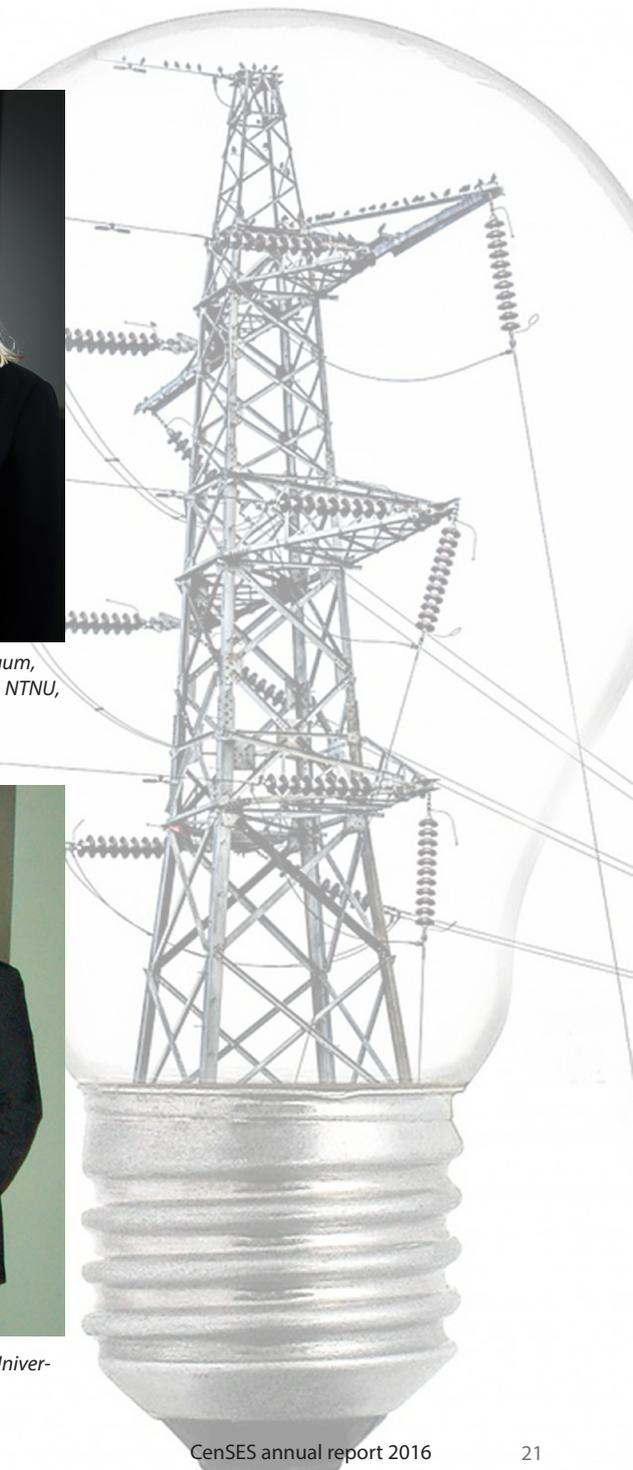
Tyson Weaver (in the middle) together with his supervisor prof. Øystein Moen, NTNU (left) and co-supervisor prof. Erling Holden, HISF(right). Photo: Elin Iversen / IØT, NTNU



From the left: Assoc. prof Lise Aaboen, NTNU, prof. Gary Knight, Willamette University, Øyvind Bjørgum, prof. Øystein Moen, NTNU and prof. Niina Nummela, University of Turku. Photo: Odd Knudsen / IØT, NTNU,



From the left: Assoc. prof Diamanto Politis, Lund University, Assoc. prof Steffen Korsgaard, Aarhus University, Vegar Lein Ausrød and prof. Øystein Moen, NTNU. Photo: IØT, NTNU



RA 5 Scenario Development

RA 5's work packages

The main objective of RA 5 is to provide scenario driven knowledge and analyses to policy- and decision makers to aid in the development and evaluation of sustainable energy strategies. In 2016, there was significant progress of the development of CenSES energy scenarios within the research centre. Throughout this process two stakeholder workshops and several direct meetings with user partners were arranged. Additional funding for the development of the CenSES scenarios external projects are necessary. The KPN project "Norwegian Energy Road Map 2050" (with SINTEF, NTNU and IFE) has been granted. The project was started up in May 2016 and has a strong collaboration with CenSES RA 5.

Research in 2016

During 2016 the development of CenSES energy scenarios was in progress. In January a two day workshop was held at Gardermoen Airport, discussing the specific research questions. The scenarios shall target at, as well as gather, various and fruitful input in the process. The second workshop, held in September at NTNU, provided the possibility to present and discuss the qualitatively developed scenarios to the CenSES user partners. The developed scenarios were published in a report as well as in relevant studies, together with inputs on the scenario work. A short description of the CenSES energy scenarios and the development process can be found under.

The KPN project "Norwegian Energy Road Map 2050" was started up during spring 2016. The main focus in 2016

was on the initial review of measures and policies within the framework of emission reduction and the definition of scenarios that shall be addressed. These build upon and are somewhat in line with the CenSES energy scenarios. In addition; significant efforts have been put into the development of common datasets, and a coupling of the various energy system models, which also will be beneficial for prospective analyses in RA5.

In 2016, the NTNU Industrial Ecology Programme work under CenSES focused on two main topics: One, assessment of electricity vehicles, including nanotechnology for electric vehicles; and two, combinations of industrial ecology models and energy scenario models. Supported in part by CenSES, PhD candidate Linda Ager-Wick Ellingsen worked on assessing the environmental impacts of electric vehicles. This includes a forward-looking analysis and evaluation of environmental costs and benefits of increased use of nanomaterials in electric vehicles, work that is presented in an article published in Nature Nanotechnology in 2016. Another article, compares life cycle greenhouse gas emissions of electric vehicles with that of fossil fuel-fed vehicles under varying assumptions about battery sizes and driving range. Further, in 2016 researcher Anders Arvesen contributed to a perspective article, now published in Nature Climate Change, reviewing large-scale integrated assessment models from an industrial ecology perspective. Also with support from CenSES, Arvesen was involved in various research on combining life cycle assessment and energy scenario analysis. ■



CenSES Energy Scenarios

Scenarios are a formal way to describe and examine future and uncertain developments, useful to increase knowledge and to give insights for policy development and decision-making. Within RA 5 the aim is to establish a common basis for scenario analyses in the form of a set of CenSES energy scenarios. The scenarios are developed with a bottom-up approach, with the aim to ensure the engagement of CenSES user partners. Based on this methodology, the established scenarios result from a combination of defined futures, which have a European/global scope and a set of strategies, which have a Norwegian focus.

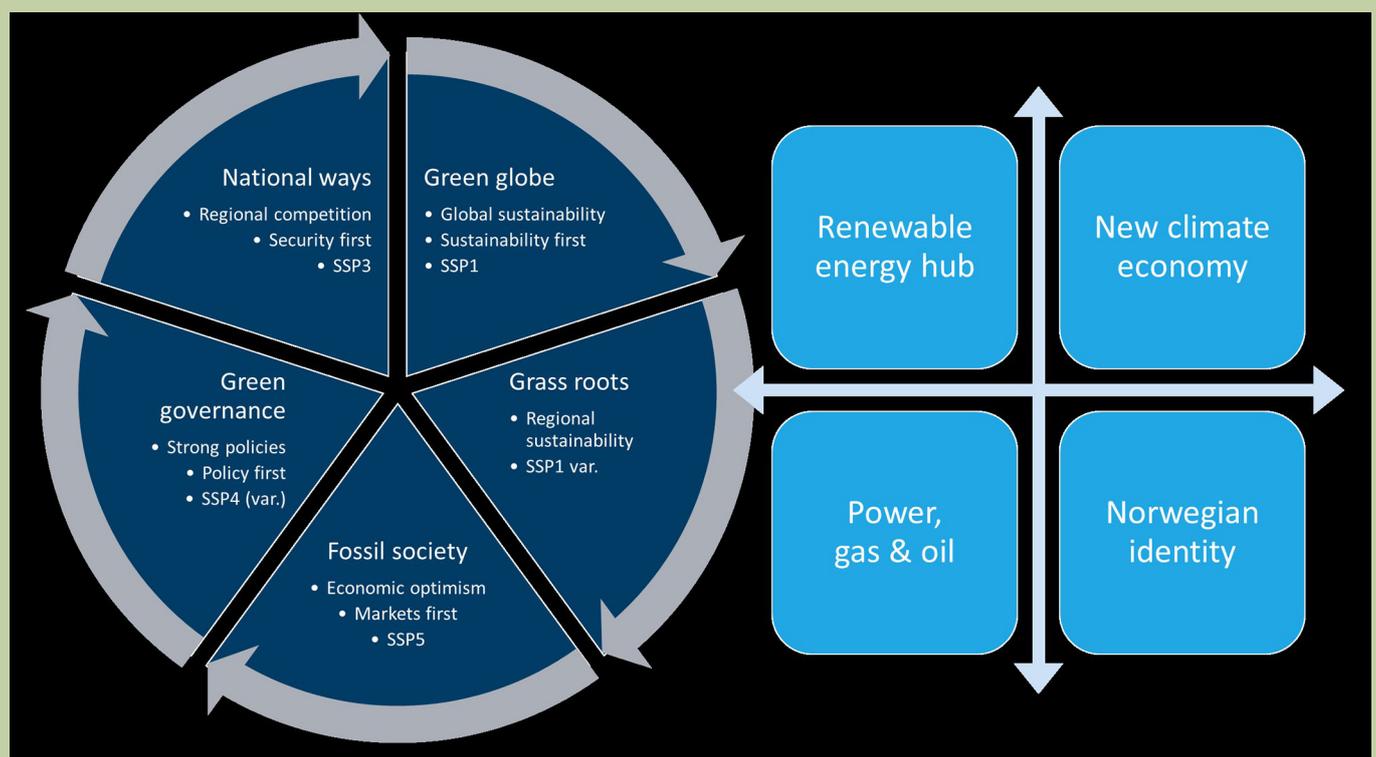
The premises set by the FME CenSES for the energy scenarios are:

- The main focus is the energy system.
- The target group is Norwegian society and industry including policy and decision makers.
- The target horizons will be 2030 to 2050
- The main geographic target of the scenarios will be Norway, while interactions with the Nordic area, Europe and globally have to be taken into account

The key research question for the scenarios developed in RA 5 is defined as: "How can Norway contribute to the global reduction of GHG and meet its climate targets for 2030 and 2050, while ensuring value creation within the framework of the energy system? Where can Norway be a leader and contribute to a sustainable value creation based on its particular advantages?"

The five resulting futures are Green globe, Grass roots, Fossil society, Green governance and National ways. These are combined with the four different strategies Norwegian identity, Power Gas & Oil, Renewable energy hub and New climate economy. A set of four apparent and four potential combinations is selected as the CenSES energy scenarios. The suggested combinations of futures and strategies resulting into scenarios are:

- S1: Green globe | New climate economy
Living the green revolution – There is a global commitment to a sustainable and environmental friendly development, including Norway.
- S2: Green governance | Renewable energy hub
Green on the large scale – The development to a sustainable energy system is mainly imposed by strong policies, where the focus is on RES in Norway.
- S3: Fossil society | Power, Gas & Oil
Faith in the economy – Globalisation and economic growth continues and intensifies, where Norway uses its chance to benefit based on its fruitful natural energy resources.
- S4: National ways | Norwegian identity
Management in the Norway – The collaboration and trade of nations weakens and national security becomes more important, likewise leading to a Norwegian focus and on the Nordic area. ■



Overview of established futures (left) and strategies (right)

User cases and position papers

The user cases in CenSES bring together researchers across the defined Research Areas to address specific research topics. The topics are decided upon in cooperation with the user partners in CenSES, and all user partners can suggest new user cases. The end result of the user cases will be a Position Paper that will be made publicly available and launched at open workshops.

Ongoing user cases in CenSES:

- Prosumers in the future energy system
- Green factory
- Fossil free mobility
- The hydrogen value-chain

These four user cases will be started up during 2017.

Position papers:

- Energy demand projections in Norway towards 2050. This user case was started in 2013 and led by Kari Espegren, Institute for Energy Technology (IFE). (Finalized in 2015).
- Decarbonization of transport and the role of electrification and hydrogen (Finalized in 2016).
- Nurturing new technologies (Finalized in 2016)
- Do they work? Policy instruments for energy efficiency in buildings (Finalized in 2016)
- Norway's role as a flexibility provider in a renewable Europe (Finalized in 2016)
- The common Swedish - Norwegian elcertificate market (Finalized in 2016)

Prosumers in the future energy system

Prosumers are active participants in the energy system. In addition to consuming energy, they can both provide flexibility to the system in terms of flexible loads as well as selling their own production to the market. An example of a technology that enables prosumers to sell power to the grid is solar power. In this user case we will discuss the potential future role of prosumers in the energy system. Relevant considerations include barriers and incentives for the individual prosumers, their influence on grid stability and development as well as the overall impact on the efficiency of the energy system.

Green factory

Norway has substantial amounts of valuable, flexible energy resources that have been the backbone of industry development over the last hundred years. In this user case we will examine the most efficient utilization of these energy resources from an environmental and value creation viewpoint. One important element in this discussion is the potential impact of increased exchange capacity with the European power system. The trade-off between utilizing the flexibility in the Norwegian power system for providing flexibility services to the European energy system, and utilizing the renewable energy for national value creation through large scale industry development will be an important part of the analysis.

Fossil free mobility

There are ambitious targets for reduction of Norwegian emissions both on a national and regional level. The largest cities in Norway have put forward goals for drastic reductions in emissions from the transportation sector. In this user case we will gather these regional goals and strategies to present a comparable overview of the similarities and differences between the cities. Based on this, barriers and opportunities for successful implementation and transition to a fossil free mobility in the largest cities will be discussed and presented for policy makers and other decision makers. Important elements in the discussion include emissions, rebound effects, consequences for the energy system, economic effects and technology choices.

The hydrogen value-chain

There is an increased interest for hydrogen in the Norwegian energy system. This is true both for the potential of large scale production of hydrogen (either from natural gas or renewable sources), and for the possibility of using hydrogen in the transportation sector. There is also notable interest in hydrogen internationally, and the potential for the hydrogen society will be demonstrated in the upcoming Olympics in Japan. In this user case we will summarize the experiences with hydrogen in other countries and regions. Additionally, we will discuss the potential for profitable value-chains based on hydrogen and the current market outlooks. New business models and opportunities will be an integrated part of the user case.

CenSES position paper on “Decarbonization of transport and the role of electrification and hydrogen”

The paper gives an understanding of development trends, status and further development paths for how Norway could achieve decarbonization in the transport sector. The paper looks at the role that electrification could play, and discusses hydrogen’s future role in Norwegian transportation.

It mainly builds on and synthesises research conducted by CenSES partners during the last three to four years. As such, the paper builds on insights from several social scientific disciplines such as economy, energy systems analysis, policy analysis, science, technology and innovation studies. It addresses the rationale and motive for electrification of different carriers and transportation modes in the Norwegian energy system. Moreover, it looks at one of the most important economic policy instruments the new vehicle registration tax (‘engangsavgiften’) which aims to change the composition of the vehicle fleet through new vehicle sales.

It finds that the new vehicle registration tax has worked as intended and has stimulated consumers to buy CO2 leaner cars, and the overall exemption from this tax for electrical cars has contributed to its fast implementation rate in Norway. It also discusses the electrification of the transport sector and its systemic effects. What is the additional need of electricity production? Are there challenges for the distribution grid as well as future developments for transmission grid?

It includes a discussion of the role of hydrogen in future transport in Norway and a scenario model showing how Norway could reduce its domestic transport GHG emissions by 50 percent within 2030.

Finally, it discusses barriers and conditions that must be present to achieve a sustainable transition of the transport sector in Norway. It argues that to fully decarbonize the transport sector, strategies are needed that go beyond large-scale introduction of electrification and hydrogen. Full decarbonization requires policy that ensures stable framework conditions, a switch in transport modes as well as an overall curbing of growth in transport volumes, both for passengers and freight transport. ■

CenSES position paper on “Nurturing new technologies”

The key topic of this user case is the development of renewable energy (RE) technologies in Norway, or involving Norwegian actors. The case reflects upon the conditions for development and deployment of RE technologies in Norway, drawing on key arguments and factors with empirical research undertaken in RA 4 (and RA 1). This position paper was developed with input from CenSES user partners from three dedicated workshops. Despite substantial variety of approaches in RA 4, the various points of departure for specific (empirical) research projects can all be linked to a shared interest in innovation and processes of industrial change and transformation. Another common feature is that technological development is not seen to be the result of technological innovations per se. Instead, the development of RE technologies is considered as part of broader processes encompassing change and innovation in organizations, business models, framework conditions (including regulation and policies) and systems.

Development of new renewable energy technologies is and has been an important policy ambition in Norway. In

the context of nurturing new technologies, it is especially important to distinguish between the development of new technologies and their deployment. There are important synergies in learning and knowledge development to be gained from seeing deployment and development in tandem. This is because ‘technology push’ and ‘market pull’ processes are both important mutually reinforcing drivers of renewable energy.

Because framework conditions are crucial for RE technological development and deployment, many contributions in RA 4 have touched upon the role of (lacking) policy instruments, either directly or indirectly. Therefore, this position paper also draws upon insights generated in CenSES RA 1 on Policy making and transition strategies. Reflecting the use of broad perspectives on innovation, research in RA 4 has gone beyond the role of energy policy instruments (e.g. types of subsidy schemes for RE) to also look at the role of industry and innovation policies that may directly or indirectly support technological development. In the final sections of the position paper, research topics that deserve further attention are addressed, as are recommendations for Norwegian policy makers. ■

User cases and position papers



CenSES position paper on “Do they work? Policy instruments for energy efficiency in buildings”

The main results from the user case report about policy instruments for energy efficiency in buildings may be summarised as follows:

- In Norway, over a long period, buildings have become more energy efficient. However, the reasons for this development are complex. Some of the improvement is due to policy instruments – not the least a stricter building code – some owes to a general upgrading/renovation of the building stock, some is caused by demographic changes, and some may be attributed to technological change.
- Largely, the energy efficiency policy has been dominated by a principle that investments in energy efficiency shall be profitable or cost effective, and by arguments to support energy efficiency measures that have been unilaterally oriented towards pointing out economic gains. This mode of thinking has resulted in a misleading understanding in the social dynamics of energy efficiency activities. Important weaknesses include:
 - Households base their assessments of energy efficiency measures on a composite set of criteria, like comfort, moral and environmental/climate policy related appraisals, and idiosyncratic interpretations of what actions that are lucrative to implement.
- Actors in industry also find it difficult to calculate the economic benefits of energy efficiency measures. Those who invest the most in energy efficiency do it because they wish to have a public profile as environmentally friendly and/or because leading actors in the organisation are particularly eager to enact sustainability.
- Many improvements in energy efficiency have indirectly been caused by new, improved technologies that replace old ones and because of rehabilitation to improve comfort.
- A stricter building code seems to have been the most effective policy instrument, but its effect is limited since it primarily influences design of new buildings.
- There is a need for innovative thinking with regard to policy instruments for energy efficiency, in particular related to considerations regarding what we call the social potential for energy efficiency – a concept that supplements the traditional ideas related to technical and economic potential. ■

CenSES position paper on “Norway’s role as a flexibility provider in a renewable Europe”

Many scenario studies describe the development of the European power system until 2050. They all include a large increase in power generation from renewable sources. Due to the variability of wind and solar power, policies leading to an increased share of renewables will lead to larger variations in power generation.

These variations will require flexibility services for time scales ranging from seconds to between seasons. The flexibility services are necessary to ensure a stable and reliable power supply. In order to assess the role of Norwegian hydropower and natural gas in a low-carbon European power system we have applied the investment model EMPIRE. In this study, a baseline decarbonization scenario has been constructed, in which assumptions on

the main drivers of power system development were based on the most recently published reports by the European Commission and IEA.

As one of the key uncertainties in the future development of the European power system is the availability of carbon capture and storage (CCS) for power generation, the baseline scenario was contrasted against a no-CCS scenario where assumptions are identical except for the exclusion of the CCS technology. Our results indicate that the combination of renewables and CCS is a cost-efficient strategy for reducing emissions from the European power system.

For Norway to supply Europe with flexibility services, substantial extensions in export capacity is needed. We also find that natural gas will play an important role in the future energy system in Europe. The role of natural gas is highly dependent on the CCS technology, but the total consumed volumes are more or less independent of CCS. ■

CenSES position paper on “The common Swedish - Norwegian elcertificate market”

The common Norwegian-Swedish market for electricity certificates was established in 2012. Norway and Sweden share a combined goal of establishing 28.6 TWh new electricity production based on renewable energy by 2020.

Producers of renewable electricity receive one certificate per MWh generated for a period of 15 years. Electricity suppliers have a statutory duty to buy green certificates, and each year the market participants with an obligation to buy green certificates must redeem certificates in order to fulfil their obligation according to a yearly quota. This creates the demand for green certificates.

A new CenSES position paper summarizes existing research related to this common Norwegian-Swedish electricity certificate scheme. The research has been performed by CenSES-partners during the last years. Risks and uncertainties related to the certificate scheme have influenced investment decisions in Norwegian wind power and hydro power since the scheme first was discussed in the Norwegian Parliament. CenSES researchers have analyzed and discussed different types of risks, as well as the cost efficiency of the scheme and the distribution effects. The main risks related to the electricity certificate scheme have been addressed in different research projects by CenSES researchers:

- Risk related to volume: Will the renewable production goal be reached? And will it be reached in a cost effective manner?

- Risk related to price: The certificate scheme was introduced to reduce risks related to rate of return for the investors; however this implies that the certificate price at least covers the difference in price between the market price of electricity and the cost of new electricity production. The certificate price is marked based, and as such uncertain.
- Risk related to policy: Will the design of the certificate scheme influence the profitability? And will there be a continuation of the scheme?
- Risk related to distribution effects: Who will win and who will lose with this new policy instrument?

Based on this research it is our view that the design of the certificate scheme is an effective instrument to ensure implementation of new renewable electricity production. However, the certificate scheme is not cost efficient and it does not divide the risk between authorities and private actors in an optimal way. As a consequence, it is possible that not the best renewable energy projects have been built. The research shows that the electricity certificate scheme results in a welfare loss in Norway. The actors that have the highest welfare loss are the existing power producers (they do not receive certificate price for the electricity production), while the new power producers that receive the certificate price, will win. However, this total welfare loss will be reduced, if Norway increases the power export. If new power production is combined with increased Norwegian power demand, the result will be an increased welfare for all actors, both the existing and new power producers, and the consumers. ■

International Cooperation

There has been a high degree of international cooperation in 2016. CenSES has nine international partners and we are in the process of involving our international partners more deeply in the research, at the same time as we emphasize giving our own researchers international experience. In the following we present some of the highlights from our international cooperation.

International networks and new international projects

CenSES was central in organizing the transatlantic forum in Chicago. CenSES researcher Tomas Moe Skjølvold co-organized a session on smart cities, smart energy technologies and societal challenges. The session focused on how industries, cities and research can work together. The session had presentations from different sectors, authorities and researchers in Chicago (At&T University of Chicago and City of Chicago) and Norway (Lyse, Stavanger municipality, etc). The session also contained a debate where RA 1 leader, Prof. Knut H. Sørensen held a presentation on how to understand the concept «smart».

CenSES researchers have been active in a number of international fora. To mention some, Tomas Moe Skjølvold was invited in the international working group on “Smart grids – Smart cities?” financed by the German Academy of landscape planning (ARL) that consists of renowned international energy researchers such as Harriet Bulkeley, Harald Rohrer, Rob Raven and Simon Marvin.

You can view videos of the different sessions on YouTube here: <https://www.youtube.com/playlist?list=PLvhR0FbIMLFC0jh4ChIVn-ZwtEFhcKQV> ■



RA 1 leader, prof Knut H. Sørensen held his presentation to the audience in Chicago October 24-25
Photo: Tomas Moe Skjølvold



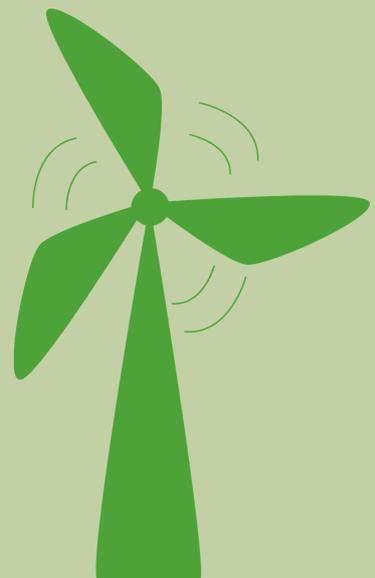
CenSES researcher Tomas Moe Skjølvold and Stephanie Ormston at the Transatlantic Forum 2016 in Chicago
Photo: Private

Visiting researcher from University of Bergamo

Wiebe Eco Bijker, professor in Science and Technology Studies has visited NTNU several times this year, as part of his professor II position at Dept of interdisciplinary studies of culture, NTNU. Wiebe has, among other things, been giving advice to PhD students and others on writing and publishing. ■



Wiebe Eco Bijker

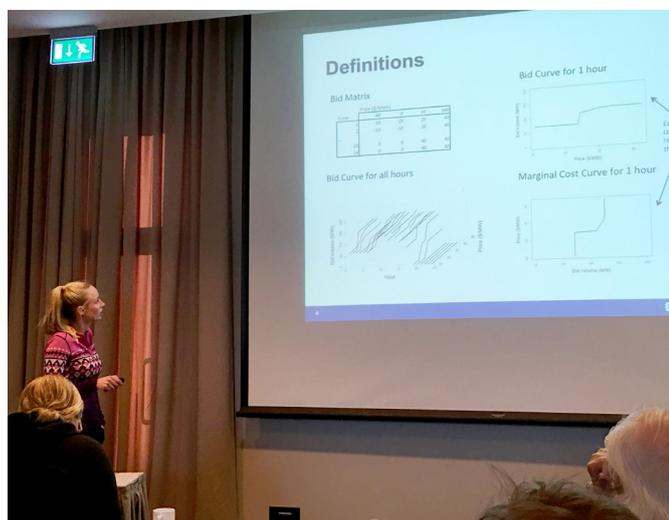


PhD Winter School in Oppdal

On March 13-17 the PhD Winter School on «Stochastic programming in Energy» was held in Oppdal, Norway. Topics discussed during the workshop were:

- Modeling and applications of stochastic optimization
- Multistage models and algorithms
- Bilevel models and algorithms
- Models for energy markets and systems

Close to 50 national and international PhDs and lecturers gathered in Oppdal where all participants were invited to present a research paper to the audience. After the PhD school was finished all participants were invited to submit



PhD student Ellen Aasgård presents at the Winter Workshop in Oppdal, Mette Bjørndal (left) and Sjur Flåm (right) is visible from behind. Photo: Stein-Erik Fleten

a paper to a special issue journal. The best papers were also published.

CenSES partners such as: NTNU, NHH, University of Santa Catarina, University of Maryland were involved in teaching, and the winter school was organized by CenSES director Asgeir Tomasgard and Stein-Erik Fleten (both representing NTNU), and Mette Bjørndal and Endre Bjørndal from NHH. Other lecturers who took part in the winter school were:

- Erlon Finardi, Federal University of Santa Catarina
- Steven Gabriel, University of Maryland
- Daniel Huppmann, IIASA, Vienna
- Juan Pablo Luna, Universidade Federal do Rio de Janeiro
- Elise Miller-Hooks, University of Maryland (tbc)
- Afzal Siddiqui, University College London
- Ramteen Sioshansi, University of Ohio
- Golbon Zakeri, University Auckland

Inbetween lectures the participants had the option to explore the downhill pistes, and cross country skiing in sunny conditions. The teaching program encouraged both students and lecturers to engage in outdoor activities, discussions and other social activities such as networking. ■



The main organizers of the Real Options 2016 conference. From the left: Diderik Lund (UiO), Lenos Trigeorgis (U. Cyprus) and Stein-Erik Fleten (NTNU)

Photo: Stine Mari Skeide

Real Options 2016

The annual international conference on real options took place in Oslo and Trondheim 15-18 June. This was the twentieth conference of its kind, and investments and trends related to real options were some of the topics discussed.

The conference began in Oslo 15-16 June, while the last part took place in Trondheim 17-18 June. The conference gathered academics and other contributors from the Netherlands, England, Spain, Austria, and many other countries. Stein-Erik Fleten, professor at NTNU and researcher within CenSES, was one of the main organizers of the conference. CenSES was one out of three sponsors of Real Option 2016. The keynote speakers were Kuno Huisman and Peter Kort, both from Tilburg University.

The conference ended with an open invitation for all interested to go on a boat trip to Munkholmen. Read more about the conference here: <http://www.realoptions.org/abstracts2016.html> ■

International cooperation

SET-Nav (Navigating the Roadmap for Clean, Secure and Efficient Energy Innovation)

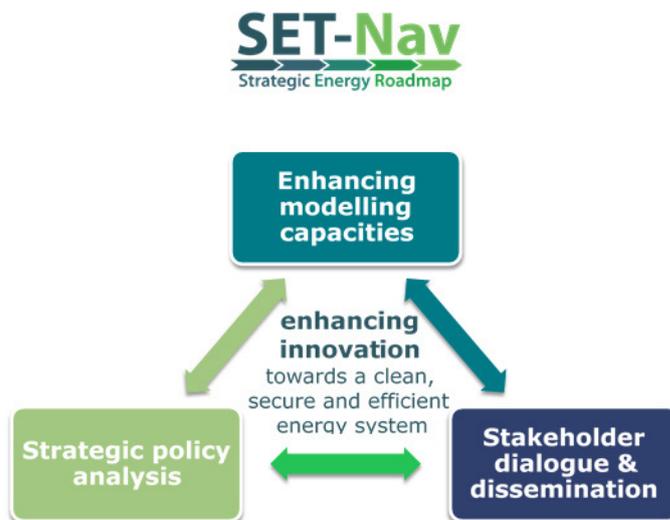
SET-Nav is a research and innovation project that was launched in April 2016 and is a co-funded EU Horizon 2020 programme. One of the key purposes of the project is to support strategic decision making in Europe's energy sector, enhancing innovation towards a clean, secure and efficient energy system. SET-Nav is expected to support the scientific underpinning for the implementation of the SET-Plan by strengthening the knowledge base for decisionmaking concerning feasibility, effectiveness, costs and impacts of related measures and options. The results should assist policy makers in identifying and analysing effective strategies for a transition to an efficient low carbon energy system.

The main contributions of the SET-Nav project are along three dimensions:

- the development of a modelling portfolio for strategic decision making in the energy sector
- the analysis of pathways and policies towards 2050
- development of stakeholder dialogue and dissemination

The project is coordinated by TU Wien and implemented by a consortium of academic, research and industry partners from Austria (IIASA, Axpo, TU Wien), Germany (DIW Berlin, Fraunhofer ISI, M-Five), Norway (NTNU, SINTEF), France (Seureco), Spain (Comillas), Greece (NTUA), Hungary (REKK), Belgium (CEPS), the United Kingdom (UEA) and Switzerland (ETH, General Electric).

There are three models from the CenSES modelling portfolio participating in SET-Nav: EMPIRE, Ramona and REMES. During the SET-Nav project, these models will be further developed and improved. A selection of the planned developments includes: integrating EMPIRE and Ramona to get an electricity-gas infrastructure planning model, implementing the interaction between heat and electricity production in EMPIRE, implement demand response measures in EMPIRE and increasing the geographical coverage of REMES to include the entire EU + Norway. ■



EERA Joint Program

EERA Joint Program The New European Energy Research Alliance (EERA) program E3s was approved in June 2013. The purpose of the joint program is to coordinate research within European research institutes and universities in the following subprograms:

- Public perception and engagement
- Analysis of policies and R&D choices
- A life-cycle approach for evaluating the sustainability performance of energy technologies
- Energy models for a system assessment of European low-carbon energy futures: markets, environmental and economic impacts
- Sustainable low carbon platform

CenSES coordinates the subprogram on Public perception and engagement, lead by Asgeir Tomasgard. The program has continued on in 2016. International partners in the EERA Joint program are among others: Technalia, DTU, Austrian Institute of technology, UKERC, VTT, Aalborg University, Enea, Vito, and Karlsruhe Institute of Technology. ■



Karen Byskov Lindberg



Marianne Ryghaug

CenSES researchers participates in panels

CenSES has been an important part in many international conferences and seminars. Researchers in CenSES lead panels in some of the most renowned conferences in Europe, such as ECEEE where deputy director in CenSES, Marianne Ryghaug is leading the group on transportation and smart cities with Neil Wallis from the Low carbon vehicle Partnership, (UK) and CenSES researcher Karen Byskov Lindeberg has been leading the group on energy use in buildings with Åsa Wahlström from CIT Energy Management AB (Sweden). ■

ECHOES (Energy Choices Supporting the Energy Union and the Set-plan)

In the centre of all research activities are the technological topics of a) smart energy technology, b) electric mobility, and c) buildings. These technological aspects will significantly impact the economic and environmental development of the European Union.

ECHOES addresses the challenges extracted from the call by employing the innovative theoretical concept of “energy collectives” that covers determinants of energy choices from the individual level to formal social units on the societal level. Three main theoretical perspectives will be integrated into this concept, namely the perspective on (1) individual decision-making as part of collectives, (2) the perspective of collectives constituting energy cultures and life-styles, and (3) the perspective of formal social units such as municipalities, states, energy providers, or NGOs as collectives of people.

Geographical distribution of ECHOES primary data collection efforts: Countries represented in the ECHOES survey effort (blue, left), countries represented in the ECHOES psychological lab experiments (yellow, middle), and countries represented in the ECHOES focus group discussions (green, right).

Theoretical concepts

ECHOES introduces the new theoretical concepts

“energy collectives” and “energy memories” that are able to combine a large spectrum of determinants of energy choices and acceptability of energy transitions and bridge the gap between different research disciplines as well as between research and policy implementation. Even though the concepts are new, they are based on established knowledge in the participating scientific fields and grounded on continuous stakeholder involvement. ■

Impact

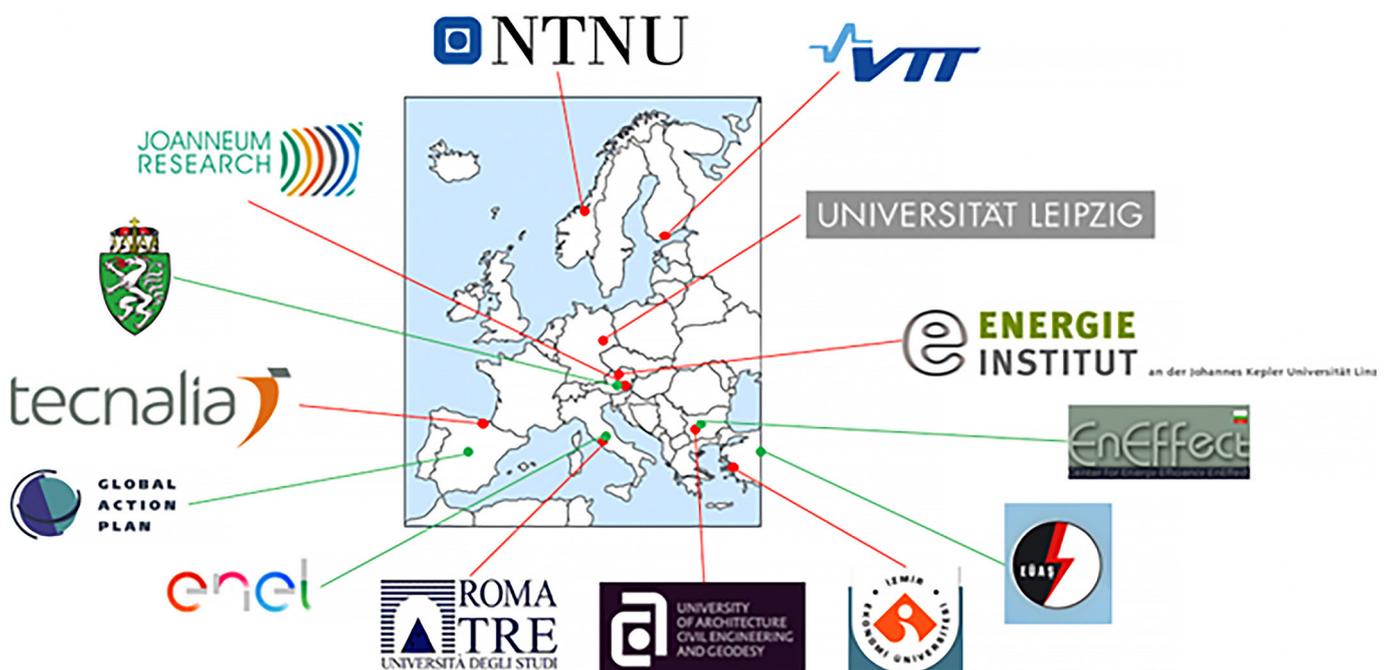
The relevant levels of policy-making for transitioning toward a sustainable energy model in the European Union and implementing the SET Plan Action are:

- The Commission Services
- The European Parliament
- The Member States, represented in the SET Plan Steering Committee and other forums
- The European regions, represented in the Committee of the Regions and associations such as FEDARENE or ERRIN
- The municipalities organized in the Covenant of Mayor or associations such as ICLEI European survey

Objectives

The overarching objective of ECHOES is to **unlock the policy potential of an integrated social science perspective** of central socio-cultural, socio-economic, socio-political, and gender issues that influence **individual and collective energy choices and social acceptance of the energy transition in Europe**. Hereby, ECHOES will foster the implementation of the SET Action Plan and advance the Energy Transition, as well as the decarbonizing of the EUs future energy system.

ECHOES consortium



Dissemination

CenSES Annual Conference 2016

CenSES annual conference in 2016 was organized at Radisson Blue Scandinavia in Oslo December 5 and 6. Topics included were energy efficiency in buildings, electrification of transport with, commercialization of new energy technologies, green certificates, Norway as a flexibility provider to Europe, and scenario studies. Around 80 participants took part in the conference program. In addition to contributions from the researchers, several of CenSES user partners gave excellent presentations, for example:

1. Jan Bråten (Statnett): Which instruments do we need in the future to ensure investments in new energy generation and transport
2. Karen Byskov Lindberg (NVE): Large scale implementation of Zero Emission Buildings reduce investments in wind power
3. Ottar Skagen (Statoil) : Statoils scenarios towards 2040
4. Anders Kringstad(Statnett): Statnetts long-term market analysis and scenario studies.

Presentations can be downloaded from:
www.ntnu.no/censes/arskonferanse2016

On the second day of the annual conference, group work was carried out to establish new CenSES user cases. The new user cases have been approved by the CenSES board and are described on p. 24 in this annual report. ■



The participants were engaging in conversations during coffee breaks at the annual conference

Photo: Stine Mari Skeide



Christian Skar (left) and Kjetil Midthun held a presentation about the flexible Norwegian energy as a green service to Europe at the conference.

Photo: Stine Mari Skeide

CenSES presented research about Smartgrid to the Norwegian Ministry of Petroleum and Energy

CenSES, represented by deputy director Marianne Ryghaug and Tomas Moe Skjølvold, was invited by the ministry of petroleum and energy to present social scientific research from two ERA-net projects on smart grids. The presentation highlighted the need to understand the social and cultural dynamics of innovation in the smart grid field, as well as the importance of understanding the dynamics of everyday life and the role that electricity plays there, in order to be able to design successful technologies and market mechanisms for ordinary households. The presentation concluded with concrete advice for designers, policy makers and funders of research. ■



Marianne Ryghaug, NTNU (KULT) and Tomas Moe Skjølvold, NTNU (KULT)
Photo: NTNU



From the left: Eldar Sætre (Statoil) and Gunnar Bovim (NTNU) wish to build up a world-leading research group to develop sustainable energy solutions.
Photo: NTNU/ Thor Nielsen



Over 50 participants from government, industry and public offices were invited to the workshop that was held at Rådssalen, NTNU on October 20-21.
Photo: Stine Mari Skeide

Energy Transition Strategies

In 2016 NTNU og Statoil initiated a new research program on Energy Transition Strategies. The ambition is to requite international experts on the topics and strengthen cooperaton with leading research groups. So far Statoil and NTNU both financed the new program with 25 mill each over 5 years. In October a start-up workshop, "Energy Transition 2016", was organized in Trondheim to get ideas for the shaping of the program. Leading experts from DIW Berlin, TU Berlin, IIASA, MIT, University of Maryland, Joint Global Change Research Institute, University College Dublin, Imperial college, Oxford University and Cambridge University participated. A number of CenSES user partners were also there, among others Statoil, Statnett, Statkraft and Enova. Topics identified so far are: Energy and climate policy towards 2050, the role of integration of natural gas, heat an electricity, the role of natural gas towards 2050 , megatrends and disruptive changes: new business models in the energy sector, the role of demand side management, energy storage and transmission in interplay with renewables.

This is an open research program were also other participants from industry, public offices and government will be invited. The program will among others organize a yearly conference, starting with Energy Transition 2017. <https://www.ntnu.edu/energytransition2017>. ■

Cooperation for the future

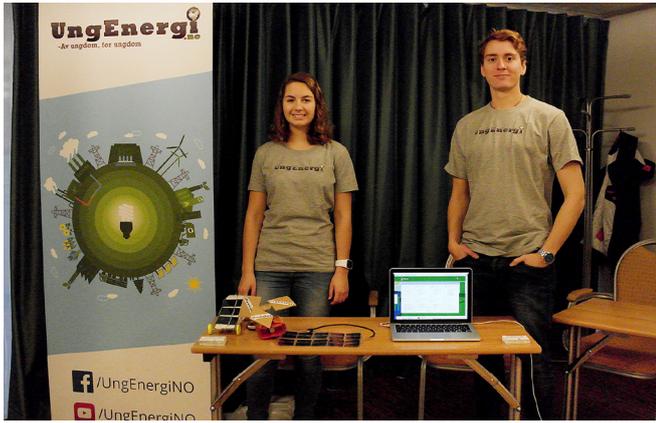
The Research Council awarded 8 new FME research centres in May 2016. This time, only technology oriented centres could apply as the centres with social science focus, like CenSES still have funding until early 2019. CenSES director Tomasgard says: "We already have a good dialogue with the new centres and we look forward to cooperating with them". CenSES already had cooperation agreements with 4 of the new centres, on smart grids(CINELDI), Zero Emission Neighbourhoods (ZEN), Carbon Capture and Storage (NCCS) and environmentally friendly transport (MOZEES) before the awards were given. CenSES researchers will participate in the remaining 4 centres in different ways. Examples on cooperation will be joint workshops and seminars, joint course for PhD students and new projects. ■



Arild Gustavsen (left) is the centre director in FME ZEN, and ZEN is one of the new centres CenSES are cooperating with. On the right you can see Terje Jacobsen, Vice President, Research at SINTEF Byggeforsk.

Photo: ABFakultetet, NTNU

Dissemination



UngEnergi participated on Kurvfest 2016 - Digital innovasjon i skolen November 7th. Pictured is Kristine Fleten and Erling Gjeset from UngEnergi. Photo: UngEnergi

UngEnergi

Ung Energi is a group of students who seek to improve secondary school students' understanding and interest in renewable energy. FME CenSES established Ung Energi in 2012. Our main goal is to encourage teachers to include information about renewable energy in their teaching lessons. In 2016, Ung Energi has done a lot of work to renew the website ungenergi.no, which contains information about renewable energy. The website is UngEnergi's main product, and the statistics show that between 10 000 and 15 000 people visit the site every month.

Since the project started, a lot of new content has been added to the website, and therefore the structure of the site had to be upgraded. The work with the new design for the site was finalized in the fall, and we hope that the new menu system has made the site more user friendly.

We constantly work with new content to the webpage. In the fall 2016, we published our newest video about the relationship between society and the development of technology. The video is available at ungenergi.no/filmer. We also work with developing teaching material about how to make the use of information and communication technology more environmental friendly. We have focused on the mobile phone and have published to texts about batteries.

Ung Energi works to make teachers use the website directly in teaching, and in November we were present at a gathering about digital innovation at the schools. Here, we met with teachers from the all over Sør-Trøndelag.

Read more about UngEnergi on our website:

www.ungenergi.no ■

Tweet tweet



In April 2017 CenSES had 634 followers, an increase of 70 more followers since 2015. We were following 897, all key national and international stake-holders such as industry decision makers, politicians, scientists and researchers.

We use twitter to present our research and to communicate with people that are sharing the same passion about sustainable energy.

Follow us on twitter! [@FMECenSES](https://twitter.com/FMECenSES)

CenSES RA 3 researchers presents paper to Energy Norway

The paper focuses on how companies learn and adapt under an incentive regulation scheme, and we base our discussion on a survey of Norwegian electricity distribution companies. The main research question is to what extent, and how, the companies take into account the effect on their regulated revenue when making decisions on various operational and strategic issues. We have also asked them about how well they understand different aspects of the regulation / benchmarking models, and how they evaluate the regulation regime. One of the main findings is that the companies tend to be positive to the changes made to the regulation model in 2007, when the efficiency incentives were substantially strengthened. A majority of the companies see the changes as beneficial, especially when asked to take a system perspective. Another main finding is that the companies to a greater extent take the regulation model into account when considering strategic decisions, than when the decisions are about operational issues. Finally, we find that large companies are more likely than small companies to be involved in restructuring / merger projects.

The latter observation is interesting, since several previous studies have found that most of the companies in this industry tend to be below the optimal size. This survey was conducted as part of the Elbench research project, which has partners from academia (SNF/NHH/INN), the energy industry, and the regulator (NVE). The results were presented at a seminar for members of Energy Norway, 21/9-2016, in Oslo. ■



CenSES board member Mette Bjørndal and researcher Endre Bjørndal were two of the participants from NHH

Photo: Press photos/ NHH

Activities in RELEASE in 2016

Meeting the EU's and Norway's ambitious renewable energy targets will have significant local consequences. Norwegian policymakers must make decisions that balance the consequences for the economy, the society, and the environment. The RELEASE project in CenSES develops knowledge that assists them in such decision-making, while simultaneously providing new theoretical and empirical contributions to real-options theory, social theory, restoration ecology, and local sustainable development.

RELEASE aims at ensuring the flow of knowledge to the regional project's partners beyond the academic dissemination in scientific journals and books. We have from 2016 on arranged tailored workshops at partners' workplaces. These workshops have been very successful and we will continue this form of dissemination throughout the project period.

Dissemination activities:

- Co-organized yearly regional conference on renewable energy, "Kraft i Vest" from 2013 on. The conferences gather more than 200 participants from traditional power utilities, small-scale renewable energy firms, supply industries, regional and local governments, and academia, <http://www.sfe.no/kraftivest>
- Conducted more than 100 site visits to renewable energy firms with students from bachelor program in renewable energy. Firms include hydropower, bio energy, solar energy industries, wind power, grid developers as well as governments.
- Tailored half-day seminars at project partners to

present and discuss project findings. RELEASE work package leaders and project partner management participates.

- Disseminated project results regularly on Sogn and Fjordane Science Park's Web page, <https://www.kpsf.no/?s=renewable>. ■



Erling Holden is a member in the CenSES Management group, and he is the project leader in Renewable Energy Projects: Local Impacts and Sustainability (RELEASE)

Photo: Høgskulen på Vestlandet

CenSES centre director is a member in the Climate Council

CenSES director, Prof. Asgeir Tomasgard has from 2014 participated in the advisory board of the Minister of Climate and Environment (Klimarådet). The main role of this advisory board is to give input on the transition to a low emission society in 2050. The board consists of participants from business and industry, labor organizations, NGOs and academia. Tomasgard presents insights from CenSES research on topics like the climate law, national transport plan, green growth, climate policy and climate negotiations. ■



*Professor Asgeir Tomasgard
Photo: Stine Mari Skeide*

Education

Master students

In 2016 approximately 22 master students wrote their thesis on environmentally friendly energy systems and markets in CenSES. Key researchers, post docs and phd students from the center supervised the master students.

PhD students

There were 27 PhD students funded by CenSES in 2016. Eight of these students finished their thesis during the year: Tyson Weaver (NTNU), William Throndsen (NTNU), Øyvind Bjørgum (NTNU), Lars Hellemo (NTNU), Christian Skar (NTNU), Hilde Reinertsen (UiO), Ha Thi Bich Pham (UiO), Vegar Lein Ausrød (NTNU).

Further to this, an additional 21 PhD students were employed in related projects with funding from other sources. These students were invited to participate in events organized by CenSES, and some of them presented their work at the annual conference in December. Four of these students finished their thesis during the year: Markus Steen (SINTEF), Geoffrey Gilpin (Vestlandsforsk), Gunnar Yttri (RELEASE) and Siri Jakobsen (Nord University). ■



Master thesis: “Structural Estimation Analysis in Hydropower Scheduling” by Maren Boger, Einar Midttun Vestbøstad, NTNU

When planning production, hydro power reservoir managers need to form expectations about electricity prices in the future. When forming expectations, the Nordic electricity market is a useful tool for predicting how the underlying spot price will change. In this paper we developed a structural estimation model for a single agent hydropower producer in Norway. With this model, we analyzed how primitives in the price process, related to the forward price, can be inferred from empirical data from actual production time series. By analyzing trends and patterns in observed time series we have approximately parametrized the state space transition. Central here is the connection we model between inflow and price, to capture dry- and wet year dynamics in the two. The model has also been applied to a hydro power plant in Norway. From that experience we made a preliminary analysis regarding what extent the producer uses forward information when planning production. The results indicate that the producer is inclined to consider the forwarded price when planning, and that a forward price with 6 months to maturity is favored. An important byproduct of our model is the ability to calculate water values from the outputs. ■

Master thesis: “Carbon Footprint – A Luxury Good: Implications for a Norwegian Tax Proposal” By Mathias Juell Johnsen and Petter Lindheim Reinem, NHH

This thesis is focused on consumption based emissions for Norway, including emissions caused elsewhere, excluding emissions that produce exportables from Norway. Results showed that carbon emission across Norwegian households is a luxury good, so a carbon tax would be progressive. This may appear puzzling, for two reasons.

One reason is that one generally considers energy to be a normal good, in the sense that energy takes a greater share of consumption expenditures for poor than for rich, and energy is typically emission intensive. In Norway, however, according to the ‘footprint’ methodology, electricity – which is the most important energy carrier for households – is emission free. Another reason one would think carbon emissions are ‘normal’ rather than ‘luxury’ (or progressive) is the stylized idea of sectoral composition of national income, for which when a nation is rich, it is an emission-lean sector such as services that is growing. But services will to some extent not be part of consumption household expenditures (‘government’ pays for health, education and bureaucracy). A part of services that is emission intensive and paid for by household – transport – can very well be a luxury good. The students used the findings to discuss the prospects of a carbon tax. A carbon tax is not less interesting given that it is progressive, rather more attractive, from perspectives both of welfare and politics. ■



2016 dissertation: Siri Jakobsen, Nord University

Siri Jakobsen defended her PhD thesis on April 29th in Helgeland, Nord University, Handelshøgskolen. Her thesis is titled: «Environmental innovation cooperation: The development of cooperative relationships between Norwegian firms». Jakobsen's thesis aims to understand the development of the relationship between environmental innovation partners.

While firms were considered as the source of pollution in the past, they are now increasingly considered to be the solution, largely thanks to their innovative activity. Although many firms find the general innovation process challenging, environmental innovations (EIs) are found to be even more difficult because they unfold with other organizational and institutional changes within the firm. Because of this, EIs are less likely to be developed without policy influence, and for society to reap the positive spillovers of less pollution, firms need to overcome the risks and difficulties associated with the development of EIs. This thesis aims to open the “black box” of EI cooperation and understand whom firms might cooperate with and how this cooperation should be managed in order to reach its desired output.

To provide insights into the development of cooperative relationships between EI partners, this thesis builds on three separate research questions that I address in four empirical papers. This thesis has utilized both qualitative

and quantitative methods in order to answer the research questions. The first research question addresses how the innovation process is different within environmental firms and seeks to detect generalizable relationships between firms' environmental objectives and different parts of the innovation process. Research question two addresses how policies influence environmental innovation cooperation and seeks to understand the effects of policies on the EI process. The third and final research question addresses innovation cooperation within a competition context and explores how cooperation between competitors develops over time. The main contribution of this thesis is the increased understanding of the development of relationships between environmental innovation partners. Based on the theoretical discussion and the findings from the thesis, I propose a conceptual overview of how these cooperative relationships develop over time. The results from the thesis can assist firms in managing their cooperative relationships as well as helping policy makers to design more effective environmental policies. Research area leader in RA 4, Roger Sørheim, was Siri Jakobsen's main supervisor. ■



PhD Siri Jakobsen.



2016 dissertation: Hilde Reinertsen, UiO

Hilde Reinertsen defended her PhD thesis on April 27th in Oslo at Gamle festsal. Her thesis is titled: «Optics of Evaluation. Making Norwegian Foreign Aid an Evaluable Object, 1980-1992».

Energy has been a key sector of Norwegian foreign aid during several decades, notably through supporting the development of hydropower, petroleum, energy grids, and more recently other renewable energy sources. This dissertation investigates one part of this portfolio: The establishment of Norwegian aid to the petroleum sector during 1980-1992 (what is currently organized under the program “Oil for Development”).

The dissertation traces this early history through an in-depth study of Norway’s support to Mozambique’s petroleum administration during 1980-1992. Combining methods and theoretical approaches from Science and Technology Studies (STS) and History, the analysis shows how the sharing of the so-called “Norwegian oil experience” often involved diverging concerns between petroleum expertise, aid expertise, and recipient country governments. These divergences were further enhanced when the

aid administration during 1990-1992 implemented new systems and routines for project planning, monitoring, and evaluation (what I suggest to call “optics of evaluation”), in order to make all aid programs, including petroleum aid, into evaluable objects.

As such, the field of petroleum aid serves as a particularly interesting case in point for understanding both the unique features of the Norwegian oil experience; the fundamental challenges of translating this experience into widely different geological, political, and historical contexts; and the inherent contradictions between the aid administration’s concern for accountability and evaluability of aid programs and the oil administration’s concern for flexibility, in-depth analyses, and long-term perspectives. ■



PhD Hilde Reinertsen



2016 dissertation: Tyson Weaver, NTNU

Tyson Weaver defended his PhD thesis on April 28th in Trondheim, NTNU, Gløshaugen. His thesis is titled: «Strategic Management of Power Producers: Implementing international renewable power production growth strategies».

Tyson Weaver's thesis investigates the internationalization motives and methods for electric power producers. Using international business and strategic management literature streams, he focuses on the business dynamics that are driving or hindering internationalization of these firms. Additional focus is placed on firm characteristics and strategies that embody successful internationalization of the power producer. The four articles in the thesis use a variety of methods and data, often combining diverging data sources in mixed method designs. His summary chapter of the thesis concludes with a discussion on 5 key findings:

1. **Companies are motivated** (both offensively and defensively), **but face many obstacles** (both internal and external)
2. **The public ownership model restricts growth potential**
Lengthy discussion on dividend policies, access to capital for investments, composition and competence of the board, and how political meddling is

undermining the commercial capabilities of these industrial firms

3. **Returning focus to core business results in less new business development.**

Argues that sole hydropower focus results in missed opportunities for firm renewal

4. **Internationalization provides a financial hedge to the market downturn**

Argues for a mid-term investment strategy to offset lower prices (revenues) in Nordpool

5. **Fresh capital and new ownership structures are needed to go abroad** Argues for minority stake privatization to finance capital needs

Tyson concludes with a practitioner's guide for successful internationalization strategies, and policy recommendations suggesting that board members of publically owned yet privately operated power utilities should not be of current political representation to free management in their commercial decision making processes. ■



PhD Tyson Weaver (now a CenSEs postdoc) held his trial lecture on the following topic: «Internationalization of established firms: motives, market selection processes and the role of institutions»

PhD candidates with financial support from the centre budget



**Martin
Anfinen**
NTNU



**Veronica
Araoz**
NHH (2012)



**Lisa Maria
Assman**
NHH



**Vegar Lein
Ausrød**
NTNU (2016)



**Øyvind
Bjørgum**
NTNU (2016)



**Xiaomei
Cheng**
NHH (2015)



**Linda
Ellingsen**
NTNU



**Kyritsis
Evengelos**
NHH



**Thomas
Gibon**
NTNU



**Geoffrey
Gilpin**
Vestforsk/UMB
(2016)



**Mads Dahl
Gjefsen**
UiO (2015)



**Ole Inge
Gjerald**
Vestforsk/
NTNU



Jens Hanson
UiO (2013)



**Daniel
Haugstvedt**
NTNU



**Puck
Hegeman**
NTNU



**Robert L.
Jomisko**
NTNU (2015)



**Susanne
Jørgensen**
NTNU



**Karen Byskov
Lindberg**
NTNU (2016)



**Sylvia
Lysgård**
NTNU



**Tuukka
Mäkitie**
UiO



**Hector
Marañon-
Ledesma**
UiO



**Johannes
Mauritzen**
NHH (2012)



**Patrick
Narbel**
NHH (2014)



**Håkon
Normann**
UiO



**Hilde
Nykamp**
UiO (2015)



**Ha Thi Bich
Pham**
UiO (2016)



**Hilde
Reinertsen**
UiO (2016)



**Bente
Johnsen
Rygg**
HiSF/NTNU
(2015)



Vivek Sinha
NTNU



**Christian
Skar**
NTNU (2016)



Zhonghua Su
NTNU



**Eirik
Swensen**
NTNU (2015)



**William
Throndsen**
NTNU (2016)



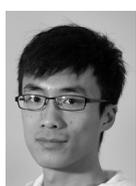
**Trine
Unander**
NTNU



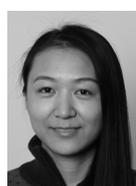
**Hans Jakob
Walnum**
Vestforsk/AAU
(2015)



**Tyson
Weaver**
HiSF/NTNU
(2016)



**Shiyu
Yan**
NHH



**Ni
Yuanming**
NHH

Post docs with financial support from the centre budget



Ekaterina Bjørnåli
NTNU



Chiara Bordin
NTNU



Jens Hanson
UiO



Gitte Koksvik
NTNU



Marius Korsnes
NTNU



Liste Lucia
NTNU



Johannes Mauritzen
NHH (2015)



Adela Pages
NTNU (2014)



Stefan Pauliuk
NTNU (2015)



Parmita Saha
HiSF (2014)



Christian Skar
NTNU



William Thronsen
NTNU



Gerardo Perez Valdés
NTNU (2014)



Ola Edvin Vie
NTNU (2014)



Tyson Weaver
HiSF/NTNU



Financial overview

Budget and reported costs

Partner	2011	2012	2013	2014	2015	2016	2017	2018	2019	All years
NTNU IØT	4 142	7 049	8 197	6 491	5 540	5 061	7 050	5 816	741	50 086
NTNU HF	4 661	6 420	6 842	6 726	5 573	7 305	9 846	9 548	1 811	58 733
NTNU Indecol	0	616	1 496	2 161	2 076	1 011	710	34	36	8 140
NTNU Elkraft	96	247	239	321	350	95	93	0	0	1 440
NTNU Samfunnsforskning	0	0	76	12	40	0	235	0	0	598
UIO	1 074	4 140	4 127	3 655	3 086	2 323	3 192	3 191	142	24 930
HISF	1 794	2 896	1 852	2 194	8 650	4 941	7 819	4 058	1 448	35 651
VF	1 042	1 127	797	1 195	510	510	483	482	0	6 145
NHH	2 349	3 089	2 688	2 738	3 429	2 837	2 836	2 248	0	22 214
Sintef EF	3 178	4 856	3 510	3 207	2 909	3 070	2 811	3 014	0	26 555
Sintef TS	1 804	2 433	2 381	2 234	3 294	2 075	1 493	969	0	16 683
IEE	2 100	2 047	2 032	2 110	2 269	2 030	2 050	1 994	0	16 632
SNF	1 407	1 398	1 289	1 551	1 449	1 449	1 322	1 318	0	11 023
Total research partners	23 648	36 317	35 525	34 595	39 015	32 708	39 940	32 907	4 178	278 832
Total user partners	947	1 127	1 006	1 276	765	744	1 100	1 100	0	8 066
Abroad	160	173	156	192	497	284	458	458	0	2 777
Total	24 755	37 617	37 087	36 062	40 277	33 735	41 498	34 465	4 178	289 675

For the tables showing budget and results, the numbers for 2011-2016 are the actual reported costs. The numbers for NTNU HF includes the costs for the centre management and joint activities.

Funding plan

Partner	2011		2012		2013		2014		2015		2016		2017		2018		2019		All years	
	financial	in-kind	financial	in-kind	total															
NTNU IØT	0	4 015	0	6 236	0	6 391	0	5 315	0	4 348	0	3 759	0	5 371	0	4 541	0	741	0	40 718
NTNU HF	0	3 670	0	3 951	0	4 246	0	4 601	0	3 018	0	3 819	0	4 828	0	5 060	0	1 811	0	35 004
NTNU Indecol	0	0	0	616	0	616	0	674	0	609	0	121	0	32	0	34	0	36	0	2 737
NTNU Elkraft	0	0	0	0	0	22	0	32	0	87	0	42	0	0	0	0	0	0	0	183
NTNU Samfunnsforskning	0	0	0	0	0	18	0	12	0	0	0	0	0	25	0	25	0	0	0	80
UIO	0	990	0	3 414	0	2 776	0	2 542	0	2 190	0	1 989	0	1 990	0	1 991	0	142	0	18 024
HISF	0	613	0	1 166	0	866	0	952	0	6 536	0	3 593	0	7 142	0	3 183	0	1 448	0	25 499
VF	0	392	0	477	0	797	0	684	0	0	0	0	0	0	0	0	0	0	0	2 350
NHH	0	1 650	0	1 912	0	1 750	0	1 800	0	1 850	0	1 900	0	1 950	0	2 000	0	0	0	14 812
Sintef EF	0	2 179	0	2 362	0	2 039	0	2 166	0	2 049	0	1 612	0	1 605	0	1 637	0	0	0	15 649
Sintef TS	0	964	0	1 265	0	1 277	0	1 219	0	1 384	0	1 060	0	230	0	230	0	0	0	7 629
IEE	0	700	0	700	0	700	0	700	0	700	0	701	0	700	0	700	0	0	0	5 601
SNF	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	500	0	0	0	4 000
Total research partners	3 900	15 673	0	22 599	0	21 998	0	21 198	0	23 271	0	19 097	0	24 373	0	19 901	0	4 178	0	172 287
Total user partners	4 235	0	4 025	1 127	2 317	1 006	3 202	4 832	765	5 020	744	3 650	1 100	2 300	1 100	1 100	0	0	0	29 245
Research Council	8 135	16 619	13 891	23 726	14 590	23 004	12 931	22 474	16 241	24 036	14 044	16 025	25 473	13 464	21 001	0	0	0	0	80 076
Total	16 619	16 619	13 891	23 726	14 590	23 004	12 931	22 474	16 241	24 036	14 044	16 025	25 473	13 464	21 001	0	0	0	0	109 322

Cost per Research Area

	2011		2012		2013		2014		2015		2016		2017		2018		2019		All years	
	financial	in-kind	financial	in-kind	financial	in-kind	financial	in-kind	financial	in-kind	financial	in-kind	financial	in-kind	financial	in-kind	financial	in-kind	total	
BUDGET RA1	506	3 977	1 149	4 953	597	4 740	558	5 151	811	3 113	1 479	4 358	3 514	3 735	3 505	3 677	0	1 656	12 120	35 360
BUDGET RA2	2 699	5 036	3 465	5 286	3 137	5 205	2 333	4 009	2 131	2 458	2 352	1 100	2 554	1 819	1 929	1 793	0	0	20 600	26 706
BUDGET RA3	1 612	2 586	2 282	2 851	2 093	2 651	2 731	2 778	2 983	2 721	2 309	2 879	2 036	2 725	1 398	2 775	0	0	17 445	21 966
BUDGET RA4	1 634	2 207	3 590	6 466	3 345	6 800	3 952	6 086	4 630	10 558	2 316	5 666	1 949	12 057	1 784	7 715	0	1 817	23 199	59 372
BUDGET RA5	364	1 050	1 052	1 888	2 093	1 622	2 050	2 091	2 443	2 650	2 127	3 432	1 733	2 822	1 124	2 415	0	36	12 986	18 006
BUDGET Management	785	1 764	1 542	2 256	1 046	1 928	1 312	1 861	1 095	2 513	1 071	2 406	1 837	2 315	1 834	2 626	0	669	10 521	18 339
BUDGET Center	535	0	811	26	1 772	58	652	498	2 147	23	2 241	0	2 402	0	1 890	0	0	0	12 450	605
TOTAL	8 135	16 619	13 891	23 726	14 083	23 004	13 588	22 474	16 241	24 036	13 894	19 841	16 025	25 473	13 464	21 001	0	0	109 322	180 353

Appendix 1: Personell - Key Researchers

Name	Institution	Main research area
Heidenreich, Sara	NTNU	RA 1
Skjølsvold, Tomas Moe	NTNU	RA 1
Ryghaug, Marianne	NTNU	RA 1 og 4
Lagesen, Vivian A	NTNU	RA 1 og 4
Sørensen, Knut	NTNU	RA 1 og 4
Robert Næss	NTNU	RA 1 og 4
Wicken, Olav	UiO	RA 1 og 4
Walnum, Hans Jakob	Vestlandsforskning	RA 1 og 4
Baltruszewicz, Marta	Vestlandsforskning	RA 1 og 4
Aall, Carlo	Vestlandsforskning	RA 1 og 4
Holden, Erling	HiSF	RA 1 og 4
Yttri, Gunnar	HiSF	RA 1 og 4
Rygg, Bente Johnsen	HiSF	RA 1 og 4
Espegren, Kari	IFE	RA 2
Westgaard, Sjur	NTNU	RA 2
Fleten, Stein-Erik	NTNU	RA 2
Lind, Arne	IFE	RA 2
Rosenberg, Eva	IFE	RA 2
Seljom, Pernille (16,7 % IFE)	IFE	RA 2
Midthun, Kjetil	SINTEF TS	RA 2 og 3
Tomasgard, Asgeir	NTNU	RA 2 og 3
Skar, Christian	NTNU	RA 2 og 5
Eskeland, Gunnar	NHH	RA 3
Bjørndal, Mette	NHH	RA 3
Bjørndal, Endre	NHH	RA 3
Sandal, Leif	NHH	RA 3
Andersson, Jonas	NHH/SNF	RA 3
Rud, Linda	NHH/SNF	RA 3
Gaasland, Ivar	SNF	RA 3
Godal, Odd	SNF	RA 3
Heum, Per	SNF	RA 3
Stokka, Arne	SINTEF TS	RA 3
Egging, Ruud	NTNU	RA 2 og 5
Østerlie, Thomas	NTNU Samfunnsforskning	RA 4
Moen, Øystein	NTNU	RA 4
Widding, Øystein	NTNU	RA 4
Sørheim, Roger	NTNU	RA 4
Weaver, Tyson	NTNU	RA 4
Steen, Markus	SINTEF TS	RA 4
Bjørgum, Øyvind	NTNU	RA 4
Vie, Ola Edvin	NTNU	RA 4
Schwanz, Valeria Jana	HISF	RA 4 og 5
Nilsen, Sverre Konrad	SINTEF TS	RA 5
Graabak, Ingeborg	SINTEF Energi	RA 5
Belsnes, Michael	SINTEF Energi	RA 5
Fodstad, Marte	SINTEF Energi	RA 5
Voller, Steve	SINTEF Energi	RA 5
Wolfgang, Ove	SINTEF Energi	RA 5
Schäffer, Linn Emelie	SINTEF Energi	RA 5
Ahcin, Peter	SINTEF Energi	RA 5
Arvesen, Anders	NTNU	RA 5
Hertwich, Edgar	NTNU	RA 5
Strømman, Anders Hammer	NTNU	RA 5

Postdoc researchers with financial support from CenSES in 2016

Name	Nationality	Period	M/F	Topic
Bjørnåli, Ekaterina	Norwegian	01.11.11-25.08.16	F	Commercialization processes in entrepreneurial firms: examples from renewable energy
Bordin, Chiara		01.01.17 – 05.02.17	F	
Hanson, Jens	Norwegian	01.10.13-17.05.17	M	Innovation processes in renewable energy technologies and industries
Koksvik, Gitte	Norwegian	01.12.16-30.11.19	F	Horizon2020
Korsnes, Marius	Norwegian	01.05.16 – 01.05.19	M	Prosumers and new forms of energy use in low-energy buildings and neighborhoods.
Liste, Lucia	Spanish	06.08.16-31.12.16	F	Sociomaterial change in multi-stakeholder environments
Skar, Christian	Norwegian	01.09.16 – 31.08.18		Stochastic programming, power markets, SET-NAV
Thronsen, William	Norwegian	01.06.16 – 31.05.19		Smartgrid
Weaver, Tyson	American	01.08.16 – 31.07.18	M	Renewable energy technologies in the power sector

Postdoc researchers working on CenSES projects with financial support from other sources in 2016

Name	Funding	Nationality	Period	M/F	Topic
Arvesen, Anders		Norwegian	01.02.13-31.12.17	M	Scenario-based life cycle assessment of energy technologies and energy systems
Haugom, Erik		Norwegian	01.10.13-30.09.17	M	
Heidenreich, Sara	IEE	German	01.04.14 - 31.03.16	F	UseItSmartly
Skjøtsvold, Tomas Moe		Norwegian	27.08.12-23.03.16	M	

PhD candidates with financial support from CenSES

Name	Nationality	Period	M/F	Topic
Anfinsen, Martin	Norwegian	21.11.16-20.11.20	M	Gender and Energy
Araoz, Veronica (Defended 30.05.12)	Mexican	01.08.08-30.05.12	F	Pricing in Non-Convex electricity markets
Assmann, Lisa Maria	German	15.08.12-14.08.16	F	Speed optimization theory and practices In maritime shipping
Ausrød, Vegar Lein (14.12.16)	Norwegian	01.11.10-30.06.16	M	Commercialization of renewable energy
Bjørgum, Øyvind (Defended 09.05.16)	Norwegian	01.10.10-09.06.16	M	New firms developing novel technology in a complex emerging industry. The road towards commercialization of renewable marine energy technologies
Cheng, Xiaomei (Defended 18.12.15)	Chinese	15.09.11-18.12.15	F	Essays on Efficiency and Productivity in Electricity Networks
Ellingsen, Linda	Norwegian	15.09.13-14.01.17	F	Life cycle assessment of traction batteries for transport applications
Evangelos, Kyritsis		15.08.14-14.08.18		Empirical analysis of energy markets
Gibon, Thomas	French	01.12.11 - 30.11.15	M	Scenario-based life cycle inventory methods to inform climate mitigation
Gjefsen, Mads Dahl (Defended 11.05.15)	Norwegian	15.03.10-11.05.15	M	Discords in Science and Technology Advocacy: Lessons from CCS for Geoengineering
Gjerald, Ole Inge	Norwegian	01.09.08-31.12.15	M	Renewable strategies? Implementing and commercializing new energy technologies
Hanson, Jens (Defended 04.10.13)	Norwegian	01.01.08-04.10.13	M	Dynamics of Innovation Systems for Renewable Energy Technology: The Role of Post-Introduction Improvements
Haugstvedt, Daniel	Norwegian	01.06.10-17.01.14	M	Hydropower Scheduling Analysis Using Statistics and Stochastic Programming
Hegeman, Puck	Dutch	01.06.16-31.05.19	F	
Hellemo, Lars (Defended 06.06.16)	Norwegian		M	Managing Uncertainty in Design and Operation of Natural Gas Infrastructure
Jomisko, Robert L. (Defended 04.09.15)	Norwegian	01.09.10-15.11.15	M	Under investigation. About processes of learning and management of knowledge in climate, energy, and environmental policy
Jørgensen, Susanne	Norwegian	01.10.15-13.08.19	F	Numbers and Narratives in Energy
Lindberg, Karen Byskov (50% CenSES, 50% ZEB) (Defended 03.02.17)	Norwegian	01.09.11- 01.05.16	F	The impact of zero emission buildings (ZEB) on the energy system through smart grid and demand side management (DSM)
Lysgård, Sylvia	Norwegian	23.01.12 - 25.05.17	F	Hva dreier det seg om? Næringsliv, politikk og praksiser i to norske (miljø)saker
Mäkitie, Tuukka		11.05.15-10.05.18		Innovation activities of offshore oil and gas industry in the emergence of niche technologies
Marañon-Ledesma, Hector		01.09.15-31.08.18	M	Demand Response in the future sustainable European Power System
Mauritzen, Johannes (Defended 14.05.12)	Norwegian	01.08.08-14.05.12	M	Windonomics: empirical essays on the economics of wind power in the Nordic electricity market
Narbel, Patrick (Defended 14.06.14)	Swiss/Finnish	15.08.10-14.08.14	M	Framework promoting the development of renewable energy in developing countries
Normann, Håkon (Defended 09.03.17)	Norwegian	19.03.12-30.09.16	M	New renewable industry formation: The constraining and enabling role of the oil and gas industry on an emerging offshore wind industry in Norway
Nykamp, Hilde (Defended 16.11.15)	Norwegian	01.02.12 - 16.16.16	F	Green Innovation in the Norwegian Construction Industry
Pham, Ha Thi Bich (Defended 04.02.16)	Vietnamese	01.12.08-04.02.16	F	Building and transforming dominant technology - The Portland cement industry
Reinertsen, Hilde (Defended 27.04.16)	Norwegian	01.05.10-27.04.16	F	Optics of evaluation: Making Norwegian foreign aid an evaluable object, 1980-1992
Rygg, Bente Johnsen (Defended 17.04.15)	Norwegian	01.02.11-17.04.15	F	Renewable Energy as a Community Concern: How Local Communities Face the Challenge of Increasing Use and Production of Renewable Energy
Sinha, Vivek	Indian	01.08.11-01.12.16	M	Unleashing the potential of renewable energy for decentralized production: an investigation into organization strategies and system requirements
Skar, Christian (Defended 29.07.16)	Norwegian	16.08.10-01.05.15	M	Modelling of the European power market for low emission scenarios
Su, Zhonghua	Chinese	01.03.13 - 01.12.16	F	Equilibrium models for energy systems
Swensen, Eirik (Defended 13.05.15)	Norwegian	01.09.10-13.05.15	M	Love and intricacies" – Stumbling stones for development of carbon capture and storage
Thronsdén, William (Defended 25.05.16)	Norwegian	01.04.11-25.05.16	M	Response and Responsibility. Smart meters, end use, and the possibility of a green material public
Unander, Trine	Norwegian	08.01.13 - 29.08.18	F	Environmental organisations as boundary organisations
Walnum, Hans Jakob (Defended 23.09.15)	Norwegian	01.09.11- 23.09.15	M	Fixing or transferring environmental problems in the transport sector
Weaver, Tyson (Defended 28.04.16)	American	01.09.11-28.04.16	M	Norwegian hydropower international development
Yan, Shiyu	Chinese	01.09.13-31.08.17	M	Using CO2 differentiated vehicle tax to improve new vehicle fuel economy: evidence from Norway
Yuanming, Ni		15.08.14-14.08.18		

PhD candidates working on CenSES projects with financial support from other sources

Name	Funding	Nationality	Period	M/F	Topic
Arvesen, Anders (Defended 30.01.13)	Indecol	Norwegian	01.08.08- 31.07.12	M	Understanding the environmental implications of energy transitions: A case study for wind power
Babri, Sahar (Defended 20.08.15)	NHH	Iranian	08.12- 20.08.15	F	Essays on Transportation
Bouman, Evert (Defended in 2015)	DION	Dutch	01.06.12 - 31.05.15	M	Prospective Environmental Impacts of Selected Low-Carbon Electricity Technologies
Cai, Hong	NHH			F	Energy, Natural Resources and the Environment
Dahlen, Kai Erik	PURELEC/ RENERGI	Norwegian	01.10.10-30.09.14	M	Risk management and assessment for energy markets: Extreme value statistics
Forminykh, Elena	NHH	Russia	01.10.10-30.09.14	F	
Gilpin, Geoffrey (Defended 10.11.16)	Vestforsk/UMB	Canadian	01.09.08-31.07.16	M	Life cycle analysis of 1st through 4th generation biofuels
Godbolt, Åsne Lund (Defended 13.06.14)	RENERGI	Norwegian	01.08.08-13.06.14	F	Building markets, shaping policy? The role of economics in energy policy and energy use
Gribovskaja, Victoria (Defended 08.06.15)	NHH	Belarusian	2007 - 08.06.15	F	Essays on Pricing in Electricity Markets
Hagfors, Lars Ivar	NFR, RISKY-RES	Norwegian	01.10.13-30.09.17	M	Building markets, shaping policy? The role of economics in energy policy and energy use
Haugom, Erik (Defended 24.10.12)	NFR - Renergi	Norwegian	01.01.09-24.10.12	M	Modelling and forecasting electricity prices and volatilities
Heidenreich, Sara (Defended 24.10.14)	RENERGI	German	15.09.10-24.10.14	F	Blowing in the wind: The socialization of offshore wind technology
Helgesen, Per Ivar	RENERGI	Norwegian	01.06.12-31.05.16	M	Regional effects of energy policy
Hopaneng, Lina Ingeborgrud	NTNU/KULT	Norwegian	01.08.14 - 31.07.17	F	BREV (Bringing Environmental Knowledge into Action)
Jakobsen, Siri (Defended 29.04.16)	NFR, Forskningsløft nord	Norwegian	01.08.10-31.07.14	F	Sustainable innovation in the process industry, innovation, cooperation and technology transfer
Johansen, Ulf	NTNU/IØT	Norwegian	21.03.12 - 15.11.14	M	Winners and losers in regional economic development
Karlstrøm, Henrik (Defended 20.03.12)	RENERGI	Norwegian	18.08.08- 20.03.12	M	Empowering markets? The construction and maintenance of a deregulated market for electricity in Norway.
Klimek, Alexandra (Defended 09.12.14)	NFR.RENERGI	German	01.09.09-09.12.14	F	Engineering and Politics: Embedding Carbon Capture, Transport and Storage (CCS) in Norway
Kong, Jiehong (Defended 25.08.12)	NHH	Chinese	14.08.08 - 25.08.12	F	Integration and coordination of supply chain: Case studies in forestry and petroleum industries
Korsnes, Marius (Defended 01.12.15)	NTNU, China project	Norwegian	21.05.12-20.05.15	M	Chinese Renewable Struggles. Innovation, the Arts of the State and Offshore Wind Technolog
Lauvås, Thomas	RFF-Nord/ Helgeland Sparebank	Norwegian	19.09.13- 18.09.17	M	Technology entrepreneurship and university- industry technology transfer
Ottesen, Stig Ødegaard (Defended 09.03.17)	NCE Halden	Norwegian	01.01.11-30.06.16	M	Techno-economic models in Smart Grids: Demand side flexibility optimization for bidding and scheduling problems
Seljom, Pernille	RENERGI	Norwegian	01.01.11-31.12.14	F	The future Norwegian energy system in a European context
Skjeret, Frode	NECCI	Norwegian	01.11.12-01.03.15	M	Regulation of electricity markets
Skjølvold, Tomas Moe (Defended 24.08.12)	RENERGI	Norwegian	01.08.08-24.08.12	M	Innovation and commercialization in bioenergy
Stavø, Jorunn-Elisabeth	HiSF (RELEASE)	Norwegian		F	
Steen, Markus (Defended 09.09.16)	RSO/SVT	Norwegian	01.06.10-30.05.15	M	Green industrial restructuring and the emergence of novel production networks in new renewable energy
Steinmo, Marianne (Defended 27.03.15)	HBS	Norwegian	01.08.10-27.03.15	F	How Firms use University-Industry Collaboration to innovate: The role and development of Social Capital and Proximity Dimensions
Suboticki, Ivana	NTNU			F	Sustainable Transition through Transformed Transportation
Sulavik, Jan	HiSF (RELEASE)	Norwegian		M	
Søraa, Roger	NFR, Klimaforsk	Norwegian	01.09.14-30.08.17	M	Craftspeople as climate advisors
Toftaker, Marit	RENERGI	Norwegian	01.01.10 - 01.12.15	F	EV User Preferences and User Strategies

PhD candidates working on CenSES projects with financial support from other sources (continued)

Name	Funding	Nationality	Period	M/F	Topic
Veka, Steinar (Defended in 2015)	NFR, ELCARBONRISK/ RENERGI	Norwegian	01.08.12-31.07.15	M	Essays on price formation and risk assessment in energy markets
Yttri, Gunnar (Defended 09.09.16)	HiSF (RELEASE)			M	
Tunc, Durmaz (Defended 01.09.15)	NHH	Turkish	01.08.09 - 01.09.15	M	Essays in energy, environment and technology
Xiaozi, Liu (Defended 09.11.12)	NHH	Chinese	14.08.10 - 09.11.12	F	Essays on economic optimization: bringing fisheries economics and fisheries biology
Øverås, Ingrid	NTNU/KULT	Norwegian	01.2005 - 31.12.12	F	Localization and Design of wind parks in Norway - Controversies in Environmental Planning

Completed master degrees reported by CenSES researchers (2011-2016)

Name	M/F	Institution	Topic
Aamodt, Frida Arnesen & Ytterbø, Marianne	F	NTNU	National strategic investments in electricity transmission capacity in Europe.
Alamban, Alok	M	NHH	Business models and market pricing mechanisms within virtual microgrids for smart energy networks – A European market perspective
Atroshi, Gulizar	F	NTNU	Velferdsteknologi fra planer til prosjekt". En kvalitativ studie av domestisering av velferdsteknologi
Banik, Abhijit	M	NTNU	Commercialization of norwegian wind Energy Technologies
Berglund, Belinda	F	NTNU	Hvem tar ansvaret? Teknologers bidrag til et mer bærekraftig samfunn
Berntsen, Stine Anette & Vatn, Hege Grønning	F	NTNU	Business Models for Extracting the Value of Flexibility in Electricity Systems.
Blæsterdalen, Inga	F		Forbilder for innovasjonsstrategi. Hvordan tilvirker den offentlige forbildesatsingen FutureBuilt omstillingen til energieffektive teknologiløsninger i bygningssektoren
Bredesen, Hanna	F	NTNU	El-sykkelen – en sommerfugl i vinterland? En studie av el-sykkelens teknopolitiske utfordringer i Trondheim
Birkelund, Henrik & Opdal, Martin	M	NTNU	The effects of Implied Volatility on Forecasts of Realized Volatility in the Nordic Power Forward Market.
Boger, Maren & Vestbøstad, Einar Midttun	F		Structural Estimation Analysis in Hydropower Scheduling
Bojer, Ranja	F	NTNU	Sporet av den tapte tid. Analog revansj i den digitale tidsalder.
Braun, Sebastian Matthias	M	NTNU	Business Models in Smart Grids.
Brinch, Pernille Cathrine Grüner	F		
Burheim, Edda Nerموen, Dahl, Elise Ivara	F	NHH	Norske nettselskapers tilpasning til den økonomiske reguleringen : kartlegging av den økonomiske reguleringens beslutningsrelevans ved drifts- og investeringsbeslutninger
Chiesura, Lorenzo	M	NHH	The relation between Venture Capital and Private Equity investments in Renewable Energy Sources.
Correia, J.C & Tennfjord, M.N	F	NTNU	Critical Components of business models for renewable energy based rural electrification. NTNU School of Entrepreneurship
Deal, Elliot	M	NHH	Cars Bounce Back from Tax Changes: The Rebound Effect from Recent Changes to the Norwegian Motor Vehicle Registration Tax.
Diaz Franceschi, Jean-Baptiste	M		
Dolnecianu, Andreea Luminita & Ikram, Omar	M & F	NHH	Mind the gap: analyzing the impact of offshore wind power on conventional power in the UK.
Dostanic, Ela	F	NTNU	Farlige forbindelser! Konstruksjon av bakteriologiske forbindelser i Norge, 1980-2003.
Dyrendahl, Tore	M		
Ersparmer, Kai & Moore, Finolo	M	NHH	Improved Wind Measurement and Wind Farm Project Development - Determining the Financial Value of Enhanced, High-Resolution Wind Resource Potential Data in the Investment Process.
Eliassen, Markus & Steine, Sturla	M	NTNU	A new quantile Regression Model to forecast one day ahead Value at Risk.
Godbolt, Lars Fredrik Lund	M		Understanding infrastructures: What is the mode of technological change in infrastructure sectors? Innovation in the European high voltage direct current (HVDC) subsea cable industry since 2000

Guillot, Elisabeth Stephane	F	NTNU	The WoW Factor. Leadership in World of Warcraft as Sociotechnical Practice
Heggheim, Hanne & Mogens- en, Ingvild	F	NTNU	Wind Power Investment under Uncertainty and Simultaneous Electricity and Green Certificate Equilibrium.
Hofgaard, Anniken, Kårstad, Ingrid & Skjong, Cecilie	F		Stochastic Mixed Integer Problems for Bidding in Sequential Electricity Markets
Hole, K	M	NTNU School of Entrepreneurship.	Framework for Experimental Learning: Replicable Business Models in Rural Electrification.
Ingebretsen, Erik & Johansen, Tor Haakon Gimsdal	M	NHH	The profitability of pumped hydro storage in Norway.
Ingebrigtsen, Kristoffer & Kaldahl, Jonas	M	NTNU	Sequential investment in gas fired power plants: A real options analysis
Jullinen, Mai-Liis	F	NHH	The impact of increased interconnection capacity with continental Europe for the Nordic power market
Jørgensen, Susanne	F	NTNU	Smart strøm - smarte kunder? En studie av norske husholdningers domestisering av smarte strømmålere og styringsteknologier
Knoll, Espen Brevik	M	NTNU	Can the world be saved by rethinking buildings and their users? An analytic approach into Norway's first renovated energy plus house
Kristiansen, Aurora	F	NTNU	Kunnskapsproduksjon i grenseland - en studie av forholdet mellom vitenskap og politikk i Nordområdene
Lahn, Bård Lappegård	M		Forest through the paper mill: Assembling REDD+ through the production of papermill
Leiva, David	M		Agent based modeling for hydrogen car market in Norway, June 2016 (supervised by Ruud Egging)
Lundstad, Marie Moi	F		Bærekraft og kompleksitet. Utfordringer med å realisere en klimaeffektiv områdeutvikling
Kvam, Yrjan	M	NTNU	Skogens mange ansikt. Om å gi mening til skogen.
Mekki, Adrian & Virk, Kamaljeet Singh	M	NHH	Investment Analysis of Rooftop Solar Photovoltaic Panels for Energy-Efficient Residential Areas in Norway, under Different Regulatory Scenarios - Zero Village Bergen as a case study
Morency-Lavoie, Felix	M	NHH	A von Thünen model of the commute. Ongoing.
Ni, Yuanming	F	NHH	Global Potential for Carbon Storage Based on Forest Ecosystems.
Næss, Trine Rollesfens & Schaf- fer, Linn Emelie	F		A Profit Maximisation Model for Operation of a Tidal Lagoon Power Plant Determination of Optimal Operational Schedule and Potential Value Added by Integration in a High Intermittent Power System
Oliver, Emil Johan & Toftesund, Hans Christian	M	NTNU	Collaborating in research centres
Oprja, Risto	M	NTNU	Sykkel-IKTs uunngåelige rolle i sykkelhverdagen – en døråpner til bedre helse i Norge?
Pedersen, Sondre Malde	M		Progression through CEO succession: - Literature review and quantitative study of succession's effect on USOs' human capital and development
Peeva, Zhelyiana	F	NHH	Energy Efficiency in Buildings in Bulgaria: A case study of schools.
Petterson, Tor Brørs	M	NTNU	Det er ikke noen motbakker å grue seg til ". En kvalitativ studie av elsykkisters domestisering av elsykkelen
Roalsø, Helene, & Jacobsen, Tina Slåttedal & Størksen, Benedicte Hjelle	F	NTNU	Multinational Corporations Investing in the Marine Energy Industry The process of MNC's investing in the wave and tidal energy industries.
Rogne, Jonas Pauck & Wangen, Thor Morten	M	NHH	A real option approach to Hydro's investment at Karmøy.
Ruíz, Hector Campos	M	NHH	Analysis of Petroleum Tax Regimes for Private Investments in the Mexico. Ongoing.
Rundlang, Erik & Tjeransen, Carl Fredrik	M	NTNU	Effektiviteten i det europeiske kraftmarkedet: Et tiltak for å inkludere fleksibilitet fra termisk kraftproduksjon.
Salvesen, Mari	F	NTNU	Det målbare mennesket. En kvalitativ studie av unge kvinners bruk av treningsapper.
Sefakor, Abgesi	M	NHH	The 21st Century Environmental Kuznets Curve (EKC): An analysis of OECD and Non-OECD Countries.
Skorstad, Lise	F	NTNU	Miljøfyrtårn. En sertifiseringsordning som viser vei? NTNU/KULT 2015
Tobiassen, Karoline	F	NTNU	Grønt i alt vi gjør? En undersøkelse av rådgivende ingeniørers miljøkunnskap og håndtering av miljøutfordringer.
Tsagkaropoulos, Nikolaos	M	NHH	Bicycle Sharing Systems, Are they here to stay?
Tveter, Henrik Thorgesen	M	NHH	Large scale transition from conventional to electric vehicles and the consequences for the security of electricity supply – a demand side analysis of electricity consumption.
Velázquez, Stephanie Maritza Villegas	F	NHH	The road from diesel to natural gas. The impact of changing fuel sources in road transportation: the case of Kuehne + Nagel.
Vingen, Anita	F	NTNU	Smått er godt? Utfordringer og muligheter i midtnorsk småskalaproduksjon.

Appendix 2: Related Projects Including CenSES Research Partners

Modelling and forecasting risk in the electricity market, carbon market and related energy markets (ELCARBONRISK).

RCN/RENERGI. 2010 - 2014

Project leader: Sjur Westgaard, NTNU.

Total budget: NOK 13 770 000

Investment in renewable electricity under climate policy uncertainty (PURELEC).

RCN/RENERGI. 2010 - 2014

Project leader: Stein-Erik Fleten, NTNU.

Total budget: NOK 8 450 000

Public acceptance of post carbon strategies

RCN/RENERGI. 2009 - 2014

Project leader: Knut Holtan Sørensen, NTNU.

Total budget: NOK 8 891 000

Building markets, shaping policy? The role of economics in energy policy and energy use.

RCN /RENERGI. 2007 - 2013

Project leader: Knut Holtan Sørensen, NTNU.

Total budget: NOK 3 368 000

ECar, A strategy for electrification of road transport in Norway.

RCN /RENERGI. 2009 - 2013

Project leader: Tarjei Solvang, SINTEF Energy Research.

Total budget: NOK 10 600 000

Environmental Sustainability Benchmarking of Low-Carbon Energy Technologies.

RCN/RENERGI. 2011 - 2013

Project leader: Edgar Hertwich, NTNU.

Total budget: NOK 2 954 000

Optimal power network design and operation.

RCN /RENERGI. 2011 - 2015

Project leader: Morten Hovd, NTNU.

In budget for CenSES: NOK 2 700 000

Dissemination of Scientific Knowledge as a Policy Instrument in Climate Policy. RCN/NORKLIMA. 2011 - 2014

Project leader: Göran Sundqvist, UiO.

Total budget: NOK 6 200 000

Intermittent Renewables, Balancing Power and Electricity Market Design (INTREPED).

RCN/RENERGI. 2012 - 2015

Project leader: Gunnar Eskeland, SNF.

Total budget: NOK 6 000 000.

Regional effects of energy policy (RegPol).

RCN /RENERGI. 2012 - 2015

Project leader: Arne Stokka, SINTEF Technology and Society.

Total budget: NOK 11 950 000

Renewable energy as transition strategy.

RCN/RENERGI. 2011 - 2014

Project leader: Keith Smith, UiO

The future Norwegian energy system in a European context

RCN/RENERGI. 2011 - 2014

Project leader: Kari Aamodt Espegren, IFE.

Total budget: NOK 7 270 000

Energy Technology System Analysis Programme

RCN/RENERGI. 2012 - 2015

Project leader: Kari Aamodt Espegren, IFE.

Total budget: NOK 1 720 000

Integrating households in the smart grid (IHSMAG).

ERA-NET. 2012 - 2014

Project leader NTNU: Marianne Ryghaug, NTNU.

Total budget: EUR 1 148 810

NORSTRAT - Nordic electricity road map 2050: Strategic choices towards carbon neutrality

Nordic Energy Research. 2011 - 2015

Project leader: Ingeborg Graabak, SINTEF Energy Research

NORD-STAR - Centre of Excellence for Strategic Adaptation Research.

Nordforsk. 2011 - 2015

Centre director: Michael Goodside, Aarhus University.

Total budget: NOK 35 000 000

Greenhouse gas emission goal for cars; feasibility and policy instruments.

SD, 2012 - 2013.

Project leader: Gunnar Eskeland, NHH

Total budget: NOK 500 000

Teknologibasert entreprenørskap og innovasjon som driver for industriell utvikling i Nord-Norge.

NFR og Helgeland Sparebank. 2013-2016.

Project leader: Roger Sørheim, NTNU/Handelshøgskolen i Bodø.

Total budget: NOK 5 500 000

Crafting Climate Advisors - Developing Arenas for the Education of Craftsmen in the Face of Climate Transitions

KLIMAFORSK. 2013

Project leader: Jøran Solli, NTNU

Total budget: NOK 187 000

Influence of bioethanol fuels treatment for operational performance, ecological properties and GHG emissions of spark ignition engine

EEA. 2013-2015

Project leader: Otto Andersen, Vestlandsforskning

useTsmartly - Environmental peer-to-peer education for youths with focus on smart use of Information and Communication Technologies.

IEE. 2013 - 2016.

Project leaders: Knut H. Sørensen and Robert Næss, NTNU.

Total budget: NOK 2 300 000.

Hvordan vil en dreining av fornybarstøtten i EU i retning av mer markedsstyrte instrumenter påvirke grønne investorer? (RISKY-RES)

NFR, ENOVA, NVE, Statnett og Energi Norge. 2013-2016.

Project leader: Stein-Erik Fleten, NTNU.

Total budget: NOK 7 000 000.

Bringing environmental knowledge into action: Environmental knowledge management in Norwegian local governments.

Miljø2015 program. 2014 - 2017

Project leader: Vivian Anette Lagesen, NTNU.

Total budget: NOK 5 000 000

Europeanisation of energy-technological innovation systems: drivers,

consequences and strategic challenges for Norway.

ENERGIX. 2014 - 2017

Project leader: Per-Ove Eikeland, Fridtjof Nansens Institutt.

Day-ahead bidding with multiple short-term markets?.

Sintef Energy Research. 2015-2018

Project leader: Marte Fodstad

Total budget: NOK 18 000 000

Hybrid and other configurations for environmentally friendly transport

MARINTEK. (2014 - 2015)

Project leader: Elizabeth Lindstad

Total budget: NOK 2 550 000

Norwegian Energy Road Map 2050.

SINTEF Energy Research.

Project leader: Marte Fodstad

Project startup: 2016

Total budget: NOK 14 900 000

Navigating the Roadmap for Clean, Secure and Efficient Energy Innovation - SET-Nav (Horizon 2020)

TU Wien, NTNU and SINTEF Technology & Society with partners

Project leader: Gustav Resch,

Local project leaders: Ruud Egging (NTNU), Kjetil Midthun (SINTEF)

Project startup: 1. April 2016 - 31. March 2019

Total budget: EUR 3 999 411,25

Internationalization of Norwegian Offshore Wind Capabilities (In-NOWic)

EnergiX. 2016 - 2020.

Project leader: Asbjørn Karlsen

Total budget: NOK 10 800 000

Project title: Markets - actors - technologies: A comparative analysis of smart grid solutions
Funding source: ERA-net Smartgrid plus
Year: 2015-2017
Project leader: Toke H. Christensen, Aalborg universitet
Total budget: NTNU: 5,3 mill NOK, whole consortium 14, 1 mill Nok

Framtidsbilder: Det norske lavutslippssamfunnet
Vestlandsforskning
Employer: ENOVA
Project leader: Carlo Aall, Vestlandsforskning

SHAPE-ENERGY.
Coordinated by: Anglia Ruskin University.
Partner: NTNU (KULT).
Project leader from NTNU: Sara Heidenreich, KULT

INVADE.
Coordinated by: Smart Innovasjon Østfold.
Project partner: NTNU (KULT)

ECHOES
Financed by H2020
Project partner: NTNU

MATCH
Financed by Smartgrids ERA-net
Project partner: NTNU

Assessment of the Value of Flexibility Services from the Norwegian Energy System
2016
IFE, SINTEF, NTNU
Project leader: Kari Espegren

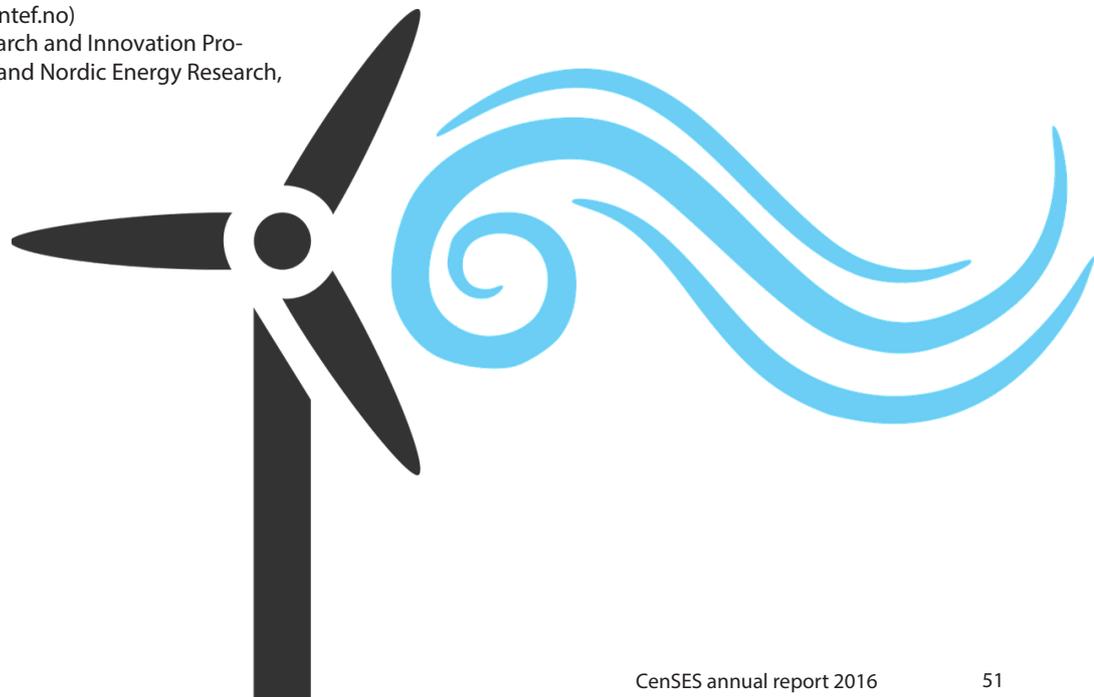
[Greening the Fleet – Sustainability Transitions in the Maritime Shipping Sector \(GREENFLEET\)](#)

Project leader: Tone Merethe Aasen (tone.m.aasen@sintef.no)
Programme: EnergiX, Norges Forskningsråd 2017-2020
Budget: 11,8 mill NOK

Conditions for growth in renewable energy industries
2016
UiO TIK, SINTEF TS

[Where Does the Green Economy Grow? The Geography of Nordic Sustainability Transitions \(GONST\)](#)

Project leader: Teis Hansen, Lund University. Leader WP5 (Policy Learning): Håkon Finne (hakon.finne@sintef.no)
Programme: Nordic Green Growth Research and Innovation Programme, Nordic Innovation, NordForsk and Nordic Energy Research, 2017-2020
Budget: 20 mill NOK



Appendix 3: Publications

Journal papers

1. Aall, Carlo; Hall, Michael C.; Groven, Kyrre. *Tourism: Applying Rebound Theories and Mechanisms to Climate Change Mitigation and Adaptation. I: Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon*. Springer 2016 ISBN 978-3-319-38805-2. s. 209-227
2. Agra, Agostinho; Christiansen, Marielle; Ivarsøy, Kristine S.; Solhaug, Ida Elise; Tomasgard, Asgeir., Combined ship routing and inventory management in the salmon farming industry. *Annals of Operations Research.*, 2016
3. Aune, Margrethe; Godbolt, Åsne Lund; Sørensen, Knut Holtan: Mismatch or misunderstanding? Calculation and qualculation among economists and consumers in their framings of the electricity market. *Acta Sociologica* 2016
4. Aune, Margrethe; Godbolt, Åsne Lund; Sørensen, Knut Holtan; Ryghaug, Marianne; Karlstrøm, Henrik; Næss, Robert: Concerned consumption. Global warming changing household domestication of energy. *Energy Policy* 2016 ;Volum 98. s. 290-297
5. Berrill, Peter; Arvesen, Anders; Scholz, Yvonne; Gils, Hans Christian; Hertwich, Edgar G.: Environmental impacts of high penetration renewable energy scenarios for Europe. *Environmental Research Letters* 2016 ;Volum 11:014012.
6. Bjørgum, Øyvind; Netland, Torbjørn H.: Configuration of supply chains in emerging industries: A multiple-case study in the wave-and-tidal energy industry. *International Journal of Manufacturing Technology and Management (IJMTM)* 2016
7. Diego Garcia-Gusani, Diego Iribarren, Mario Martin-Gamboa, Javier Dufour, Kari Espegren, Arne Lind "Integration of life-cycle indicators into energy optimisation models: the case study of power generation in Norway." *Journal of Cleaner Production* 112, Part 4: 2693-2696, 2016.
8. Diego Garcia-Gusani, Kari Espegren, Arne Lind, Martin Kirkengen. "The role of the discount rates in energy systems optimisation models." *Renewable and Sustainable Energy Reviews* 59: 56-72, 2016.
9. Egging, Ruud; Fleten, Stein-Erik; Grønvik, Ida Alexandra Utheim; Hadziomerovic, Ajla; Ingvoldstad, Nina. *Linear Decision Rules for Hydropower Scheduling under Uncertainty*. *IEEE Transactions on Power Systems* 2016
10. Egging, Ruud; Holz, Franziska. Risks in global natural gas markets: Investment, hedging and trade. *Energy Policy* 2016 ;Volume 94. p. 468-479
11. Egging, Ruud; Pichler, Alois, Kalvø Øyvind, Walle-Hansen, Thomas, 2016. Risk Aversion in Imperfect Natural Gas Markets. *European Journal of Operational Research*. 2016
12. Ellingsen, Linda Ager-Wick; Singh, Bhawna; Strømman, Anders Hammer. The size and range effect: lifecycle greenhouse gas emissions of electric vehicles. *Environmental Research Letters* 2016 ;Volum 11.(5) s. –
13. Fischer, David; Lindberg, Karen Byskov; Madani, Hatef; Wittwer, Christof: Impact of PV and variable prices on optimal system sizing for heat pumps and thermal storage. *Energy and Buildings* 2016 ;Volum 128. s. 723-733
14. Fodstad, Marte, Egging, Ruud, Midthun, Kjetil and Tomasgard, Asgeir: Stochastic Modeling of Natural Gas Infrastructure Development in Europe under Demand Uncertainty, *Energy economics*, accepted, 2016
15. Fodstad, Marte; Midthun, Kjetil Trovik; Tomasgard, Asgeir; Egging, Ruud. Natural Gas Infrastructure in Europe: Stochastic Modeling of an Uncertain Demand. *Energy Journal* 2016
16. Fyhn, Håkon; Keskitalo, Carina H.; Juhola, Sirkku; Baron, Nina; Klein, Johannes: Implementing Local Climate Change Adaptation and Mitigation Actions: the Role of Various Policy Instruments in a Multi-Level Governance Context. *Climate* 2016 ;Volum 4.(1)
17. Garcia-Gusano, Diego; Espegren, Kari Aamodt; Lind, Arne; Kirkengen, Martin. The role of the discount rates in energy systems optimisation models. *Renewable & Sustainable Energy Reviews* 2016 ;Volum 59. s. 56-72. IFE
18. Garcia-Gusano, Diego; Iribarren, Diego; Martin-Gamboa, Mario; Dufour, Javier; Espegren, Kari Aamodt; Arne, Lind. Integration of life-cycle indicators into energy optimisation models: The case study of power generation in Norway. *Journal of Cleaner Production* 2016 ;Volum 112. s. 2693-2696 IFE
19. Graabak, Ingeborg; Wu, Qiuwei; Warland, Leif; Liu, Zhaoxi. 2016. Optimal planning of the Nordic transmission system with 100% electric vehicle penetration of passenger cars by 2050. *Energy* 2016 ;Volum 107. s. 648-660. ENERGISINT
20. Haugseth, Jan Frode; Huseby, Vilde Blix; Skjølsvold, Tomas Moe. Ti klimalogikker - En kvalitativ analyse av klimatiltak i norsk offentlig debatt (2007-2013). *Tidsskrift for samfunnsforskning* 2016 ;Volum 56.(3) s. 285-314. NTNU
21. Heidenreich, Sara: Out of sight, out of mind? Controversy over offshore wind energy in Norway's news media. *Science as Culture* 2016
22. Hellemo, Lars & Tomasgard, Asgeir: A Generalized Global Optimization Formulation of the Pooling Problem with Processing Facilities and Composite Quality Constraints, *Journal of the Spanish Society of Statistics and Operations Research(TOP)*, vol 24:209, 2016.
23. Holden, Erling., Linnerud, Kristin & Banister, David (2016): The imperatives of sustainable development: needs, equity, and limits. 2016-10-02 (RELEASE)
24. Korsnes, Marius: A sustainable Chinese catch-up? Product quality and interactive learning in the offshore wind industry. *International journal of technological learning, innovation and development* 2016 ;Volum 8.(2) s. 172-196
25. Korsnes, Marius: Ambition and ambiguity: Expectations and imaginaries developing offshore wind in China. *Technological forecasting & social change* 2016 ;Volum 107. s. 50-58
26. Korsnes, Marius; Ryghaug, Marianne: With license to build: Chinese offshore wind firms rejecting European certificates. *Technology Analysis & Strategic Management* 2016
27. Kriegler, Elmar; Bauer, Nico; Popp, Alexander; Schwanitz, Valeria Jana. Fossil-fueled development (SSP5): An energy and resource intensive scenario for the 21st century. *Global Environmental Change* 2016

28. Lindberg, Karen Byskov; Fischer, David; Doorman, Gerard L.; Korpås, Magnus; Sartori, Igor: Cost-optimal energy system design in Zero Energy Buildings with resulting grid impact: A case study of a German multi-family house. *Energy and Buildings* 2016 ;Volum 127. s. 830-845
29. Lindberg, Karen Byskov; Doorman, Gerard L.; Fischer, David; Korpås, Magnus; Ånestad, Astrid; Sartori, Igor: Methodology for optimal energy system design of Zero Energy Buildings using mixed-integer linear programming. *Energy and Buildings* 2016 ;Volum 127. s. 194-205
30. Linnerud, Kristin & Holden, Erling: Five criteria for global sustainable development. *International Journal of Global Environmental Issues* 2016 (RELEASE)
31. Nykamp, H. A transition to green buildings in Norway, *Environmental Innovation and Societal Transition*, 2016
32. Ottesen, Stig Ødegaard; Tomasgard, Asgeir; Fleten, Stein-Erik., Prosumer bidding and scheduling in electricity markets., *Energy*. vol. 94, 2016.
33. Pichler, Alosis; Tomasgard, Asgeir. Nonlinear Stochastic Programming With a Case Study in Continuous Switching. *European Journal of Operational Research* 2016 ;Volum 252.(2). NTNU
34. Ryghaug, Marianne; Toftaker, Marit: Creating transitions to electric road transport in Norway: The role of user imaginaries. *Energy Research & Social Science* 2016 ;Volum 17. s. 119-126
35. Saha, Parmita; Idsø, Johannes: New hydropower development in Norway: Municipalities' attitude, involvement and perceived barriers. *Renewable & Sustainable Energy Reviews* 2016 ;Volum 61. s. 235-244 (RELEASE)
36. Schwanitz, Valeria Jana; Wierling, August. Offshore wind investments – Realism about cost developments is necessary. *Energy* 2016 ;Volume 106. p. 170-181
37. Skjølsvold, Tomas Moe; Jørgensen, Susanne; Ryghaug, Marianne. Users, design and the role of feedback technologies in the Norwegian energy transition. An empirical study and some radical challenges. *Energy Research & Social Science* 2016. NTNU
38. Steen, Markus: Reconsidering path creation in economic geography: aspects of agency, temporality and methods. *European Planning Studies* 2016 ;Volum 24.(9) s. 1605-1622
39. Steinmo, Marianne; Rasmussen, Einar: How firms collaborate with public research organizations: the evolution of proximity dimensions in successful innovation projects. *Journal of Business Research* 2016 ;Volum 69.(3) s. 1250-1259
40. Throndsen, William. What do experts talk about when they talk about users? Expectations and imagined users in the smart grid. *Energy Efficiency* 2016
41. Wierling, August; Schwanitz, Valeria Jana. Robinson und der ferne Osten. Sibirien in Reiseberichten zwischen 1670 – 1922. *OAG-NOTIZEN* 2016 ;Volume 3. p. 10-18
42. Ydersbond, Inga Margrete; Korsnes, Marius. What drives investment in wind energy? A comparative study of China and the European Union. *Energy Research & Social Science* 2016 ;Volum 12.(2) s. 50-61

Dissertations

1. Ausrød, V. L. (2016) Commercialization of renewable energy in rural India: Entrepreneurial activities for building a profitable venture at the base of the pyramid. PhD Dissertation, NTNU
2. Bjørgum, Ø. (2016). New firms developing novel technology in a complex emerging industry: The road towards commercialization of renewable marine energy technologies. PhD Dissertation, NTNU.
3. Gilpin, G. (2016) Life cycle analysis of 1st through 4th generation biofuels. PhD dissertation. Vestforsk/UMB
4. Hellemo, L. (2016). Managing Uncertainty in Design and Operation of Natural Gas Infrastructure. PhD Dissertation, NTNU. (ekstern finansiert)
5. Jakobsen, S. (2016) Environmental innovation cooperation: The development of cooperative relationships between Norwegian firms. PhD Dissertation, HHB/UiN (Ekstern finansiert)
6. Pham Thi Bich Ha, Building and Transforming Dominant Technology. The Portland Cement Industry, PhD thesis, TIK, University of Oslo 2016
7. Reinertsen, H. (2016) Optics of evaluation. Making Norwegian foreign aid an evaluable object, 1980-1992, PhD thesis, TIK, University of Oslo
8. Skar, C. (2016). Modeling low emission scenarios for the European power sector. PhD Dissertation, NTNU.
9. Steen, M. (2016). Becoming the next adventure? Exploring the complexities of path creation: The case of offshore wind power in Norway. PhD Dissertation, NTNU. (ekstern finansiert)
10. Throndsen, W. (2016) Response and Responsibility: Smart meters, end use, and the possibility of a material public. PhD Dissertation, NTNU.
11. Weaver, T. (2016). Strategic Management of Power Producers: Implementing international renewable power production growth strategies. PhD Dissertation, NTNU.
12. Yttri, G. (2016). Gjennombrøt og kjenneteikn: Liner i saga om høgare utdanning i Sogn og Fjordane. PhD Dissertation. UiO. (Ekstern finansiert)

Articles published in anthologies

1. Arvesen, Anders; Zhongying, Wang; Jingting, Yuan; Mingliang, Liu; Hertwich, Edgar G.. Wind power. I: Green energy choices: the benefits, risks and trade-offs of low-carbon technologies for electricity production. United Nations Environment Programme 2016 ISBN 978-92-807-3490-4. s. 205-253
2. Aune, Margrethe; Støa, Eli: Second homes in Norway – Multiple Homes and Patterns in Distributed Ways of Residing. I: Ways of Residing in Transformation – Interdisciplinary Perspectives. Ashgate 2016 ISBN 9781472426079. s. 57-76
3. Espegren, K., Lind, A., & Rosenberg, E. Nordic Energy Technology Perspectives - Cities, flexibility and pathways to carbon-neutrality, International Energy Agency (IEA) 2016.
4. Hertwich, Edgar G.; Aloisi de Lardere, Jacqueline; Arvesen, Anders; Bayer, P.; Bergesen, Joseph; Bouman, Evert; Gibon, Thomas; Heath, Garvin; Peña, Claudia; Purohit, P.; Ramirez, Andrea; Suh, Sangwon: Green energy choices: the benefits, risks and trade-offs of low-carbon technologies for electricity production. United Nations Environment Programme 2016 (ISBN

- 978-92-807-3490-4) 456 s.
5. Hertwich, Edgar G.; Weinzettel, Jan; Bouman, Evert; Gibon, Thomas; Arvesen, Anders; Knápek, Jaroslav. Matching supply and demand: grid and storage. I: Green energy choices: the benefits, risks and trade-offs of low-carbon technologies for electricity production. United Nations Environment Programme 2016 ISBN 978-92-807-3490-4. s. 397-423
 6. Korsnes, Marius (2016): Kinas grønne revolusjon. Hva skjer på klima- og energifeltet i Kina - og hvorfor? i Kina tar vinden i bruk. S 58-63.
 7. Lindberg, Karen Byskov; Dyrendahl, Tore; Doorman, Gerard L.; Korpås, Magnus; Øyslebø, Eirik; Endresen, Harald; Skotland, Christer Heen: Large scale introduction of Zero Energy Buildings in the Nordic Power System. I: 13th International Conference on the European Energy Market, EEM 2016. IEEE conference proceedings 2016 ISBN 978-1-5090-1297-8
 8. Linnerud, Kristin & Holden, Erling: FN's bærekraftsmål--veike, vage og verdiløse?. Klima. Norsk magasin for klimaforskning 2016 (RELEASE)
 9. Linnerud, Kristin (2016): Nei til elsertifikater. Klima. Norsk magasin for klimaforskning 2016 (RELEASE)
 10. Linnerud, Kristin (2016): Norsk fornybarpolitikk - tre anbefalinger. Klima. Norsk magasin for klimaforskning 2016 (RELEASE)
 11. Purohit, P.; Saurat, Mathieu; Heath, Garvin; Viebahn, Peter; Arvesen, Anders; Gibon, Thomas. Concentrating solar power. I: Green energy choices: the benefits, risks and trade-offs of low-carbon technologies for electricity production. United Nations Environment Programme 2016 ISBN 978-92-807-3490-4. s. 255-305
 12. Ryghaug, Marianne; Skjølvold, Tomas Moe. Climate Change Communication in Norway. I: Oxford Research Encyclopedia of Climate Science. Oxford University Press 2016 ISBN 9780190228620. NTNU
 13. Santarius, Tilman; Aall, Carlo; Walnum, Hans Jakob: Introduction: Rebound Research in a Warming World. I: Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon. Springer 2016 ISBN 978-3-319-38805-2. s. 1-17
 14. Santarius, Tilman; Walnum, Hans Jakob; Aall, Carlo (2016): Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon. Springer 2016 (ISBN 978-3-319-38805-2) 294 s.
 15. Santarius, Tilman; Walnum, Hans Jakob; Aall, Carlo: Conclusions: Respecting Rebounds for Sustainability Reasons. I: Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon. Springer 2016 ISBN 978-3-319-38805-2. s. 287-294
 16. Skar, Christian; Egging, Ruud; Tomasgard, Asgeir. The role of transmission and energy storage for integrating large shares of renewables in Europe. IAAE Energy Forum 2016 ;Volum Q1. s. 35-36
 17. Sørensen, Knut Holtan: Innovasjonspolitik og nyskapingsspraksiser. I: Det norske samfunn. Gyldendal Akademisk 2016 ISBN 978-82-05-49021-5. s. 112-138
 18. Tomasgard, A., Møller-Holst, S., Thomassen, M., Bull-Berg, H., Damman, S. og Bjørkvoll, T., "Nasjonale rammebetingelser og potensial for hydrogensatsingen i Norge", SINTEF-rapport A27350, 2016.
 19. Walnum, Hans Jakob; Aall, Carlo. Transportation: Challenges to Curbing Greenhouse Gas Emissions from Road Freight Traffic. I: Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon. Springer 2016 ISBN 978-3-319-38805-2. s. 243-267
 20. Walnum, Hans Jakob; Andrae, Anders. The Internet: Explaining ICT Service Demand in Light of Cloud Computing Technologies. I: Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon. Springer 2016 ISBN 978-3-319-38805-2. s. 227-243
 21. Wicken, Olav, Industrial Diversification Processes and Strategies in an Oil Economy: Norway. In Economic Diversification Policies in Natural Resource Rich Economies. Routledge 2016

Invited lecturers and guest researchers

1. Baltensperger, Tobias. March -May 2016, PhD from ETH Zurich (visited Ruud Egging)
2. Blacker, Sarah from Max Planck Institute, Tyskland visited TIK (UiO) 02.11.2016. Title on presentation: Making traditional knowledge matter: Environmental contamination, Indigenous Health, and Oil Production in Canada
3. Durant, Darrin from University of Melbourne, Australia visited TIK (UiO) 23.09.2016. Title on presentation: Misreading Experts: The case of the politics of climate change
4. Finardi, Erlon. (Santa Catarina, Florianópolis) Nonlinear Nonconvex Problems in Generalized Benders Approach. 10-Mar-2016
5. Gabriel, Steven. University of Maryland, March 1 week
6. Gabriel, Steven. University of Maryland, October 1 week
7. Golbon Zakeri, University of Auckland, visited NHH from 17/8-6/9, 2016. The visit was linked to CenSES-related research activities, and it was partly financed by CenSES.
8. Härtel, Philipp (Fraunhofer IWES) Implications of alternative flexibility options for the cost-benefit allocation in offshore grids. 29-Apr-2016.
9. Mauro Viccaro, PhD candidate in the School of Agricultural, Forestry, Food and Environmental Sciences at the University of Basilicata, Italy. Working with Ruud Egging, Nov 2015-Apr/May 2016
10. Pauli, Gunter from ZERI, Japan visited TIK (UiO) on 02.12.2016. Title on presentation: Changing paradigms – Making transition towards a biobased economy possible
11. Piergiuseppe Morone, University of Rome. Presentation: Changing paradigms - Making the transition towards a bio-based economy possible, at TIK 08.11.2016
12. Ratinen, Mari from Finland visited TIK (UiO) on 02.12.2016. Title on presentation: Social construction of niche development towards sustainability transition. Examples from wind energy and photovoltaics
13. Sambeet Mishra, PhD student, University of Vilnius, November-May
14. Singh, Bismark. University of Texas Austin, October 25th. Visited Trondheim.
15. Sterling, Andrew from SPRU, UK visited TIK (UiO) on 30.11.2016.

Title on presentation: Emancipating Transformations: from Antropocene control to democratic care for the Earth

June 2016

16. Trivella, Alessio (italiener, mann), Danm Tekniske Universitet. Prosjekt m Norsk Hydro, Aluminium smelter operations; electricity sourcing and closure risk. (23.5-10.6/2016) (Visited Stein-Erik Fleten).
17. Xiaolin, W. Senior researcher in the School of Economics. Working with Ruud Egging on modeling of the Chinese Natural Gas market and Management, China University of Geosciences, in Wuhan City, August 2015- July 2016

13. Faller, Fabian; Steen, Markus; Ullern, Eli Fyhn. Smart specialisation and the green economy in European regions. Royal Geographical Society - Annual International Conference 2016; 2016-08-30 - 2016-09-02. SINTEF
14. Fyhn, Håkon; Søraa, Roger Andre; Solli, Jøran: Hands and plans: achieving dialogue between traditional crafts and technological systems at a high-tech building site. 4S/EASST Conference; 2016-08-31 - 2016-09-03
15. Hanson, Jens: Grønne spirer og brune røtter: Kan brunt næring-sliv bidra til grønn industriutvikling? Presented on: Energiforskningsskonferansen 2016. 26.05.16 - 26.05.16.

Conference presentations

1. Bjørnali, E., Giones, F., Nordskar, G., Wright, P., Klimas-Hermansen, V. 2016. Insights from Technology Entrepreneurship for Green-Tech Startups. Presented at the 100% Renewable Energy – Solutions for crossing borders. Flensburg. October, 4-5 2016.
2. Bjørndal, Endre; Bjørndal, Mette Helene; Midthun, Kjetil Trovik; Zakeri, Golbon. Congestion Management in a Stochastic Dispatch Model for Electricity Markets. 28th European Conference on Operational Research; 2016-07-03 - 2016-07-06. NHH SINTEF
3. Bjørndal, Endre; Bjørndal, Mette Helene; Midthun, Kjetil Trovik; Zakeri, Golbon. Congestion Management in a Stochastic Dispatch Model for Electricity Markets. IAEE International Conference 2016; 2016-06-19 - 2016-06-22. NHH SINTEF
4. Bjørndal, Endre; Burheim, Edda Neramoen; Bjørndal, Mette Helene; Dahl, Elise Ivara. Learning and Adaptation under Incentive Regulation: A Survey of Norwegian Electricity Distribution Companies. Berlin Conference on Energy and Electricity Economics (BELEC 2016); 2016-10-13 - 2016-10-13. NHH
5. Bjørndal, Endre; Bjørndal, Mette Helene; Cai, Hong. Flow-based Market Coupling in the European Electricity Market. INFORMS Annual Meeting 2016; 2016-11-13 - 2016-11-16. NHH
6. Cheng, Xiaomei; Bjørndal, Endre; Bjørndal, Mette Helene. Malmquist Productivity Analysis based on Robust Frontier Estimates. INFORMS Annual Meeting 2016; 2016-11-13 - 2016-11-16. NHH
7. Cheng, Xiaomei; Bjørndal, Endre; Bjørndal, Mette Helene. Malmquist Productivity Analysis based on Robust Frontier Estimates. IAEE International Conference 2016; 2016-06-19 - 2016-06-22. NHH
8. Egging, R. Pichler, Ø Kalvø, T Walle-Hansen, Risk aversion in imperfect natural gas market - Shale gas investment in Poland and Ukraine. Presented at INFORMS, Nashville, TN, USA,
9. Ellingsen, Linda Ager-Wick; Hung, Christine Roxanne; Strømman, Anders Hammer. Lifecycle impacts of lithium-ion batteries: a review. EVS29; 2016-06-19 - 2016-06-22
10. Espegren, Kari Aamodt; Lind, Arne. The Use of Bottom-up Optimisation Models in Different Modes for Analysing the Transition to Sustainable Urban Areas. International Energy Workshop; 2016-06-01 - 2016-06-03. IFE "
11. Espegren, Kari Aamodt; Remme, Uwe; Lind, Arne; Koljonen, Tiina; Lindroos, Tomi. Analysis of Urban Energy in the Nordic Region. International Association for Energy Economics; 2016-06-19 - 2016-06-22. IFE
12. Espegren, Kari, Remme, Uwe, Lind, Arne, Koljonen, Tiina & Lindroos, Tomi. "Analysis of Urban Energy in the Nordic Region", International Association for Energy Economics, Bergen, 19-22.
13. Faller, Fabian; Steen, Markus; Ullern, Eli Fyhn. Smart specialisation and the green economy in European regions. Royal Geographical Society - Annual International Conference 2016; 2016-08-30 - 2016-09-02. SINTEF
14. Fyhn, Håkon; Søraa, Roger Andre; Solli, Jøran: Hands and plans: achieving dialogue between traditional crafts and technological systems at a high-tech building site. 4S/EASST Conference; 2016-08-31 - 2016-09-03
15. Hanson, Jens: Grønne spirer og brune røtter: Kan brunt næring-sliv bidra til grønn industriutvikling? Presented on: Energiforskningsskonferansen 2016. 26.05.16 - 26.05.16.
16. Hanson, Jens; Steen, Markus; Weaver, Tyson; Normann, Håkon Endresen; Hansen, Gard Hopsdal: Path creation through branching and transfer or complementary resources: the role of established industries for new renewable energy technologies. American Association of Geographers Annual Meeting; 2016-03-29 - 2016-04-02
17. Heidenreich, Sara: Citizen Social Science in Schools: Involving students in finding and communicating solutions for energy efficient ICT practices. First International ECSA Citizen Science Conference; 2016-05-19 - 2016-05-21
18. Heidenreich, Sara; Ryghaug, Marianne: Creating energy citizenship through material participation. Energy and Society Conference; 2016-09-12 - 2016-09-14
19. Korsnes, Marius. The Entrepreneurial Chinese State: Innovation in China's wind turbine industry. Presented on: 2016 Eu-SPRI Conference: Exploring new Avenues for Innovation and Research Policies (CIRCLE - Lund University). 07.06.16 - 10.06.16
20. Lind, Arne, Espegren, Kari. "The Use of Bottom-up Optimisation Models in Different Modes for Analysing the Transition to Low Carbon Urban Areas", CIENS Urban Conference, Smart and green cities – for whom? 13. October 2016, CIENS, Oslo
21. Lind, Arne, Rosenberg, Eva. "Implications of Limited Foresight on Wind Park Investments in Norway", wholeSEM Conference UCL London UK, 28-29. April 2016
22. Lind, Arne; Espegren, Kari Aamodt. The Use of Bottom-up Optimisation Models in Different Modes for Analysing the Transition to Low Carbon Urban Areas. CIENS Urban Conference, Smart and green cities – for whom?; 2016-10-13 - 2016-10-13. IFE "
23. Lind, Arne; Rosenberg, Eva. Implications of Limited Foresight on Wind Park Investments in Norway. wholeSEM Conference UCL; 2016-04-28 - 2016-04-29. IFE "
24. Lindberg, Karen Byskov; Dyrendahl, Tore; Doorman, Gerard L.; Korpås, Magnus; Øyslebø, Eirik; Endresen, Harald; Skotland, Christer Heen: Large scale introduction of Zero Energy Buildings in the Nordic Power System. 13th International Conference on the European Energy Market; 2016-06-06 - 2016-06-09
25. Lindberg, Karen Byskov; Seljom, Pernille Merethe; Tomasgard, Asgeir; Doorman, Gerard L.; Sartori, Igor: Cost-optimal integration of ZEBs in the Scandinavian Energy System. 39th IAEE International Conference on Energy: Expectations and Uncertainty; 2016-06-19 - 2016-06-22
26. Linnerud, Kristin (2016): Tradable green certificates and feed-in tariffs: protection against price and policy risk. Presented on: Real Options. Theory meets practise. 20th annual international conference. Oslo and Trondheim 15.06.16 - 18.06.16 (RELEASE)

27. Linnerud, Kristin (2016): Tradable Green Certificates vs. Feed-in Tariffs: A note on risk. Presented on: the 39th International IAEE conference; 2016-06-19 - 2016-06-22 (RELEASE)
28. Liste Muñoz, Lucia; Heidenreich, Sara: Practicing proximity, doing sustainability: Experiments with cities and citizens' responses to climate change. 4S/EASST Conference; 2016-08-31 - 2016-09-03
29. MacKinnon, Danny; Dawley, Stuart; Menzel, Max-Peter; Sommer, Pascal; Steen, Markus; Karlsen, Asbjørn; Normann, Håkon Endresen; Hansen, Gard Hopsdal: Global production networks, energy transition and regional path creation: Offshore wind in the UK. American Association of Geographers Annual Meeting; 2016-03-29 - 2016-04-02
30. Mäkitie, Tuukka; Allan D. Andersen; Jens Hanson; Håkon Normann; Taran Thune (2016). Bounded synergy of green and black energy: Overlaps between offshore wind power and oil and gas sector in Norway. EurKind GCW 2016 conference, Valencia, Spain.
31. Mäkitie, Tuukka; Allan D. Andersen; Jens Hanson; Håkon Normann; Taran Thune (2016). Established sectors expediting clean technology industries? The Norwegian oil and gas sector's engagement in the emerging offshore wind power. International Sustainability Transitions Conference 2016, Wuppertal, Germany.
32. Normann, Håkon Endresen; Hanson, Jens: The role of the home market in international technological innovation systems. 2016 Eu-SPRI Conference; 2016-06-07 - 2016-06-10
33. Rydgren, Knut; Auestad, Inger; Halvorsen, Rune; Hamre, Liv Norunn; Sulavik, Jan. Restoring ecosystems: Predicting the future with help from successional rates. Presented on: The 10th European Conference on Ecological Restoration. Freising. 22.08.16 - 26.08.16 (RELEASE)
34. Ryghaug, Marianne. The dissociative dynamics of electric cars and smart meters in the transition to low carbon futures.. 11 th Interpretive Policy Analysis Conference; 2016-07-05 - 2016-07-08
35. Schwanitz, Valeria Jana. Expectations About Cost Developments of Energy Technologies. IEAA Conference; 2016-06-19 - 2016-06-22
36. Schwanitz, Valeria Jana; Wierling, August. Extrapolated Trends versus Energy Model Projections -- Global Distribution Dynamics Derived from Regional Kaya Decomposition. IEAA Conference; 2016-06-19 - 2016-06-22
37. Skar, Christian; Tomasgard, Asgeir; Valdes, Gerardo Alfredo Perez; Doorman, Gerard Lodewijk. Large scale power system investment planning using multi-horizon stochastic programming. XIV International Conference on Stochastic Programming; 2016-06-25 - 2016-07-01
38. Skjølvold, Tomas Moe: Energy transitions: expansion zones and transition processes. Annual meeting of 4S/EASST; 2016-08-31 - 2016-09-03
39. Skjølvold, Tomas Moe; Ryghaug, Marianne; Throndsen, William: Smart energy transitions. Challenges for governance and management. Disclosing sustainability. The Transformative Power of Transparency?; 2016-06-24
40. Sraml Gonzalez, Jakoba; Tuukka Mäkitie; Håkon Normann; Keith Smith; Taran Thune (2016). The green fling: Market volatility in incumbent industries and sustainability transitions in an oil-fuelled economy. SPRU 50 years Conference, Brighton, UK.
41. Steen, Markus; Ullern, Eli Fyhn; Faller, Fabian. Energy in smart specialization strategies: an exploratory study. European Forum for Studies of Policies for Research and Innovation; 2016-06-07 - 2016-06-10
42. Søråa, Roger Andre; Fyhn, Håkon; Solli, Jøran: 21st century green-collar workers. 4S/EASST Conference; 2016-08-31 - 2016-09-03
43. Sørensen, Knut Holtan. The culture of energy efficiency and the gaps in engineering knowledge. 2nd UNI-SET Energy Clustering Event; 2016-09-26 - 2016-09-28
44. Tartiu, Valentina Elena; Castellacci, Fulvio; Strøm-Andersen, Nhat. Presentation: Emerging Landscape of Bioeconomy in Norway: A Dynamic Actor Network Analysis on the Forestry Sector. Nordic Research and Innovation Pathways towards a Circular Bio-economy NoRest Conference; 2016-10-25 - 2016-10-26
45. Throndsen, William. Hvordan kan forbrukerne bidra i overgangen til et fornybart samfunn?. Norges Energidager; 2016-10-13 - 2016-10-14
46. Tomasgard, Asgeir: The future of energy Production and distribution : The future grid, NorRen summer school, Sogndal, 2016.
47. Tomasgard, Asgeir: The Role of Transmission and Storage in the European Energy System Towards 2030 and 2050, IAEE International Conference, Bergen, June 2016.
48. Tomasgard: Asgeir: Energi og klima – politikkenes store utfordring, CenSES årskonferanse 2016.
49. Tomasgard, Asgeir: A stochastic complementarity model for modeling energy and climate policy, ICSP XIV, Buzios, July, 2016.
50. Tomasgard, Asgeir: Analyzing European Climate And Energy Policy Using Stochastic Optimization, INFORMS International conference, Nashville, November 2016.
51. Tomasgard, Asgeir: Modelling energy and climate policy using multi-horizon stochastic programming, Plenary, Computational Management Science 2016, Salamanca, 2016.
52. Weaver, Tyson; Aspelund, Arild; Steen, Markus. The Role of Firm Level Motivations, Barriers and Managerial Capabilities for Diversification in Energy System Transitions. 39th IAEE International Conference; 2016-06-19 - 2016-06-22
53. Wicken, Olav, Innovation Studies and Sustainable Development Goals. Studying, transformation, transition and conflicting objectives. IndiaLics; Trivandrum, 2016-03-16
54. Wicken, Olav; Andersen, Allan Dahl Andersen. Natural Resource diversity and knowledge ideosyncrasies: Implications for innovation, development, and sustainability. SPRU conference on Transforming Innovation, Brighton, 2016-09-07
55. Wicken, Olav; Smith, Keith Harold, Resource-Based Growth in Small Open Economies: Towards a Theory. Australian and Pacific Economic and Business History conference, Adelaide; 2016-02-12
56. Zakeri, Golbon; Pritchard, Geoff; Bjørndal, Mette Helene; Bjørndal, Endre. A Revenue Adequate, Cost Recovering, Uniform Pricing Scheme For Wind Generation. INFORMS Annual Meeting 2016; 2016-11-13 - 2016-11-16

Dissemination and presentations for partners

1. Aall, C. (2016): Berekraftig eller berre kraftig transport? Innlegg på møte med Arbeiderpartiet sine medlemmer i Stortinget sin transport og kommunikasjonskomiteen, Sogndal, 13.09.2016.
2. Aall, C. (2016): Berekraftig utvikling eller berre kraftig utvikling? Innlegg på seminaret «Er bærekraft forenelig med økonomisk vekst?» arrangert av Linjeforening for økonomi i Sogndal, Sogndal, 13.4.2016
3. Aall, C. (2016): The rebound effect challenging sustainability. Examples from tourism and transport. Presentation at the Oslo Sustainability Workshop, University of Oslo 27-29 June 2016
4. Bjørnali, E., Giones, F., Nordskar, G., Wright, P., 2016. Reveal or Conceal? Signaling Strategies to build legitimacy in clean-tech ventures. Presented at the IRCA Seminar, MCI Innovation Lab, SDU. Sønderborg. October 7th 2016.
5. Bjørnali, E., Giones, F., Nordskar, G., Wright, P., Klimas-Herman- sen, V. 2016. Insights from Technology Entrepreneurship for Green-Tech Startups. Presented at the 100% Renewable Energy – Solutions for crossing borders. Flensburg. October, 4-5 2016.
6. Bjørndal, Endre. Strukturinsentiver i reguleringsmodellen - alternativer til CRS. Medlemsmøte, Energi Norge; 2016-03-10 - 2016-03-10. NHH
7. Bjørndal, Endre; Bjørndal, Mette Helene; Burheim, Edda Ner- moen; Dahl, Elise Ivara. Nettselskapenes tilpasning til den økon- omiske reguleringen. Medlemsmøte, Energi Norge; 2016-09-21 - 2016-09-21. NHH
8. Fleten, Stein-Erik: Bidding of hydroelectric power into short- term markets. Energy Research Workshop Disentis 2016; 2016- 01-27 - 2016-01-29
9. Hanson, Jens: Muligheter og barrierer for utvikling og inter- nasjonalisering i solindustrien. Workshop Arena Solklyngen (OREEC). 13.01.16 - 13.01.16.
10. Heidenreich, Sara: Kontroverser rundt vindkraft. Skolelaborato- riet, NTNU; 2016-03-15
11. Holden, Erling (2016): From 0 to 20 min in 20 years (Or: The battle for land!). NorRen Summer School. Sogndal. 07.08.16 - 12.08.16 (RELEASE)
12. Holden, Erling (2016): Sustainable mobility: the concept and its implications. NorRen Summer School; 2016-08-07 - 2016-08-12 (RELEASE)
13. Korsnes, Marius: Doing Research in China: There and Back Again. Presented on: DION 2016 Annual General Meeting & Board Election (Annual meeting). Klubben, Samfundet. 10.05.16.
14. Korsnes, Marius: User Perspectives on Energy Technologies. Presented on: Sino-Norwegian Partnership on Sustainable En- ergy, Kick-off Meeting (Tsinghua University Campus, Beijing). 13.05.16.
15. Linnerud, Kristin (2016): Bør vi fortsette med elsertifikater etter 2020? Innlegg på frokostseminar med tittel: Støtte til norsk fornybar energi -- en god klimastrategi etter 2020? 15.03.16 - 15.03.16 (RELEASE)
16. Linnerud, Kristin (2016): Gir fornybarstøtte lønnsomme inves- teringer - og er det bra for klima?. Innlegg på 'Energiseminaret 2016', et årlig heldagsseminar arrangert av studenter ved HiB.; 2016-03-16 - 2016-03-16 (RELEASE)
17. Linnerud, Kristin (2016): Snubletråder for fornybarpolitikken: usikker politikk og uregulerbar kraft. Innlegg/paneldebatt på sesjonen 'Fremtidens fornybarpolitikk' på Arendalsuka; 2016- 08-16 - 2016-08-16 (RELEASE)
18. Ryghaug, Marianne. Forbrukerrollen i elektrifisering av tranport. CenSES workshop; 2016-03-11
19. Ryghaug, Marianne: STS perspectives on Ev adoption and trans- portation practices. Research Workshop on the Social and His- torical Dimensions to Transport; 2016-01-14 - 2016-01-15
20. Ryghaug, Marianne; Skjølsvold, Tomas Moe; Heidenreich, Sara; Korsnes, Marius: Energiforskningen ved Senter for energi og samfunn, CenSES og KULT. Smakebiter. ENERGIX forskning og dialogmøte; 2016-05-31
21. Schwanitz, Valeria Jana. The World in 2050 -- How to project what can't be projected?. Lecture series at Okinawa Institute of Science and Technology, Japan; 2016-11-01
22. Skar, Christian. Kvantifisering av scenarier: Erfaringer fra pros- jektet LinkS og mulige datakilder. CenSES scenarioworkshop; 2016-09-20 - 2016-09-20
23. Skar, Christian. Modeling low carbon scenarios for the Europe- an power sector. Presentasjon hos Statoil; 2016-02-16 - 2016- 02-16
24. Skar, Christian. Transmission expansion and energy storage in future energy systems in Nordic countries: Benefits and challenges. Forelesning i FORN240: Energidistribusjon- og -la- gringssystemer; 2016-11-14 - 2016-11-14
25. Skar, Christian; Tomasgard, Asgeir. Modeling energy and cli- mate policy using multihorizon stochastic programming. Op- timization and Equilibrium in Energy Economics; 2016-01-11 - 2016-11-15
26. Skjølsvold, Tomas Moe. Towards a framework for studying tran- sition agency and transition processes. Technology, Science and Culture. Workshop and PhD course; 2016-04-14. NTNU
27. Skjølsvold, Tomas Moe: Smart energy systems and urban infra- structure. ARL working group workshop: smart grids - smart cities? Worksho; 2016-07-07 - 2016-07-08
28. Skjølsvold, Tomas Moe: Smart teknologi, smarte byer, grønne skift. Hva betyr det at noe "virker" i praksis?. Byutviklingssemi- nar, Trondheim Kommune; 2016-04-01
29. Sørensen, Knut Holtan: Innovasjonspolitik og nyskaping- spraksiser. Boklansering, Det norske samfunn; 2016-09-15 - 2016-09-15
30. Throndsen, William. Presentasjon av sentrale funn fra arbeidet med doktorgraden. ZEB Strategisamling; 2016-02-17 - 2016-02- 17
31. Tomasgard, A: "Europeisk klima- og energipolitikk: Hvordan på- virkes kraftmarkedene?" Trondheim Næringsforening, 15.9.16
32. Tomasgard, A: Carbon capture and storage in the European power sector, CICERO lunchforedrag , 13.4.2016
33. Tomasgard, A: Grønne sertifikater, fordelingseffekter og økonomiske effekter i en likevektsmodell? 14.4 CREE model forum 14.4.2016.

34. Tomasgard, Asgeir: Analyzing European Climate And Energy Policy Using Multi Horizon Stochastic Optimization, PhD workshop Oppdal, March 2016.
35. Tomasgard, Asgeir: Challenges in Energy system integration, Kick-off seminar, advisory board, Centre for Energy System Integration, Newcastle, October, 2016.
36. Tomasgard, Asgeir: National Circumstances and Challenges to Mitigation- Key forcing factors in Norway; Implications of Paris Workshop, University of Maryland, May 2016.
37. Tomasgard, Asgeir: Naturgassens rolle i Europas framtidige kraftsystem, VISTA-dagen, Det norske vitenskaps-akademi, November 2016.
38. Tomasgard, Asgeir: Slik kan vi nå lågutsleppssamfunnet, Inivitert plenary foredrag, Kraft i vest konferansen, Sandane, September 2016.
39. Tomasgard, Asgeir: Towards a Zero Emission Power System in 2050, Energy Transitions 2016, workshop, NTNU, Trondheim, October 2016.
40. Tomasgard, A: Modeling low carbon scenarios for the European power sector, 4 CREE model forum 14.4.2016.
41. Walnum, H,J (2016): Klimagassutslipp og godstransport. Innlegg på CenSES workshop knyttet til Grønne sertifikater og Dekarbonisering av transport. Kjeller, 11.03.2016.
42. Weaver, Tyson. Fornybar energi og regionalt verdiskaping. Innovasjonsfrokost: Fornybar energi; 2016-10-06 - 2016-10-06
- Thomas; Mattias, Bisailon. Nordic Energy Technology Perspectives 2016. Cities, flexibility and pathways to carbon-neutrality. OECD Publishing 2016 (ISBN 978-92-64257-66-5) CICERO IFE "
5. Fodstad, Marte. Measures and scenario studies for emission reduction : CenSES review. Trondheim: SINTEF Energi AS 2016 (ISBN 978-82-594-3675-7) 27 s. SINTEF Energi. Rapport(TR A7602) ENERGISINT
6. Jaehnert, Stefan: CenSES energy scenarios : design process and scenario description. Trondheim: SINTEF Energi 2016 (ISBN 978-82-594-3673-3) 21 s. SINTEF Energi. Rapport(TR A7590)
7. Korsnes, Marius & Sørensen, Knut H: Scenarios for the Norwegian Low Emission Society post 2050. Three different (Nor)ways to reach a low emission society in 2050 and beyond. ENOVA Trondheim. 2016.

Popular science

1. Korsnes, Marius (2016): Kinas grønne revolusjon. Hva skjer på klima- og energifeltet i Kina - og hvorfor? i Kina tar vinden i bruk. S 58-63.
2. Linnerud, Kristin & Holden, Erling: FN's bærekraftsmål--veike, vage og verdiløse?. Klima. Norsk magasin for klimaforskning 2016 (RELEASE)
3. Linnerud, Kristin (2016): Nei til elsertifikater. Klima. Norsk magasin for klimaforskning 2016 (RELEASE)
4. Linnerud, Kristin (2016): Norsk fornybarpolitikk - tre anbefalinger. Klima. Norsk magasin for klimaforskning 2016 (RELEASE)
5. Santarius, Tilman; Walnum, Hans Jakob; Aall, Carlo (2016): Rethinking Climate and Energy Policies: New Perspectives on the Rebound Phenomenon. Springer 2016 (ISBN 978-3-319-38805-2) 294 s.
6. Skar, Christian; Egging, Ruud; Tomasgard, Asgeir. The role of transmission and energy storage for integrating large shares of renewables in Europe. IAAE Energy Forum 2016 ;Volum Q1. s. 35-36
7. Tomasgard, A., Møller-Holst, S., Thomassen, M., Bull-Berg, H., Damman, S. og Bjørkvoll, T., "Nasjonale rammebetingelser og potensial for hydrogensatsingen i Norge", SINTEF-rapport A27350, 2016.

Reports and notes

1. Bjørndal, Endre; Bjørndal, Mette Helene; Cullmann, Astrid; Nieswand, Maria: Finding the Right Yardstick: Regulation under Heterogeneous Environments. Bergen: Norges Handelshøyskole. Institutt for Foretaksøkonomi 2016 37 s. Norges Handelshøyskole. Institutt for Foretaksøkonomi. Discussion Paper(4)
2. Bjørndal, Endre; Bjørndal, Mette Helene; Midthun, Kjetil Trovik; Tomasgard, Asgeir: Stochastic Electricity Dispatch: A challenge for market design. Bergen: Norges Handelshøyskole. Institutt for foretaksøkonomi 2016 30 s. Norges Handelshøyskole. Institutt for Foretaksøkonomi. Discussion Paper(11)
3. Bjørndal, Endre; Bjørndal, Mette Helene; Midthun, Kjetil Trovik; Zakeri, Golbon: Congestion Management in a Stochastic Dispatch Model for Electricity Markets. Bergen: Norges Handelshøyskole. Institutt for foretaksøkonomi 2016 32 s. Norges Handelshøyskole. Institutt for Foretaksøkonomi. Discussion Paper(12)
4. Cazzola, Pierpaolo; Dumond, Astrid; Dulac, John; Palés, Araceli Fernández; Goner, Marine; Lyons, Lorcan; Munuera, Luis; Poponi, Daniele; Remme, Uwe; Teter, Jacob; Walsh, Therese; West, Kira; Koch, Hans Jørgen; Søyland, Svend; Smith, Benjamin Donald; Bernard Karlsson, Kenneth; Münster, Marie; Skytte, Klaus; Cabrera Pérez, Cristian Hernán; Venturini, Giada; Salvucci, Raffaele; Bramstoft Pedersen, Rasmus Bo; Kofoed-Wiuff, Anders; Hethey, János; Dupont, Nina; Sawatzki, Simon; Koljonen, Tiina; Lindroos, Tomi; Lehtilä, Antti; Koreneff, Göran; Airaksinen, Miimu; Davidsdottir, Brynhildur; Byrne, Conor; Fazeli, Reza; Shafiei, Ehsan; Jóhannesson, Sigurdur; Eyþorsson, Darri; Hallgrímsson, Jonas Hlynur; Espegren, Kari Aamodt; Lind, Arne; Rosenberg, Eva; Peters, Glen Philip; Karstensen, Jonas; Andrew, Robbie; Martinsson, Fredrik; Liljeborg, Marcus; Wråke, Markus; Unger,

CenSES in media

1. Aall, C. "Norge kan ikke tømme sine olje- og gassfelt". Aftenposten, 6. oktober 2016.
2. Aall, C. "Norge kan ikke tømme sine olje- og gassfelt". Vesterålen Avis, 12. oktober 2016.
3. Aall, C. "Spenner bein for seg selv" Bt.no 20. oktober.
4. Arvesen, Anders: Grønne energivalg: vindkraft under lupen. Natur Press [Internett] 2016-09-14
5. Arvesen, Anders: Mer utslipp med solcellekraft enn med vindkraft. Aftenposten [Avis] 2016-05-24
6. Arvesen, Anders: Store klimafordeler ved skifte til fornybar energi. Gemini.no [Internett] 2016-05-25

7. Eskeland, G. "Byene våre, sett fra Oslo". DN.no. 3. august 2016.
8. Eskeland, G. "Deling for miljø og klima". Dn.no. 12. januar 2016.
9. Eskeland, G. "Det blir ikke mer utslipp i Europa når du kjører elbil" Dagbladet.no 11. oktober 2016.
10. Eskeland, G. "Hopp og sprett i miljøpolitikken" Dn.no. 13.juni 2016.
11. Eskeland, G. "Politisk ansvar for skattehjelpen" Dn.no 7. april 2016.
12. Eskeland, G. "Snevriere økonomer, takk" Dagens Næringsliv. 7. oktober 2016.
13. Eskeland, G. "Statskupp i eiendom". Aftenposten. 1. mars 2016.
14. Eskeland, G. "Trump i klimaklaveret" Dn.no 23. november 2016.
15. Eskeland, G. "Vi kan ikke gi mat til bilene". Dn.no. 4. mars 2016.
16. Espegren, Kari Aamodt. Interview about energy scenarios and technology options for the Nordic region towards 2050. TV2 Nyhetskanalen [TV] 2016-05-24. Kari Espegren, IFE
17. Kari Espegren was interview about energy scenarios and technology options for the Nordic region towards 2050, TV2 Nyhetskanalen, 24. May 2016
18. Hanson, J. "Forskning er bra, men markedet må dra". Syslagronn.no. 24. mars. 2016.
19. Hanson, J. "Lider norsk oljebransje samme skjebne som Kodak?" Syslagronn.no 31.oktober 2016.
20. Korsnes, Marius: Vindkraftsatsing i Afrika. På NRK Her og Nå. 2016-03-07.
21. Linnerud, Kristin (2016): Subsidiene må ned. Montel nyhetsbrev [Fagblad] 2016-03-18 (RELEASE)
22. Linnerud, Kristin (2016): Varsler omfattende vindmølleutbygging. NRK [Internett] 2016-02-06 (RELEASE)
23. Linnerud, Kristin: 22 prosent av veksten havnet i Norge. Resten tok Sverige.. SYSLA [Avis] 2016-02-19 (RELEASE)
24. Linnerud, Kristin: Prisisiko er bra for investorer. SYSLA [Internett] 2016-02-05 (RELEASE)
25. Linnerud, Kristin: Strømprisene må opp. P4 [Radio] 2016-03-15 (RELEASE)
26. Normann, H.E. "Overgang til hva?". 31. august 2016.
27. Ryghaug, M. & Korsnes, M.S. "Staten skaffer «den nye oljen»" Dn.no 9. juni 2016.
28. Ryghaug, Marianne; Lagesen, Vivian Anette. Er kvinnelige akademikere pingler?. Adresseavisen 2016
29. Skjølvold, T. M "Bør du ha dårlig samvittighet for flyturen?". 9. august 2016.
30. Skjølvold, T.M "Folk lo og trodde jeg var gal" (omtale i media) Dn.no 15. april 2016.
31. Skjølvold, Tomas Moe: Røykelova - modell for det grønne skiftet?. Radio Folgefonn [Internett] 2016-03-08
32. Skjølvold, Tomas Moe: Tror røykeloven blir modell for det grønne skiftet. Sysla.no [Internett] 2016-03-08
33. Steen, M. "Innovasjonsstrategier for et grønt skifte" Ledelse og Teknikk. 19. september 2016.
34. Sørensen, Knut Holtan. Krever mer klimainnsats. Smaalenenes Avis [Avis] 2016-05-31
35. Sørensen, Knut Holtan. KRITISERER KLIMAAMBISJONENE. Helgelendingen [Avis] 2016-05-31
36. Sørensen, Knut Holtan. Misfornøyd med klimainnsatsen. Dagsavisen [Avis] 2016-05-31
37. Sørensen, Knut Holtan. Misfornøyd med klimainnsatsen. Nationen [Avis] 2016-05-31
38. Sørensen, Knut Holtan. Misfornøyd med klimainnsatsen. Telemarksavisa [Avis] 2016-05-31
39. Sørensen, Knut Holtan. Nordmenn er misfornøyd med klimainnsatsen. Fosnafolket [Avis] 2016-05-31
40. Sørensen, Knut Holtan. Nordmenn er misfornøyd med klimainnsatsen. NTBtekst [Avis] 2016-06-30
41. Sørensen, Knut Holtan. Vi kritiserer klimainnsatsen. Tvedestrandposten [Avis] 2016-05-31
42. Sørensen, Knut Holtan: Imponerer ikke. Ekstra [Avis] 2016-05-31
43. Tomasgard, Asgeir. "Produksjon av hydrogen kan bli ei gullgruve". NRK sogn og fjordane. 27.09.16.
44. Throndsen, William. – Strømselskapene overvurderer folks interesse for smart strømbruk. Teknisk Ukeblad [Fagblad] 2016-11-07
45. Wicken, O., Endresen, H. N & Hanson, J. Vi trenger retning for å lykkes med omstilling, Energi og Klima, 24.11.2016

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*“Knowledge and engagement for
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