



Oslo Centre for Research on Environmentally friendly Energy

Annual Report 2015



Executive Summary

CREE – Oslo Centre for Research on Environmentally friendly Energy was established in 2011 as a social science based energy research centre funded by the Research Council of Norway (FME Samfunn) with an annual grant of NOK 8 million for 5 years (2011-16), with a possible 3 years extension. The centre started its activities in August 2011. The decision whether the centre will get funding for the period 2016-2019 is still not made.

The main focus is on economic research as the research partners include the Frisch Centre, Department of Economics (ØI) at the University of Oslo (UoO), the Research department at Statistics Norway (SSB), and Tilburg Sustainability Center, the Netherlands. Cooperation with Centre for Development and Environment (UoO), Faculty of Law (UoO), Institute for Energy Technology broadens the research perspective. The user perspective is ensured by several partners from industry and government; Gassnova, Norwegian Environment Agency, Norwegian Ministry for Petroleum and Energy, Norwegian Water Resources and Energy Directorate, Statkraft Energy AS, Statnett SF and Statoil ASA.

The main aim of the centre is to collect and develop knowledge on the effects of regulatory conditions in the energy market and how these affect technological improvements such as innovation in and diffusion of technology for renewable energy, energy efficiency and carbon capture and storage. The centre provides a basis for better regulatory strategies and for policy instruments designed to reach energy and climate goals established nationally and internationally. CREE will also strive to develop methodological frameworks appropriate for achieving these goals.

Our portfolio is divided into five working packages that cover international climate and energy policy, innovation and diffusion, markets and regulation, evaluation of policy measures, and development of numerical models.

2015 has been the fourth full year of CREE activities. The activities have been concentrated on the research in the different working packages, the annual research workshop, CREE seminars and several user activities including the annual user conference and the Dialogue seminar. In 2015 we published 19 papers in international peer reviewed journals, one book and two book chapters, 24 working papers and 7 popular science articles. The CREE scientists have held

more than 100 conference and seminar presentations in 2015, and they have been mentioned numerous times in the media.



1 CREE

There is increasing evidence that the global climate is changing, and that this change is mainly due to human activities. As has been stressed by the latest IPCC assessment report published in 2014, climate change can have a substantial impact on the economy, ecosystems and human welfare, and may have catastrophic impacts for parts of the world. Thus, there is a need to reduce greenhouse gas emissions as well as to adapt to inevitable changes. In 2015 the international community was successful in reaching a treaty (the Paris agreement) where nearly all countries in the world agreed to reduce their greenhouse gas emissions. A lot of details have still to be worked out, but technology improvements are widely held to be essential if we are to achieve the required emission cuts.

However, there are several challenges beyond the purely technological. The research and development effort, as well as diffusion and utilization of new, environmentally friendly energy sources, require appropriate incentives. Another important challenge is the future design and improvements of climate and energy treaties, such as the Paris agreement, that will help achieving a better social outcome. In this respect effective policy instruments and fair

outcomes are important. The aim of CREE, Oslo Centre for Research on Environmentally friendly Energy, is to provide a solid base for policy making on these questions. CREE will also contribute to the collection and establishment of knowledge on how different regulations affect both the energy market and technological development. The centre studies policy instruments designed to reach the goals established in national and international energy and climate policy, while also examining how international treaties could be designed differently to better achieve broad participation and deep abatement.

The research of the centre is primarily grounded in economics, as reflected by the main research partners: Department of Economics at the University of Oslo, the Research Department at Statistics Norway, the Frisch Centre and the Tilburg Sustainability Centre. In addition, in 2014 the centre has drawn on other disciplinary perspectives through cooperation with researchers from other disciplines within the social sciences, law and technology.

The centre has the following vision which is stated in our Strategic Plan:

- We want to be a leading international research centre within energy, environmental and resource economics.
- We will generate knowledge that can contribute to a cost-effective and sustainable exploitation of Norwegian and international energy resources by industry and governments, as well as an effective and fair climate and energy policy, both nationally and internationally.
- We will contribute to recruitment and training at the master, doctoral and post doctoral levels in energy and environmental economics at the University of Oslo. Recruiting women to research will have a particular focus.

This report summarizes the activities and the achievements of the centre in 2015.

2 Research plan and strategy

For the period 2011-15, CREE has organized its research into five different working packages:

Working Package I: The International Politics of Climate and Energy

(Research Directors: Michael Hoel, Department of Economics, University of Oslo, and Mads Greaker, Statistics Norway)

The research questions in this working package focus on the following issues:

- Improving the current climate regime – increase incentives to join and comply
- Alternative treaty forms – sector based treaties; research and development (R&D) treaties
- Dealing with non-signatories – preventing carbon leakage
- Equity issues – intergenerational vs. intragenerational
- Implications of the above for energy market policies

Working Package II: Innovation and Diffusion policy

(Research Director: Rolf Golombek, Frisch Centre)

Important research questions in this working package are:

- What is the optimal mix of policy instruments to achieve innovation of environmentally friendly technologies?
- What is the optimal R&D policy for a small country with limited demand for carbon capture and storage (CCS), but with good technological competence?
- What types of market failures may arise in the application and diffusion of environmentally friendly technologies and how can we overcome them?

Working Package III: Regulation and Market

(Research Director: Nils-Henrik M. von der Fehr, Department of Economics, University of Oslo)

This research package focuses mainly on the electricity markets:

- Is there a contradiction between the policy to develop more green energy and regulations that will provide more efficiency in the energy market?
- Which policies can provide a sustainable use of energy?

- What is a reasonable level of energy security and how can we ensure that it is achieved?

Working Package IV: Evaluation of Environmental and Energy Policy Measures

(Research Director: Bente Halvorsen, Statistics Norway)

This is an empirical part of the project and studies the success of environmental and energy policy measures so far. Important questions are:

- What amount of energy savings is eaten up by increased consumption (rebound-effect)
- Can regulation of a good have unintended effects on close substitutes?
- What are the effects of soft policy measures?
- Focus on transportation: Does CO₂ taxation lead to higher demand for energy efficient vehicles? How does the increase in cars that run on biofuels and electricity affect emissions from road traffic?

Working Package V: The Next Generation of Numerical Models

(Research Director: Brita Bye, Statistics Norway)

This working package focuses on developing our numerical models by updating the data, improving the modeling of new technologies, and making innovation processes endogenous. The models will be used to study research questions in the other working packages. We use and develop

- The energy market model LIBEMOD
- Computable general equilibrium (CGE) models at Statistics Norway; the MSG-TECH model, the ITC (Induced Technological Change) model, and the SNoW-models (Statistics Norway World models).
- The new petroleum market model PETRO2

Our strategy is to follow the plans put down in the annual research plans, see

<http://www.cree.uio.no/projects.html>. The research will benefit from close contact with

subcontractors and user partners. For the vision and strategy of the total CREE activity, see the new CREE strategy plan, which was finalized in 2016:

http://www.cree.uio.no/adm/Strategi_Komunikasjon/CREE%20strategic%20plan%202015-2019.pdf.

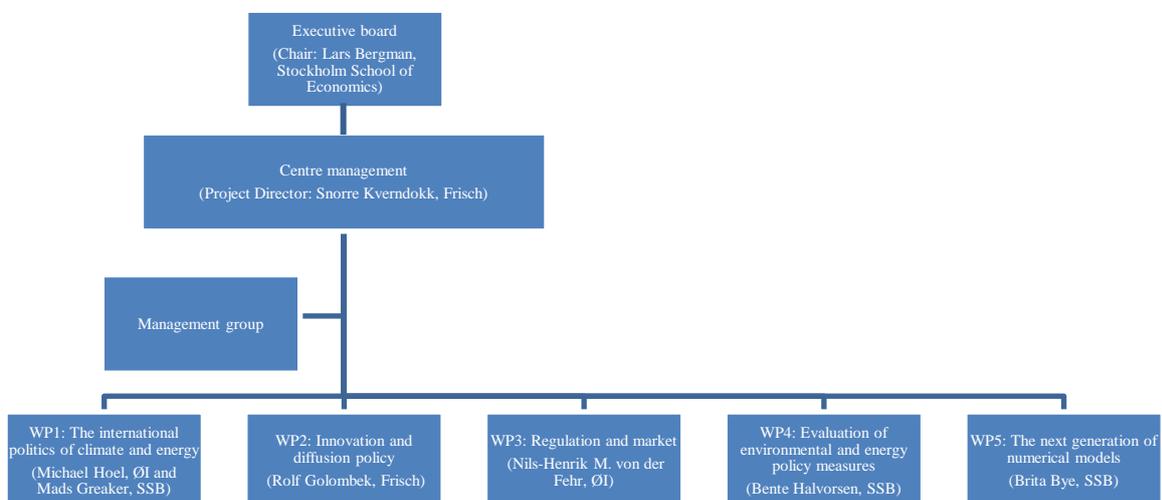
3 Centre organization

The organization of the centre in 2015 was as shown in the figure below.

The chair of the executive board does not represent any of the research partners, user partners or sub-contractors, and is therefore independent of the partners in CREE. Einar Hope, The Norwegian School of Economics, was the chair from 2011 until summer 2015. He was replaced by Lars Bergman, Stockholm School of Economics.

The first half of 2015, the board also consisted of one member from each of the three Norwegian research partners (Oddbjørn Raaum, Frisch; Taran Fæhn, SSB; Karine Nyborg, ØI), while the user partners are represented by two members, one from industry (Tor Kartevold, Statoil) and one from Government (Guro Børnes Ringlund, The Norwegian Environment Agency). From summer 2015, the board was extended so that all user partners were offered to appoint a member to the board. Thus, the user partner representatives in the board now became Guro Børnes Ringlund (The Norwegian Environment Agency), Kjell Berger (Statkraft), Jan Bråten (Statnett), Ellen Skaansar (Norwegian Water Resources and Energy Directorate) and Ståle Aakenes (Gassnova). The board had four meetings in 2015, see http://www.cree.uio.no/board_meetings.html.

The administration of CREE is located at the Frisch Centre. Dr. Snorre Kverndokk is the Project Director, and Jørg Gjestvang is the Projectcoordinator. The administration has regular meetings with the management group consisting of all the working package leaders to discuss matters of importance for the centre.



The partners of CREE are divided into research partners and user partners. The research partners are:

Ragnar Frisch Centre for Economic Research (Frisch Centre), Oslo (host institution)
Research department, Statistics Norway, Oslo
Department of economics, University of Oslo
Tilburg Sustainability Center, Netherlands

CREE has seven user partners:

Gassnova SF
Norwegian Environment Agency
Norwegian Ministry for Petroleum and Energy
Norwegian Water Resources and Energy Directorate
Statkraft Energy AS
Statnett SF
Statoil ASA

Statoil has announced that they will withdraw as a user partner from 15 March 2016.

The user partners of the centre contribute with funding and with members on the board, but also to the research with detailed knowledge about markets, technologies and politics.

Like in earlier years, we have a CREE luncheon about every second month that brings together the CREE network and contributes to unify the Norwegian CREE research institutions.

4 Funding

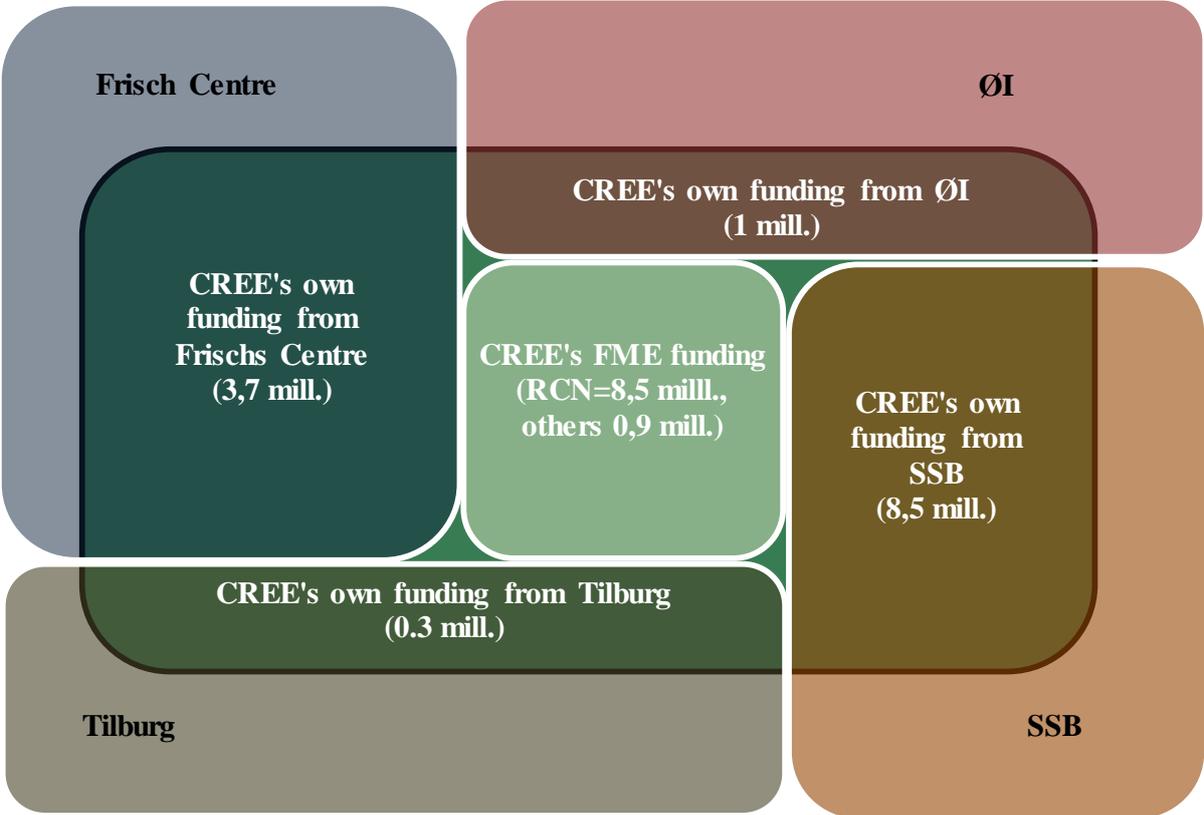
The funding of CREE in 2015 comes from various sources. The centre has an annual contribution from the Research Council of Norway (RCN) of NOK 8 million, user partner funding of NOK 350,000¹, and funding from the University of Oslo (UoO) of NOK 500,000. In addition, the centre has secured its own funding through other programs under RCN and

¹ Statoil withdrew its funding for 2015.

international research programs. The figure below gives an overview of the total funding in 2015. Note that in the figure, the funding from RCN is NOK 8.5 million, which is more than the annual grant. The reason is that some of the money is transferred from 2014. For more detailed information, see Appendix A2, which also shows the distribution of costs by CREE research partners and other units affiliated to the centre. Note that costs cover activities directly funded by RCN as well as activities financed by own funding, for example, funding through other research council programs.

CREE funding in 2015

Total CREE centre funding incl. own funding. (22,7 mill.)



Own funding = professional work that is beneficial to the CREE centre, but is not part of CREE's direct funding from The Research Council of Norway. Own funding should be at least 25% of the total budget of CREE.

FUNDINGS

The Research Council of Norway	8,5
Others	0,9
<i>Public funding (UoO)</i>	0,5
<i>Privat funding (User partners)</i>	0,4
Own funding	13,4
<i>Frisch</i>	3,7
<i>SSB</i>	8,5
<i>ØI</i>	1,0
<i>Tilburg</i>	0,3
<hr/> <hr/> Sum total funding	<hr/> <hr/> 22,7

5 Professional activities and results

The professional activities in 2015 have been concentrated on the research in the different working packages described above, the research workshop, CREE seminars, a common workshop with the other FME-S centres and several user activities including the user conference and the Dialogue seminar.

The CREE workshop took place in Oslo (Lysebu hotel) on 14-15 September. 35 people attended the workshop, mainly researchers from the research partners and sub-contractors in CREE, but also from our international network. Presentations covered research from all our work packages, and on subjects related to the work packages. The program is available at http://www.cree.uio.no/Workshop_Sem_Conf/5th_research_workshop.html .

The CREE seminar series included 20 seminars in 2015, among them 10 international visitors, 5 researchers from other fields than economics, and one user partner. The seminars were given at Statistics Norway, Frisch Centre and University of Oslo. For a list of all seminars, see http://www.cree.uio.no/seminars_earlier_years.html.

The user conference was held in April and was co-organized with CICEP, another social science FME centre. The conference was in Norwegian and the topic was “Norway's New Climate Targets”. This was very successful with, and about 100 people attended the conference. For more information about the conference, see http://www.cree.uio.no/Workshop_Sem_Conf/Bruerkonferanse_CREE_CICEP_150415.htm
1. CREE also organized a half-day Dialogue seminar with all its user partners, where the user

partners chose the subjects for dialogue; see http://www.cree.uio.no/Workshop_Sem_Conf/Dialogseminar_151109.html, as well as a seminar for the Norwegian Environment Agency.

In 2015 19 papers were published in international peer reviewed journals (see the Publications table below and Appendix A3). We have also published one book², two book chapters and produced 24 CREE working papers. Further, we have published 7 popular science articles and 16 other publications. The CREE scientists have also held more than 100 conference and seminar presentations. They have also been mentioned at least 26 times in the media.

Publications 2011-2015

	2011	2012	2013	2014	2015
Journal papers:	8	16	21	28	19
Books and article in books:		2	7	6	3
Working Papers:	9	21	30	20	24
Popular scientific articles:	4	10	12	7	7
Other publications:		5	3	2	18
Conference and seminar presentations:		100	100	74	108
CREE in the media:	9	41	31	23	26

For more information about the publications, see <http://www.cree.uio.no/publications.html>

Below we give some more details for our activities in 2015. However, we start by giving an overview of the research in the different work packages for the first years of the centre activity, before we give some highlights from the research in 2015. We also give some more details about our user activities and interdisciplinary contact and cooperation.



² Førsund, F. (2015): *Hydropower Economics*. Second Edition. New York; Springer Science & Business Media.

5.1 A synthesis of the CREE research 2011-2105

The first period of the CREE centre comes to an end in the summer 2016. This gives a good opportunity to summarize our research in the first period for the different working packages.

Working Package 1: The International Politics of Climate and Energy

By the end of 2015 the UN climate negotiations ended with a treaty in Paris in which nearly all countries in the world agreed to reduce their emissions of greenhouse gasses (GHG).

Moreover, the countries restated their commitment to the 2⁰C-target. Although a success, the Paris treaty raises many challenges: First and foremost, the current emission reduction pledges are not large enough to reach the 20 C target. Second, there is no sanction mechanism built into the treaty aimed at countries not fulfilling their pledges. Third, everyone agrees that technological development is crucial for combatting climate change, but how the clean energy step up is going to happen is not formalized in the treaty.

Our research the last few years can shed light on the Paris treaty, such as its strength and weaknesses as well as its implications. The research in this working package is categorized into five topical areas: Improving the current climate regime, Alternative treaty forms, Dealing with non-signatories, Equity issues, and Implications for energy market policies.

In our research on alternative treaty forms, CREE has done game theoretic research that may throw light on the Paris treaty. Among others, we have found that the lack of a separate agreement on green technology investment may be a possible strength since this may allow for more participating countries. On the other hand, the short duration of the emission pledges – the emission pledges are to be revised every 5 years - may pose a problem. While some authors advocate a short duration for agreements and others a long duration, we have shown the importance of letting the duration be endogenously negotiated by committed countries. In particular, we find a positive relationship between depth, breadth, and length, that is, the longer the commitment periods, the more participants and the more ambitious mitigation plans. To take advantage of these relationships, it is important that follow up agreements focus only on emission levels and not on investments as well.

We have also looked at compliance mechanisms for a post-Kyoto climate agreement. In a cross-disciplinary paper (economics and political science) we outline a compliance enforcement system that is simple, flexible, potent, and credible. The main idea is that each

country must deposit a significant sum of money at ratification, and make additional yearly deposits during the preparation stage prior to the commitment period. When the commitment period ends, countries meeting or beating their emissions limitation target will receive a full refund, whereas countries failing to meet their target will forfeit part or all of their deposit. Provided each country's deposit is no less than its abatement costs, this system will effectively deter noncompliance.

In order to allow for high ambitions in the countries' mitigation efforts, the Paris treaty (Article 6) also recognizes trade in emission reductions between countries. Studies on emissions trading are categorized under the topic "Improving the current climate regime". Emission trading as a part of a global treaty on climate change is said to be characterized by two favourable features. First, it minimizes mitigation costs for any given global emission reduction target. Second, without impeding efficiency, the emission reduction contributions of countries can be set according to their level of development, which is in accordance with the principle of common but differentiated responsibilities. All the same, moral objections to emission trading are common in public discussion. The underlying moral reasoning is often hard to extract from the public's rhetoric, and economists often claim that the objections are due to misunderstandings. In our research we have tested experimentally one possible objection to trading emission rights: that selling pollution rights is objectionable because it involves trade in the right to do something wrong. To our surprise, we observed no reluctance to trade these rights compared to a control treatment with identical incentives but no negative externalities. Subjects in both treatments are almost unanimous in the support to trade. A post experiment survey showed that our subject pool had a negative attitude to real life trade of emission quota. The experiment, however, finds no indication that this attitude is due to a concern over tradable quotas legitimizing morally objectionable actions.

Emission trading between private firms may be different than emission trading between countries. In fact, our research shows that emission trading across countries introduces a fiscal incentive which may render trading inefficient. Crucial to this proposition is that national governments may be fiscally constrained - that is, they are unable to tax the private sector sufficiently to finance their first-best levels of public spending. Our research shows that if one or more countries are fiscally constrained, abatement costs will no longer be minimized. Moreover, the permit price will be below the cost-efficient permit price. If developed countries are fiscally unconstrained, while developing countries are fiscally constrained,

incentives for research and development of new pollution abatement technology may be too weak. One possible solution could be global auctioning of emission permits directly to firms, and transfers of the revenues from the auctioning to developing nations by a predetermined scheme. We show that this process improves global welfare, and in fact, this is the way in which the EU ETS heading.

Several studies of ethical issues are conducted during the first centre period. One studies official transfers from rich to poor countries which is part of the Paris treaty. Traditional development transfers to increase income and reduce poverty are complemented by new financial flows to reduce greenhouse gas emissions (mitigation transfers) and become climate-resilient (adaptation transfers). We find that in the absence of barriers to adaptation, mitigation or development, climate change will make isolated transfers less efficient: A large part of their intended effect dissipates as the poor countries reallocate their own resources to achieve the mitigation, adaptation and consumption balance it prefers. Only in the case of least-developed countries, which are unable to adapt fully due to income constraints, will adaptation support lead to more climate resilience. In all other cases, if the rich countries wish to change the balance between mitigation, adaptation and consumption it should structure its transfers as “matching grants”, which are tied to the poor countries own level of funding.

CREE researchers have also looked at intergenerational equity issues related to climate change. Most studies show that the present generation has to take the burden and reduce consumption to mitigate future climate change. This may be one reason why it has proven difficult to reach an ambitious global climate agreement. However, significant climate change is due to a market failure, and corrections of market failures give possibilities of welfare improvements for all generations and nations. In one paper we have studied the implication of climate policies that explicitly seeks to make transfers between generations. By reducing real investments, the consumption level for the present generation may be maintained even if they reduce emissions. Future generations may therefore have a lower capital stock, but will benefit from a better climate. Thus both generations may be better off (a Pareto Improvement). We find that such Pareto improving policies have higher total emissions than the social optimum when transfers within a generation are allowed. Without the possibility of transfers, total emissions may be lower than under the social optimum.

In the case of a global pollutant, like greenhouse gasses, marginal abatement costs should ideally be equalized across countries, in order to allocate abatement effort efficiently. For several reasons - like the principle about common but differentiated responsibilities - this rule is not implemented in the current climate regime. Unilateral increases in the stringency of regulation can then alter the competitiveness of industries and lead to carbon leakage. Carbon leakage occurs whenever efforts by one country to reduce emissions leads to increased emissions in other countries. The welfare costs of meeting targets of environmental protection are then increased both globally and in the country with a more stringent environmental policy. The problem is then how to deal with non-signatories.

Import tariffs on embodied carbon have been proposed as a remedy to carbon leakage. We consider alternative designs for such tariffs, and analyse their effects on global welfare within a multi-region, multi-sector computable general equilibrium (CGE) model of global trade and energy. Our analysis suggests that the most cost-efficient policy could be region-specific tariffs on all products, based on direct emissions from production plus electricity emissions. In the end, however, the potential cost savings through carbon tariffs must be weighed against the administrative costs as well as legal issues and political considerations.

When it comes to “Implications for energy market policies”, this topic will be covered by Working Package 5 below. Here, we only refer a study on the climate effect of biofuels mandates. This study is novel because it includes the repercussions through the oil market. We find that a biofuels mandate may reduce climate costs even if biofuels also implies emissions since the mandate postpones petroleum extraction.

Working Package 2: Innovation and Diffusion Policy

Transition to a low-carbon society will require radical environmentally-friendly technology innovations as well as diffusion of these technologies. Like other types of Research, Development and Diffusion (R&D&D), also environmentally-friendly R&D&D is characterized by market failures and obstacles: Research creates new knowledge, which benefits other firms, and thus entails a positive externality. On the other hand, competing research firms may duplicate each other or exhaust the pool of good ideas, thereby negatively affecting other research firms.

In designing R&D&D instruments the policy maker should take into account that these instruments will work together with environmental policy. A key research topic in this work package is therefore the optimal design of the R&D&D policy instruments. A main reason to support private R&D is that the innovator will in general not be able to appropriate the full social benefit of the innovation. In economics, this is usually referred to as the appropriability problem, and it provides a rationalization for the government to support private research and development. Therefore, this work package examines how technology policies – like innovation prizes and R&D subsidies - should be designed in order to overcome the appropriability problem.

Whereas research subsidies are standard policy instruments, innovation prizes have not been much discussed in the literature. With an innovation prize, the actor receives an amount of money from the regulator/government if he succeeds in developing a new technology that meets some pre-specified technical conditions. The innovator invests in research and development in order to develop a new technology, being aware that an innovation prize will be received if he is successful.

We have shown that the regulator can design an innovation prize that solves the appropriability problem. Further, we have identified conditions under which an innovation prize for environmental R&D should be greater than an innovation prize aimed to lower cost of production for standard market goods, and how these conditions depend on i) heterogeneity among users of the technology, and ii) the environmental policy instrument of the regulator. We have also showed how an innovation prize can be combined with a diffusion subsidy in order to reach the social efficient outcome of R&D&D. To sum up, an innovation prize may be an important policy instrument to trigger more environmentally-friendly research and development.

Another instrument that might trigger more use of renewable energy is simply a subsidy on use of renewable energy and/or on production of renewable energy capital. We have demonstrated that under imperfect competition upstream, subsidies may improve welfare both globally and nationally. From a national point of view, upstream subsidies – support to producers - are preferred over downstream subsidies – support to users of renewable energy. We have also conducted a study on how patents work together with R&D subsidies and climate policy. If the right emission price is used (set according to the marginal damage of the

emissions), the optimal level of R&D subsidies and patent lifetime change with the stages of the climate problem. In the early stages of clean energy development, innovators find it more difficult to capture the social value of their innovations. Thus, for a given finite patent lifetime optimal clean energy R&D subsidies are initially high, but then fall over time. Alternatively, if research subsidies are kept constant, the optimal patent lifetime should initially be long and fall over time.

Design of instruments to promote more CCS is another key research topic in this work package. For some years this technology has been seen by the IEA and the EU as having the potential to bridge the gap between the current carbon-based society and a future low-carbon society. Using CCS electricity technologies, either with coal or natural gas as the fuel, may reduce emissions by as much as 90 percent relative to standard fossil-fuel based technologies. One main disadvantage of CCS is high costs. These may, however, be lower through continued R&D. An important question is then whether CCS should be prompted through subsidizing the producers of CCS technology (upstream subsidy) or through subsidizing the use of CCS technology (downstream subsidy). We have shown – within a theory model of imperfect competition - that for the EU it is optimal to offer an upstream subsidy to the EU producers, but no downstream subsidy. By offering an upstream subsidy to the EU producers, production is shifted from the non-EU producers to the EU producers, thereby shifting profits to the EU producers and at the same time gaining consumers because total production increases.

We also use the numerical equilibrium model of the European energy market LIBEMOD, combined with a new model block with non-competitive supply of CCS technologies, to study how the CCS subsidy should be designed when factors that are not contained in the theory model are taken into account.³ These are the welfare effects of lower CO₂ emissions, obtained through increased use of CCS, and terms-of-trade effects, reflecting that the EU is a major importer of both coal and gas, and demand for these fossil fuels increases when CCS subsidies are offered. The numerical simulations confirm that upstream subsidies should be preferred over downstream subsidies. Further, there should be a higher subsidy to CCS coal than to CCS gas.

³ Technical assumptions in the LIBEMOD CCS model block have been developed joint with Gassnova.

This work package also contains an econometric part on the efficiency of Norwegian policy instruments that have impact on R&D. One study, see subsection 5.2 below, examines empirically how environmental regulations may trigger more environmentally friendly R&D, measured by number of patents. Here we draw on a rich Norwegian panel data set that includes information about the type and number of patent applications, technology standards, non-tradable emission quotas, and a large number of control variables. We identify strong and significant effects on innovations from the implicit regulatory costs of direct environmental regulations. Another study examines the impact of R&D tax credits and direct R&D subsidies on Norwegian firms' patenting. For environmental patenting, no significant effects of tax credits are documented, whereas the effects of direct subsidies are large and significant.

Behavioural economics is also part of this work package. Therefore, a literature review of behavioural economics related to energy efficiency and energy efficient technology has been written. In an ongoing project we study demand management of electricity by drawing on behavioural and experimental economics. Here, a field experiment will be conducted in cooperation with Ringeriks-Kraft. Finally, lab experiments within the field of behavioural economics have been conducted under Working Package 1.

Working Package 3: Regulation and Market

Extensive regulatory reforms have been implemented over the last decade to increase the efficiency in the utilization of energy resources. In parallel, various measures to promote green energy have been introduced. While some of the general regulatory reforms have paved the way for green energy, they have not been directed at green energy per se; indeed, some of these reforms have hampered, rather than promoted, the use of green energy. At the same time, some of the measures introduced to support green energy have undermined the energy market overall and increased the costs of satisfying the need for reliable and secure energy. In some cases, there has been considerable tension – if not outright conflict – between measures used to promote green energy and regulations which aim at more efficient energy markets; one example is the introduction of large amounts of new intermittent energy into systems in which regulation of networks has not allowed for sufficient increases in transmission capacity.

While considerable effort has been expended in trying to understand the functioning of energy markets in general and the introduction of green energy in particular, we still do not have a very good understanding of how best to regulate these markets. This is in part due to the

political economy of energy, where a number of different, and often conflicting, goals are pursued. Our research has aimed at better understanding how these goals interact and how an overall consistent policy can be achieved. In particular, our main research question has been, on the one hand, how regulation of energy markets affects the development of green energy and, on the other hand, how measures to promote green energy affect the functioning of energy markets.

An example of this line of research is our study on how renewable energy policy instruments affect competition on electricity markets. We demonstrate that markets for green certificates allow generators with market power to squeeze the margins of their competitors, as a generator that is vertically integrated into network activities might do. Further, we find that whether or not a dominant firm is vertically integrated into network activities, it can disadvantage competitors in the renewables segment by distorting certificates prices, thereby inducing cost inefficiency in the generation of renewable energy. We compare green certificates to a system of feed-in tariffs, where a similar margin squeeze is not possible, concluding that these policy instruments have very different implications for competition and overall efficiency.

Another example of this line of research is our work on the integration of wind power in the Nord Pool Area and beyond. The main research question is how Scandinavian hydro capacity can cope with a large-scale expansion of wind power both in and around the North Sea, taking into account the possibility of pumped storage and the cost of building international grid interconnections that provide backup and regulate capacity to the countries in the Nord Pool area and beyond; we demonstrate that the exact regulating benefit of hydro depends finely on assumptions about availability of infrastructure, including pumped storage. Closely related is our work on nuclear power in the Europe electricity mix. Using a numerical simulation model of the European energy industry (LIBEMOD), we find that a complete nuclear phase out in Europe by 2030 has a moderate impact on total production of electricity and only a tiny impact on total consumption of energy; lower nuclear production is to a large extent replaced by more renewable electricity production, especially wind power and bio power. We refer to Working package 5 for other results on numerical modelling of the energy market.

In another line of research we study how governments of countries endowed with large natural resources govern these resources, including the choice of ownership structure and

rights to exploitation. Questions of ownership and governance are inherently political and policies may change abruptly, following changes in government, changes in the value of the resources or other events. At the same time, the type and quality of governance is crucial for the efficient exploitation of natural resources. In one of these projects we study how the regime governing natural resources depends on political and economic factors, as well as how such factors, through their influence on the regime, affect the efficiency of resource exploitation; we demonstrate, among other results, that a risk of government expropriation, not only reduces the value of natural resources, but also forces governments into shorter and less valuable contracts for exploitation of these resources. In another, related project we study how resource owners will behave under risk of losing their resource due to nationalisation, and how this risk in turn affects the incentives for governments to nationalise such resources and how world prices for resources may be affected by such interaction; we find that nationalisation may come in “waves”, given that increased risk of nationalisation in one country may, through the value of the underlying resources, spread to other countries as well. A third project aims at understanding to what extent resource exploration firms will get to keep their findings, taking account of the facts long time lags between exploration and extraction, and that governments cannot fully commit to future taxes. We find that taxation may oscillate between periods of high extraction (and low exploration) and periods of high exploration (and low extraction); more generally we establish how natural resource attributes, resource prices and political polarization and stability affect taxation and exploration efforts.

Working Package 4: Evaluation of environmental and energy policy measures

To secure an efficient use of resources in future environmental efforts, it is vital to evaluate the past performance and effectiveness of these policies in achieving their goal. This Working Package aims to increase our understanding of how households and firms respond to different types of policy instruments, and how these policies affect the economy through interactions between markets. A variety of analytical approaches has been applied, drawing on economic theory and non-economic social sciences such as anthropology.

This working package addresses a broad set of topics that are of interest both from a research and political perspective. One of the major topics has been rebound and adverse effects of energy efficiency measures, which occur because increased efficiency decreases the cost of using energy to produce goods and services. The analysis on this topic has been focused around the effect of heat pump ownership on household energy consumption, analysed both

economic and anthropological analysis. We find large rebound effects of heat pump ownership, and on average, electricity consumption is unchanged after installing a pump. This is partly due to reduced use of alternative fuel sources like firewood and fuel oils, but also a result of an increase in the heated area and higher average indoor temperature in the residence. This also implies that welfare and the energy efficiency of residential space heating has increased and that total residential energy consumption is reduced as a result of increased use of heat pumps in Norwegian homes. These findings seem to be robust with respect to analytical approach, as we find the same effects both in economic and anthropological analyses. Similar results are found in a study analysing factors effecting indoor temperature, where we find that the indoor temperature varies with the heating equipment. The group with the highest indoor temperature is households with a common central heating system, followed by households with a heat pump, whereas households that use a lot of firewood for heating have a lower average temperature in the living room than other households.

Another important topic has been behavioural responses to soft policy tools. Using anthropological methods, we have analysed how households relate to electricity meters showing energy consumption by various activities. We find that households are concerned with the information provided, and especially seems to appreciate information about costs. An agent based simulation model has also been built to simulate the effects of changes in attitudes and norms on household energy consumption. This model will be used for future analyses.

On sustainable transportation, we have analysed the effects of purchase taxes on cars, and construct a simple model that generates predictions regarding the effect of fiscal policies on average CO₂ emissions of new cars. The studies find that fees have a significant effect, but they also lead to more purchases of polluting vehicles before tax changes taking effect. In the simulation, we find that for many countries the fiscal policies have become more sensitive to CO₂ emissions of new cars. Furthermore the simulations show that higher fuel taxes lead to the purchase of more fuel-efficient cars, but higher annual road taxes have no or an adverse effect.

In the studies of the effects of various environmental regulations on environmental performance of firms measured as changes in emission intensities, we find evidence that

direct regulations promote persistent effects. Indirect regulations will, on the other hand, only have potential persistent effects if environmental taxes are increasing over time.

On the topic of the households' choice of heating portfolio, we find that households concerned about costs tend to invest in heat pumps more than others, whereas environmental concerns are paramount in explaining purchase of wood pellets stoves. We also find that the main reason very few households chose to purchase a pellets stoves, in spite of the investment subsidy, is that other heating equipment are viewed as better or more desirable. A study comparing the distribution of electricity on different end-uses for the years 1990, 2001 and 2006 find that electricity for basic use, such as washing, cooling of food and heating of water, does not vary much over the period. However, electricity for heating may vary considerably across years, depending on relative energy prices and temperature.

Working Package 5: The Next Generation of Numerical Models

To analyse policies that stimulate innovation and diffusion of new environmentally friendly technologies, integrated economy-energy-environment models are a necessary tool. We have used the unique competence available in our research team to further develop our energy market models (LIBEMOD) including models for the petroleum market (PETRO2), and our integrated macroeconomic Computable General Equilibrium (CGE) models (the SNoW-models - Statistics Norway World models) to make them well suited for our analyses. The cooperation with our technology sub-contractors IFE and SINTEF Energy Research has been valuable in the modelling work. The research questions raised in all CREE works-packages have implied use of numerical models in order to evaluate consequences for small, open, energy-reliant economies such as Norway, but also for Europe and other regions. We have put a special focus on the following issues: National and international integrated models, technological innovation and diffusion processes, identification and quantification of policy effects, electricity market models, and Model Forums and Scenarios.

The activities related to update and upgrade the numerical model LIBEMOD that started in 2011 were finalized in 2014. Building on economic theory, this model provides now a detailed modelling of the energy markets in 30 European countries. It encompasses all activities in the energy markets: investment, extraction of fossil fuels, production of bioenergy and electricity, trade in energy and consumption of energy. LIBEMOD produces a consistent set of quantities and equilibrium prices.

In the new version of the model more countries have been added (13 East-European countries); the end-user sectors have been refined (the service and public sector has been separated from the household segment); the modelling of wind power has been changed and more renewable technologies have been included (run-of-river hydro and solar power); the modelling of natural gas has been refined; bioenergy has been split into biomass and biofuel; all data have been updated (the data base year has been changed from 2000 to 2009) and the complete model has been recalibrated. A detailed documentation of the new version of LIBEMOD is now available at <http://www.frisch.uio.no/ressurser/LIBEMOD/>. The new version of LIBEMOD has also been converted into a stochastic model. Here we build on stochastic programming where a crucial distinction is made between decisions made before the uncertainty is revealed, and decisions made afterwards.

The LIBEMOD model has been used in several research projects that are documented in other work packages as for instance analyses of phasing out nuclear power in EU, the effects of a stricter EU climate policy on imports of natural gas from Russia, the effects of climate change on electricity markets in Western Europe, and the role of carbon capture and storage (CCS) in the European power market. Some examples of results are that large cuts in costs are necessary for CCS to be profitable in existing power plants, that a changed climate will not give significant changes in electricity production in Europe, and that a stricter EU climate policy will hardly trigger much more imports of Russian gas because total EU demand for natural gas is only moderately affected. Future projects plans are; calculating the social value of green technologies, update the stochastic version, dynamics and learning about future climate policy, and regionalizing Scandinavian countries.

PETRO2 is a dynamic simulation model that analyses how market conditions and/or climate- and energy-policies affect the oil market. PETRO2 models oil as a non-renewable resource implying that the oil price contains a scarcity rent. It further models OPEC's degree of market power. The main outputs from the model are short and long run oil prices, production and consumption. PETRO2 has been updated and rests on a rich data foundation from multiple sources, and is calibrated to match the New Policies price scenario of the International Energy Agency. The base-year is 2007 and the time-period is one year. The model has so far been applied to analyse a phasing out of consumption subsidies to oil in all transportation sectors in

the world, giving lower oil consumption, in spite of some carbon leakage. Another analysis of fuel efficiency in transport finds a substantial rebound effect.

The other main model development project in the first four years of the CREE centre is the development of our new family of integrated macroeconomic CGE models for energy and environmental policy analyses; the SNoW-models. SNoW_No is our new CGE model for Norway with 41 industries, based on the GTAP database structure (a global database on trade, energy and emissions to air) and programmed in GAMS. We have generated a recursive dynamic version of the model, modelled all greenhouse gas emissions, and are about to model technological change (other than energy efficiency), and establishing an income account model.

Snow-No has been used to analyse carbon emission scenarios and policies for Norway, and has also been used in an analysis of energy efficiency policies. There has been cooperation with IFE in modelling technology costs based on long-term scenarios for energy efficiency investment costs in residential housing. We have also analysed different interpretations of the 2030 climate policy goals for residential energy efficiency and how they interact with targets for restricting CO₂ emissions. We find substantial welfare costs of energy efficiency policies, particularly when interacting with carbon pricing. Rebound effects within households are small, but economy-wide indirect rebound is significant and expansion of industries leads to increased total CO₂ emissions.

The global model version has been used in different projects analysing policies to curb carbon leakage of unilateral carbon policies. As an example, we have investigated how carbon taxes combined with output-based rebating (OBR) in an open economy perform in interaction with the carbon policies of a large neighbouring trading partner. One result is that the OBR rate should be positive in most cases, but that OBR hardly affects overall domestic welfare, leaving this instrument for other policy goals. Another analysis looks at possibilities, limitations, and implications of various border carbon adjustment (BCA) systems designed particularly for targeting the emission intensities of foreign producers. We find that firm-targeted tariffs can deliver much stronger leakage reduction and higher efficiency gains than tariff designs operated at the industry level.

During the first four years of the CREE centre we have had several Model Forums, one of them together with the CenSES group in Trondheim, with participation from our technology partners IFE and SINTEF, and users as the Norwegian Environmental Agency (NEA), The Ministry of Finance, the Ministry of Oil and Energy, Statkraft, Statoil, ENOVA, and NVE. The next CREE Model Forum will take place in April 2016. In addition we have held numerous presentations of future energy and carbon policy issues and scenarios for several of the Ministries, Parliament committees, the Government, the NEA, and at several domestic and international workshops and conferences. The Ministry of Finance will use our newly developed dynamic recursive version of SNoW_No for their projections including climate and energy scenarios, to the new long term Perspectives for the Norwegian economy that will be launched in spring 2017.

5.2 Some highlights from the research in 2015

Below we give some highlights of the research in 2015. One example is chosen for each working package.

As an example from working package 1 (The International Politics of Climate and Energy), we have chosen **Participation and Duration of Environmental Agreements** by Marco Battaglini and Bård Harstad. The paper is forthcoming in *Journal of Political Economy*, and is a good example of our theoretical research on the design of international environmental agreements.

A striking feature of the post–World War II period is the rise of international environmental agreements (henceforth, IEAs). Three features seem to characterize such agreements. First, they are voluntary: no international organization can force sovereign countries to cooperate. Second, while agreements generally specify abatement levels or other related prohibitions, they leave the regulation of investments in green technology to the discretion of the member states. Third, IEAs typically include many countries. It is quite natural that countries may desire agreements in order to limit free riding, since a healthier environment is a global public good. Participation in an IEA, however, is itself comparable to a public good contribution: besides the cost of the negotiation, it ultimately involves voluntary restrictions on economic activity that also benefit countries that do not participate. Participation, therefore, should be hindered by free-rider problems. Why, then, do we nevertheless observe a large number of countries that participate in IEAs?

This research presents a new dynamic theory to answer these questions. In our model, countries choose both emission levels and the amount of resources to invest in “green technologies”. Countries also decide whether to free ride or participate in an IEA. The length and depth of the cooperative agreement are endogenous: the coalition members negotiate the number of years for which the agreement holds and the abatement level for each participant. We consider both a “complete contracting” environment, in which the agreement can also specify the investments, and an “incomplete contracting” environment, in which such investments are not contractible. Confirming the previous literature, we show that very few countries find it optimal to cooperate in an environment with complete contracts—regardless of the discount factor and other parameters of the model. Surprisingly, the coalition may be much larger if contracts are incomplete. Thus, our analysis shows that incomplete contracts can be beneficial and explains why environmental coalitions are often quite large.

An important part of our theory is the classic holdup problem. If a country has a large stock of green technology, it will be required to abate more in any efficient agreement or reasonable bargaining game. Anticipating this, countries have few incentives to invest in green technologies during a short-lasting agreement when the next bargaining round is just around the corner. While this observation is not new, the contribution of this paper is to integrate the holdup problem with a coalition formation model to show that an IEA may be successful precisely because it is plagued by a potential holdup problem.

The results have a number of implications for the design of environmental agreements. While critics have suggested that the United Nations’ approach is flawed because it focuses only on emissions and not on investments, we have found this to be a possible strength since this may allow for more participants. While some authors advocate a short duration for agreements and others a long duration, we show the importance of letting the duration be endogenously negotiated by the set of committed countries. Although many scholars have suggested that there is a trade-off between size, depth, and length, the Kyoto Protocol arguably fails on all these accounts; this is consistent with our theory, which suggests a positive relationship between depth, breadth, and length. To take advantage of these relationships, it is important that countries coordinate on an equilibrium with a large coalition, that the contract duration is endogenously negotiated, and that future agreements focus only on emission levels and not on investments as well.

From working package 2 (Innovation and Diffusion policy), we have chosen an empirical study on how environmental regulations can affect innovation in environmental technology, namely **Can direct regulations spur innovations in environmental technologies? A study on firm-level patenting** by Marit E. Klemetsen, Brita Bye and Arvid Raknerud. The paper is forthcoming in *The Scandinavian Journal of Economics*.

There are several real-life examples showing that direct environmental regulations can spur innovations: For example, in 1998, an international agreement (The Oslo and Paris Convention – OSPAR) legally required the EU and other European countries to reduce emissions of Polycyclic Aromatic Hydrocarbons. In consequence, the Norwegian Environment Agency banned the use of the Sjøderberg technology in Norwegian aluminum plants. Firms responded differently to the coming prohibition. Some plants purchased the alternative pre-bake technology with substantial emission reductions per production unit, while others started to develop new technologies based on the old technology framework that also led to considerable emission reductions per production unit. This technology was later patented and commercialized on the international market.

This paper investigates the relation between direct (“command-and-control”) environmental regulations and innovations in environmental technologies. To this end we use a rich firm-level panel data set containing information about environmental regulations, patent applications, granted patents, and several other key economic variables for the total population of Norwegian incorporated firms. We use the number of patent applications as a measure of innovative efforts.

We contribute to the literature in three ways. First, we measure environmental regulations at the firm level, which is appropriate since regulations generally vary greatly across firms. Second, we use inspection violation status – the regulator's assessment of the severity of any violation - to measure the firms' regulatory costs relating to technology standards and non-tradable emission quotas. We argue that this variable captures the risk that a firm may be sanctioned for violating its emission permit, and that this is a more appropriate measure of regulatory costs than measures used in the previous literature (monitoring or inspections frequency). Third, our data set allows us to control for observed firm heterogeneity through a

wealth of control variables, including risk class which captures firm heterogeneity with regards to dirtiness and inspection frequency.

We identify a strong positive effect of the implicit costs of non-tradable emission quotas, and also technology restrictions measured by inspection violation status, on the number of environmental patent applications. This main conclusion is strengthened when we restrict the analysis to granted patents. Our findings indicate that implicit costs associated with the threat of being sanctioned for violating emission permits provide significant incentives for innovation. Our results contradict conventional economic theory, supported by several empirical studies, which suggests that direct regulations as technology standards or non-tradable emission quotas, provide little or no incentive to innovate.

One of the aims of the third working package (Regulation and Market) is to study how measures to promote green electricity affect the electricity market. We have chosen a paper which is a good example of this, namely **Renewable Energy Policy Instruments and Market Power** by Nils-Henrik M. von der Fehr and Stephanie Ropenus. This paper is also forthcoming in *The Scandinavian Journal of Economics*.

Reforms of electricity markets have, among other goals, aimed at increasing competition and reducing market power. Paradoxically, measures to promote investment in renewable electricity may undermine these efforts and hamper competition. In particular, green certificates give producers with market power an opportunity to limit margins in renewable generation by playing on certificate and electricity markets.

In Europe, the most common instrument for stimulating production of renewable electricity has been feed-in tariffs, i.e. price subsidies. Some regions – including Norway and Sweden – have instead introduced systems of tradable quotas, so-called green certificates. Producers who are part of a system of green certificates have two streams of revenues; they receive the regular price of electricity for output traded on the electricity market, and, in addition, they receive the price of certificates when trading on the certificates market. The price of certificates is determined by the interplay of the supply of producers of renewable electricity and demand created by the obligation imposed on consumers and retailers to buy certificates.

By increasing the supply of renewable electricity and, at the same time, reducing the supply of conventional electricity, a traditional producer may reduce the profit margin of competitors in the renewable segment and hence shift output and profit towards itself. This corresponds to the “margin squeeze” that a producer who controls infrastructure may exercise by setting a high access price for competitors.

A corresponding margin squeeze is not possible with a feed-in tariff because the premium for renewable electricity is determined by government authorities rather than in the market. If the feed-in tariff is financed by a tax on electricity consumption (which it is in many places in Europe), producers with market power may however have incentives to limit the supply of renewable electricity, in order to reduce the tax and thereby increase the demand for electricity.

We conclude that green certificates and feed-in tariffs have fundamentally different implications for how the electricity market works and hence how efficiently it delivers renewable and traditional electricity, respectively.

Interdisciplinary work using methods from social anthropology and economics is central in working package 4 (Evaluation of Environmental and Energy Policy Measures). The following paper is a good example of this: **Revisiting household energy rebound: perspectives from a multidisciplinary study** by Bente Halvorsen, Bodil Larsen, Harold Wilhite og Tanja Winther, forthcoming in *Indoor and Built Environment*.

Over a period of ten years, approximately a quarter of Norwegian households acquired a heat pump. This rapid development took place with almost no subsidies or other financial support from government policies. Households may apply for grants for the bigger heat pumps. In addition, there was an investment subsidy scheme for air-to-air pumps during the year 2003. However, the main body (between 80 to 90 percent) of heat pumps in Norwegian residences was acquired without any financial support by the government. We have not seen a similar structural change in heating technology in Norwegian homes since the transition from oil and wood to electricity in the 1970s and 1980s.

Despite the common assumption that introducing more energy efficient technologies is a cheap and effective way of reducing energy consumption, this and other empirical studies

indicate that the implementation of energy efficiency technologies often results in unanticipated behavioural changes that reduce or eliminate the expected energy savings. However, the drivers and scope of these rebound effects are still not fully understood.

In this analysis, we have synthesized the findings from two coordinated studies, one quantitative micro econometric study and one qualitative anthropologic study. The data used in the econometric study clearly showed that average electricity consumption does not differ significantly before and after acquiring a heat pump, but that there is a large variation in the savings among households. Nearly half of the households actually use more electricity after purchasing the heat pump than before, and very few achieve the technical savings potential embedded in the heat pump in the form of substantial reduced electricity consumption. This may seem like an anomaly, but the results from this triangulated analysis help us understand what goes on in Norwegian homes when they install a heat pump.

Both the qualitative and the quantitative study show that many households increase indoor temperature and change their main heating source from fuel oils and firewood to the heat pump, which runs on electricity. In addition, many households increase the size of the spaces that are heated, reduce the use of night setbacks and do not reduce the heat while away from home. The reasons behind these changes are closely linked to people's concern for comfort, convenience and time management, and also their perception that heat pumps are less costly to use compared to other heating sources. From the face-to-face meetings with users of heat pumps, there is little doubt that many people appreciate the heat pump because it provides them with increased comfort. Changes in practices associated with heating comfort explain why households with a heat pump on average use approximately the same amount of electricity compared to households without a heat pump.

It is important to note that although much of the energy savings potential of the pump is offset by behavioural changes, there is considerable variation in how households adapt and use the heat pump. This is a reflection of the heterogeneity among Norwegian households with respect to existing home practices, preferences and motivations for installing a heat pump. Our analysis also shows that while there is a rebound in the use of electricity after the installation of a heat pump, the overall energy efficiency has increased because, on average, the households consume less energy, even after the temperature and heated living space has increased.

Finally, the aim of working package 5 (The Next Generation of Numerical Models) has been building and upgrading numerical models. The paper **Residential energy efficiency and European carbon policies: A CGE-analysis with bottom-up information on energy efficiency technologies** by Brita Bye, Taran Fæhn and Orvika Rosnes, CREE Working Paper 18/2015, is an example of an application of one of these models.

Ambitious energy efficiency goals constitute an important part of the EU's road to a low carbon economy. The energy and decarbonisation ambitions are reflected in the Commission's Climate and Energy Policy Package for 2030. They include abating greenhouse gas emissions, raising the share of renewable energy, and increasing energy efficiency. Norway has recently launched its new climate policy goals for 2030 and beyond in line with the EU.

In this paper we analyse different interpretations of the 2030 climate policy goals for residential energy efficiency and how they interact with targets for restricting CO₂ emissions. We focus on Norway and analyse the two issues: what is the effect of energy efficiency targets for residential energy use and how these targets interact with carbon policies. Moreover, we account for investment costs in technological improvements in energy efficiency as a response to policies as we combine an economy-wide perspective with bottom-up information on costs and potentials for investing in energy efficiency technologies in residential buildings.

We use the CGE model SNoW-No and consider rebound effects, economic welfare costs, as well as the effects on economy-wide CO₂ emissions. The energy restrictions posed on households are costly: the shadow price corresponds to an equivalent tax of around 200%, depending on the policy design. Lower residential demand for electricity gives a substantial fall in the market price of electricity, benefitting the energy intensive industries most. We find that the electricity rebound is 37-40% with our base assumptions. The results of our analysis also confirm that instruments designed to save energy are ineffective in abating CO₂. As households reduce electricity use, energy-intensive trade-exposed (EITE) industries expand. Importantly, even if the energy use in the EITE industries is also primarily hydro-based electricity, they have substantial process emissions of CO₂ that increase as the activity expands.

5.3 User contact

CREE has user partners from both Government and industry. We have an extensive contact with our users in the form of seminars and conferences, meetings, research dissemination, project collaboration, training, participation in Governmental committees and public reports and through the work in the board of CREE.

The user conference was held on April 15 and had as its theme "Norway's New Climate Target." There were participants from both users and researchers, and the EU's ambassador in Norway held the opening address.

The dialogue seminar (formerly the mini user seminar) was held on November 9, and was organized differently than before. Instead of letting researchers present and users comment, the users chose the themes and gave the main presentations, while researchers commented on these presentations. The themes were selected by Gassnova, Statnett, Statkraft and the Norwegian Water Resources and Energy Directorate (NVE).

We held a half-day seminar in the Norwegian Environment Agency on March 24, where they chose four themes from a list issued by the researchers. We also had a number of professional meetings and seminars with users both from Governmental bodies and industry throughout the year, including the Ministry of Petroleum and Energy, Norwegian Environment Agency, Statoil, Ministry of Finance, Ministry of Climate and Environment, Ministry of Trade, Industry and Fisheries, Rystad Energy, Vista and Statnett.

CREE also actively disseminates research results through regular e-mail distributed "newletters" of publications with extensive Norwegian abstracts, updated web pages with an overview of activities and publications, as well as an extensive media activity - mainly national, but also in the foreign press - which is also documented on our website.

Cooperation with users also takes other forms. From the autumn 2015, all users were offered to be represented in the board of CREE. Board meetings are therefore an important forum for dialogue, where one hour at each meeting is allocated to research inputs from users.

Users participate in projects as they are involved in project proposals also initiates projects. For the first time we have got a KPN-project (Knowledge-building Project for Industry) in the EnergiX programme at the Research Council of Norway, with extensive user contribution.

We have had several projects in cooperation with Governmental bodies in 2015. Some are CREE-user partners, while other users of our research and expertise have chosen not to be user partners for various reasons. Ministry of Petroleum and Energy, which is a user partner, has initiated discussions and analyses resulting in CREE contributions to the Energy Report (Energimeldingen), both on energy efficiency, energy demand projections and the hydropower sector's profitability. The Green Tax Commission has received contributions from CREE researchers as a basis for evaluation of policy measures for energy and climate technology. We have also contributed to an evaluation of different policy instruments for technology development and innovation for the Ministry of Trade, Industry and Fisheries.

In collaboration with the Ministry of Finance and the Ministry of Climate and Environment, which also involves the Norwegian Environment Agency, we study the effects of the 2030 energy and climate targets by using our energy model LIBEMOD and the general equilibrium models in SSB. The aim is to evaluate the importance of coordinated implementation with EU and the effects on Norwegian emissions, investments in emission technologies, costs for industry and socioeconomic costs. The Ministry of Finance is an important user of our equilibrium models such as studies on energy, technology and climate policy issues, and we gave a full day workshop for them on the SNOW model (24 June), as well as a two-day course in GAMS modelling (20-21 April) and on the model (3-4 September). The management of the Ministry has also been introduced to these modelling tools (18 May).

CREE-researchers' competence directly benefit the Government through participation in expert committees. In 2015, three of our researchers were represented in the Green Tax Commission, and one was in the Ministry of Finance Model Commission. Several CREE researchers have attended hearings for the Ministry of Climate and Environment and the Office of the Prime Minister as well as the Prime Minister, in connection with Norway's climate targets.

In cooperation with the Office of the Auditor General of Norway and the Energy Statistics section at Statistics Norway, CREE has contributed with expertise on the analysis of energy

efficiency in buildings. Cooperation also occurs between CREE researchers and statistics providers in many empirical projects, where researchers contribute to improving the quality and availability of data, both as users, as advisors to committees and meetings, and with analytical skills directly into statistics production. We have over the last year also had good contact with new users such as Energy Norway and Ringeriks-Kraft. Both have initiated joint projects in 2015 and will be involved in future research.

5.4 Interdisciplinary contact and cooperation

Technology research is essential for developing our numerical models. IFE has been an important partner and subcontractor to CREE from the beginning. Their work on modelling various energy technologies in the detailed energy optimization model TIMES-Norway can provide valuable input in economic models. Especially IFE has supplied estimates of energy efficiency technologies and potentials in the building sector, and we are now working on a joint article for the journal *Samfunnsøkonomen* where we compare the engineering approach and the economist approach of modelling energy efficiency and relevant measures. Cooperation with IFE has so far also resulted in a new research project from the research programme Energy-X (RCN). CREE has further cooperated with SINTEF Energy Research, which in 2015 led to a joint article in *Samfunnsøkonomen* about the impact of EU climate policy in 2030.

Beyond the collaboration with technologist, we have initiated and started a series of multidisciplinary collaborative projects with researchers from the fields of anthropology, psychology and law. Social anthropologists at SUM (UoO) are heavily involved in the work package "Evaluation of Environmental and Energy Policy Measures" and a joint article was accepted in the interdisciplinary journal *Indoor and Built Environment* in 2015. A joint project with the Department of Psychology (UoO) is based on the common methodology of behavioural experiments (in lab). The project provides a good foundation for studying attitudes to risk relevant to the design of climate policies. Further, researchers at the Faculty of Law (UoO) are participating in one of our Energy-X projects via employment in a part-time position at the Frisch Centre. Finally, in a series of seminars with input from other fields on climate and energy issues, researchers in philosophy, anthropology, biology, political science, psychology and culture studies presented their perspectives and methods. This has contributed to a larger contact area and useful input to our research.

6 International cooperation

All the research partners in CREE have a large international network, which is shown through extensive co-authorship with researchers from other countries (see <http://www.cree.uio.no/publications.html>). Of the 24 papers published in our Working Paper series in 2015, foreign authors (i.e., main employment outside Norway) accounted for 1/3. When it comes to articles in peer reviewed international journals, the proportion is about the same; of the 17 papers that have been published in 2015, foreign authors or co-authors are present on 7 of them. This illustrates that CREE works internationally, both through co-authorship and through impacts in the international research community.

CREE researchers also participate actively at international conferences and seminars (e.g., IAEE and EAERE), in international groups (e.g., IPCC), networks (e.g., CESifo), and lecture at foreign universities and institutions. It may be mentioned that PhD student Katinka Holtmark (UoO) received the award "CESifo Distinguished Young Affiliate Award" at CESifo Area Conference on Energy and Climate Economics in Munich in October. This is the third time in four years this award goes to a young CREE researcher. Also CREE researcher Karen Hauge (Frisch Centre) received the Helen Potter price 2015 for "best article in the Review of Social Economy by a promising scholar of social economics".

There is an international research partner of CREE, Tilburg Sustainability Center, and three foreign researchers had a part-time position paid by CREE in 2015:

- Fridrik Baldursson, Reykjavik University
- Christoph Böhringer, Oldenburg University
- Jared Carbone, University of Calgary

In addition to the foreign researchers who are employed part time by CREE, several foreign researchers have contracts on CREE projects that are externally funded, i.e., not paid by the direct funding of CREE.

CREE organizes an annual research workshop where we invite researchers from our network. At the workshop in 2015 (14-15 September), the following non-Norwegian researchers attended (see http://www.cree.uio.no/Workshop_Sem_Conf/5th_research_workshop.html):

- Reyer Gerlagh (University of Tilburg)
- Inge van den Bijgaart (University of Tilburg)
- Christoph Böhringer (Univ. Of Oldenburg)
- Liu Qiang (NCSC / NDRC, China)
- Xu Qinhua (Renmin University of China)
- Jae Edmonds (JGCRI, USA)
- Fridrik Baldursson (Reykjavik University)

Several foreign researchers held CREE seminars in 2015. Below is a list of these seminars:

Sjak A. Smulders, Tilburg University: Dynamic Resource Management Under Weak Property Rights: A Tale of Thieves and Trespassers, 19. Nov. 2015.

Andreas Lange (University of Hamburg): Providing (Impure) Public Goods under Risk, 28. October 2015.

Matti Liski, Aalto University, Finland: Gone with the wind? An empirical analysis of the renewable energy clean transfer, 21. October 2015.

Justin Leroux, HEC Montréal: Track and Trade: A liability approach two climate policy, 3. September 2015.

Christoph Böhringer, University of Oldenburg: Vertical fiscal externalities and the environment, 25. Aug. 2015.

Shana McDermott, University of New Mexico: Biomass Energy and Climate Neutrality: The Case of the Northern Forest, 02. June 2015.

Stefan Ambec, Tolouse School of Economics: Environmental policy with intermittent sources of energy, 19. Mar. 2015.

Antony Millne, LSE: Resolving intertemporal conflicts: Economics vs. Politics, 4. Mar. 2015.

Robert Schmidt, Humboldt University of Berlin: A simple dynamic climate model Co-with large Coalition and deep emissions cuts, 3. Mar. 2015

In connection with the research workshop and seminars, many of these researchers visited the Department of Economics, Frisch Centre and Statistics Norway over a period from a few days to 1.5 months (Chris Böhringer). In addition to this, Dr. Ma Gouxia from the Chinese research institute CAEP, Beijing, was visiting SSB for one month.

Several of our researchers have had shorter or longer stays at research institutions abroad in 2015. Of the longer stays, we mention Mads Greaker (SSB – senior researcher) and Elisabeth Isaksen (SSB – PhD student) who both spent half a year at the University of Colombia, New York.

When it comes to EU projects, CREE has been involved in a project, ENTRACTE that ended 31 October 2015. CREE has been in charge of a project that applied for support from Horizon 2020, but unfortunately we did not get funding.

7 Recruitment

In 2015 we started to reap the fruits of our efforts to fund and encourage PhDs in energy and climate economics. Three PhD students defended their thesis:

Kristoffer Midttømme (Department of Economics, University of Oslo, defended his thesis "Essays on strategic considerations in environmental economics" for the PhD-degree on 25 September.

Alice Ciccone (Department of Economics, University of Oslo) defended her thesis "Decision making in environmental-related dilemmas: From natural to laboratory experiments" for the PhD-degree on 30 September.

Katinka Kristine Holtsmark (Department of Economics, University of Oslo) defended her thesis "Four essays on the dynamics of global public goods provision" for the Ph.D degree 23 October.

In addition to this Senior Researcher Bjart Holtsmark (SSB) submitted his thesis for the Dr. Philos degree in 2015. His thesis was defended in January 2016. Also Marit Klemetsen (SSB) submitted her thesis in the beginning of 2016.

CREE gives a master scholarship of NOK 20.000 to up to three master students annually. These are offered an office at one of the Norwegian research partners, supervision by one or two of the CREE researchers, access to all CREE arrangements, and the possibility to publish their thesis in the CREE Working Paper series. For 2015 scholarships were given to Ingrid Hjort, Ingrid Semb Weyer and Kjell Rune Verlo. Their theses are published in the CREE working paper series.

In connection with the recruitment of candidates, we are also engaged in research training through teaching and supervising at the Tilburg University and the University of Oslo, both at the masters and PhD level.

8 Cooperation with other FME centres

CREE has a close collaboration with CICEP, one of the other social science-related energy research centers (FME Samfunn) funded by the Research Council of Norway. CICEP has many overlapping projects with CREE as both have a large interest in international climate negotiation and agreements. Every spring CREE and CICEP organize a user conference together for our research partners and other interested institutions. We also organize research workshops together, write joint research proposals and have some joint research projects.

In addition, we have common interests with CenSES, the third FME Samfunn, in numerical modelling of energy markets and new energy technologies, and we organize workshops and Model Forums together. In 2015 we were both involved in the project “Implications of Paris”, a project initiated by Joint Global Change Research Institute (JGCRI), University of Maryland, that will study several implications of the Paris agreement reached in December 2015, using numerical models. The project will be organized as a series of workshops starting in the spring 2016.

9 Communication and dissemination

The main users of CREE are, in addition to the research community, industry, Government and the general public. The communications to users are mainly through the following channels:

- Dissemination of research and media activity through our webpage (www.cree.uio.no)
- Hold an annual user conference (April). This is organized together with CICEP. In addition we give a seminar for all users every fall (November)
- Organize user activities such as meetings and seminars
- Organize a Model Forum where users together with researchers in other disciplines can make contributions to economic modeling.

- Publish in Norwegian-language journals such as *Samfunnsøkonomen* and *Økonomiske analyser*.
- We contribute to hearings in the Parliament and public debates.

CREE has invested heavily in communication, for instance through an internal reward system for communicating through the media. We have dedicated a website for news on CREE research, see http://www.cree.uio.no/CREE_in_the_news.html, and had more than 25 reports in the media in 2015. Researchers from CREE have been involved in key debates in the media over the past year on subjects such as climate treaties warming, electric vehicles, bio fuels and energy efficiency.

When it comes to user-oriented communication measures, we usually give about 80-100 presentations each year. This includes meetings with all user partners, seminars, workshops and conferences. In addition to the two regular user arrangements in the spring and the fall, we organize seminars for users that are interested in certain topics. In 2015 we organized a seminar at the Norwegian Environment Agency.



CREE - Oslo Centre for Research on Environmentally friendly Energy

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Web: www.cree.uio.no/

Appendix: A1 Personnel

Key Researchers

Name	Institution	Main research area
Golombek, Rolf	Frisch Centre	Environmental Economics, Energy Economics, Applied Game Theory
Hallre, Hilde	Frisch Centre	Environmental Economics
Hauge, Karen	Frisch Centre	Environmental Economics
Kittelsen, Sverre	Frisch Centre	Production theory, Efficiency measurement, Regulation, Health Economics, Energy Economics
Kverndokk, Snorre	Frisch Centre	Environmental and Resource Economics, Health Economics
Nævdal, Eric	Frisch Centre	Resource Economics, Economic management of ecological systems, dynamic optimization, modeling of the risk of disasters, animal behavior
Røgeberg, Ole	Frisch Centre	Welfare analysis, endogenous preferences, rational addiction theory, consumer theory
Strøm, Steinar	Frisch Centre	Microeconomics
Asheim, Geir	Department of Economics, University of Oslo	Game theory, intergenerational justice, green national accounting
Brekke, Kjell Arne	Department of Economics, University of Oslo	Behavioral Economics, Experimental Economics, Resource and Environmental Economics, Real options and stochastic analysis
Førsund, Finn	Department of Economics, University of Oslo	Resources, energy, environment, production theory, productivity
Framstad, Nils Christian	Department of Economics, University of Oslo	Stochastic optimization
Harstad, Bård	Department of Economics, University of Oslo	Political Economics, Public Economics, Contract Theory, Environmental Economics
Hoel, Michael	Department of Economics, University of Oslo	Energy and climate economics, environmental economics, resource economics
Lund, Diderik	Department of Economics, University of Oslo	Resources, energy and environment, economics
Nyborg, Karine	Department of Economics, University of Oslo	Environmental economics, economic analysis of social and moral norms, behavioral economics.
Vislie, Jon	Department of Economics, University of Oslo	Microeconomics, environmental economics, incentives, public economics
Von der Fehr, Nils	Department of Economics, University of Oslo	Microeconomics, Industrial Economics, Regulation, Competition Policy.
Aune, Finn Roar	Research Department, Statistics Norway	Energy and environmental economics
Bye, Brita	Research Department, Statistics Norway	Macroeconomic
Fæhn, Taran	Research Department, Statistics Norway	Macroeconomic
Greaker, Mads	Research Department, Statistics Norway	Energy and environmental economics
Grimsrud, Kristine M.	Research Department, Statistics Norway	Energy and environmental economics
Hagem, Cathrine	Research Department, Statistics Norway	Energy and environmental economics
Halvorsen, Bente	Research Department, Statistics Norway	Energy and environmental economics
Holtmark, Bjart	Research Department, Statistics Norway	Energy and environmental economics
Isaksen, Elisabeth T.	Research Department, Statistics Norway	Energy and environmental economics
Larsen, Bodil Merethe	Research Department, Statistics Norway	Energy and environmental economics
Rosnes, Orvika	Research Department, Statistics Norway	Energy and environmental economics
Storrøsten, Halvor B.	Research Department, Statistics Norway	Energy and environmental economics
de Zeeuw, Aart	Tilburg Sustainability Center	Sustainability, Dynamic game theory, Environmental economics, Environmental policy, Mathematical economics
Gerlagh, Reyer	Tilburg Sustainability Center	Climate Change, Economics, Energy economics, Environmental economics

Smulders, Sjak	Tilburg Sustainability Center	Energy and environmental economics
van der Heijden, Eline	Tilburg Sustainability Center	Energy and environmental economics

Associated Researchers

Baldursson, Fridrik	Reykjavik University	Financial Economics, Industrial Economics, Environmental and Resource Economics
Böhringer, Christoph	University of Oldenburg	Energy Economics
Carbone, Jared	University of Calgary	Environmental and Resource Economics
Eyckmans, Johan	Hogeschool-Universiteit Brussel	Economics of climate change, emissions trading, applications of game theory to the formation of international environmental agreements, cost benefit analysis, general equilibrium and integrated assessment modeling, evaluation of environmental policies, economics of waste management, industrial organization and normative economic theory
Green, Richard	Imperial College London	Energy markets
Liski, Matti	Aalto University School of Economics	
Rosendahl, Knut Einar	Research Department, Statistics Norway	Energy and environmental economics

Post Doc students with financial support from the Centre budget

Name	Funding	Nationality	Period	Sex M/F	Topic
Okullo, Samuel Jovan	CREE	Dutch	2013-2015	M	Energy economics, resource economics, climate economics, and firm behavior
Spiro, Daniel	CREE		2012-2016	M	Energy and environmental economics

PhD students with financial support from the Centre budget

Name	Funding	Nationality	Period	Sex M/F	Topic
Cicccone, Alice	CREE	Italian	2011-2015	F	Economic of the climate change with econometric applications and climate technologies diffusion
Klemetsen, Marit	CREE	Norwegian	2011-2015	F	Innovation in energy- and environmental technology industries: Identifying knowledge externalities and effects of policies
Michielsen, Thomas	CREE	Dutch	2010-2014	M	Innovation in energy marked
Wahlquist, Henning	CREE	Norwegian	2014-2015	M	Energy markets and uncertainty.

PhD students working on projects in the centre with financial support from other sources

Name	Funding	Nationality	Period	Sex M/F	Topic
Midttømme, Kristoffer	Department of Economics, University of Oslo	Norwegian	2011-2014	M	Technology diffusion
Dalen, Hanne Marit	Research Department, Statistics Norway	Norwegian	2009-2014	F	The use of multiple instruments in energy and environmental policy.
Mideksa, Torben	Department of Economics, University of Oslo	Swedish	2012-2016	M	Primary Concentration: Contract Theory Secondary Concentrations: Environmental Economics and Political Economics
Holtmark, Katinka Kristine	Department of Economics, University of Oslo	Norwegian	2012-2015	F	Development Economics, Natural Resource Economics, Microeconomics
van den Bijgaart, Inge M.	Planbureau voor Leefomgeving (Netherlands Environmental)	Dutch	Nov. 2013- Aug.2016	F	Effect of Fiscal Regulations of CO2 Emissions of New Cars

Master thesis CREE

Name	Institution granting degree	Adviser	Year	Sex	Title of thesis
Abrahamsen, Kamila Lund		Spiro, Daniel	2014	F	Elektrisitetspriser: En empirisk og teoretisk analyse av tilbud og etterspørsel
Andersson, Runa Haave		Nyborg, Karine og Holtsmark, Bjart	2013	F	"STABILITY OF INTERNATIONAL CLIMATE TREATIESHE IMPORTANCE OF HETEROGENEITY"
Andenes, Liv Jorunn		Wilhite, Harold Langford	2014	F	Bicycle Commuting in Oslo - Practices, Constraints and new Directions for Policy
Beisland, Christina Stene	CREE	Greaker, Mads	2013	F	From Targets and Timetables to Technology Investments
Birkelund, Henriette	CREE	Halvorsen, Bente	2013	F	Oppvarming og innetemperaturer i norske barnefamilier - En analyse av husholdningenes valg av innetemperatur
Boroumand, Yasaman		Rosendahl, Knut Einar		F	Price Elasticity of Non-OPEC Supply
Gavenas, Ekaterina		Rosendahl, Knut Einar		F	On the way to a Cleaner Future: A Study of CO2 Emissions on Norwegian Continental Shelf
Hjort, Ingrid C.	CREE	Greaker, Mads	2015	F	Innovation Prizes for Environmental R&D in Presence of Lobbyism
Jakobsen, Anja Lund		Rosendahl, Knut Einar		F	Does the Polluter Pay in the EU ETS, or does the EU ETS Pay the Polluter?
Matungwa, Bernard		Wilhite, Harold Langford	2014	M	An Analysis of PV Solar Electrification on Rural Livelihood Transformation: A Case of Kisiju-Pwani in Mkuranga District, Tanzania
Nesje, Frikk	CREE	Ekstern	2013	M	Distrust, but verify?: Theoretical insights into auditing carbon sequestration in tropical forests
Nesvik, Linn Camilla		von der Fehr, Nils-Henrik M.	2012	F	Geografiske kostnads- og prisforskjeller i det norske kraftmarkedet : En tidsserieanalyse av de norske kraftprisene fra 2006 til 2011
Reinlie, Kristine Borgeraas		Brekke, Kjell Arne	2014	F	Er elsertifikatene grønne? En analyse av samspillet mellom det svensk-norske elsertifikatmarkedet og det europeiske kvotemarkedet
Røed, Tiril Salhus		Hoel, Michael	2014	F	Klimagassutslipp og subsidiering av fornybar Energi: En numerisk analyse av klimagevinst ved innføring av grønne sertifikater
Salvesen, Ingerid		Wilhite, Harold Langford	2014	F	Practicing the preaching?: A study of the Transition Movement in Norway and its effort to change energy-related practices
Sletten, Thea Marcelia		Hoel, Michael	2012	F	A Framework for Studying the Environmental Impact of Biofuel Policies
Valseth, Asmund Sunde	CREE	Harstad, Bård	2014	M	Competing Climate Policies
Verlo, Kjell Rune	CREE	von der Fehr, Nils-Henrik M.	2015	M	Is low carbon taxation optimal climate policy for a developing country? A numerical simulation of technology adoption
Weidle, Maiken Katrine	CREE	Greaker, Mads and Nyborg, Karine	2014	F	Is low carbon taxation optimal climate policy for a developing country? A numerical simulation of technology adoption
Weyer, Ingrid Semb	CREE	Greaker, Mads	2015	F	Directed technical change in clean and dirty technologies: Is it possible to redirect R&D in a multiregion world?

Vik, Martin Andreas

von der Fehr, Nils-Henrik M.

2012

M

Node- eller soneprising i kraftmarkeder: Hvilket markedsdesign løser best markedsmakt ved flaskehals?

A2 Statement of Accounts

(All figures in 1000 NOK)

Funding

	Amount
The Research Council	8 490

Research Partners (own funding)

Frisch Centre (Host Institution)	3 672
Statistics Norway	8 487
Department of Economics, UoO	1 000
Tilburgs Sustainability Center	250

User partners

Statkraft Energy AS	100
Statnett	250

Public partners

University of Oslo	500
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Total	22 749
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Costs

Research Partners

Frisch Centre (Host Institution)	8 656
Statistics Norway	10 619
Department of Economics, UoO	2 074
Tilburgs Sustainability Center	500

Centre for Development and the Environment, UoO	500
The Faculty of Law - Natural Resources Law, UoO	100
Institute for Energy Technology (IFE)	300

Total	22 749
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A3 Publication

Journal papers

(http://www.cree.uio.no/publications.html#Scientific_Journals)

Aune, F.R., R Golombek, A. Moe, K.E. Rosendahl and H. Hallre Le Tissier (2015): [Liberalizing Russian gas markets – an economic analysis](#), *The Energy Journal* Vol 36 - Adelman Special Issue, Page 63-97

Braaten, R. H., K. A. Brekke and O. Rogeberg (2015): [Buying the right to do wrong – An experimental test of moral objections to trading emission permits](#), *Resource and Energy Economics*, Volume 42, November 2015, Pages 110–124

Czajkowski, M., N. Hanley, K. Nyborg (2015): [Social norms, Morals and Self-interest as Determinants of Pro-Environment Behaviours: The Case of Household Recycling](#), *Environmental and Resource Economics* pp 1-24

Dalen H. M. and B. M. Larsen (2015): [Residential End-use Electricity Demand: Development over Time](#), *The Energy Journal* Vol 36: No. 4

Framstad, N.C. and J. Strand (2015): [Energy intensive infrastructure investments with retrofits in continuous time: Effects of uncertainty on energy use and carbon emissions](#), *Resource and Energy Economics*, Vol. 41, Page 1-18 [[PDF](#)]

Fæhn, T. (2015): [A shaft of light into the black box of CGE analyses of tax reforms.](#), *Economic Modelling*, Vol 49 September 2015, 320–330. [[PDF](#)]

Fæhn, T. and E.T. Isaksen (2015): [Diffusion of climate technologies in the presence of commitment problems](#), *Energy Journal*, Vol 37, No 2

Gavenas, E., K. E. Rosendahl and T. Skjerpen (2015): CO₂-emissions from Norwegian oil and gas extraction, *Energy*, Vol 90, Part 2, October 2015, Pages 1956–1966

Hauge, K. (2015): [Moral opinions are conditional on the behavior of others.](#), *Review of Social Economy*, Vol 73 (2), 154-175. [[PDF](#)]

Hauge, K. and O. Rogeberg (2015): [Representing others in a Public Good Game](#), *Games*, 6, 381-393.

Hauge, K., K.A. Brekke, L.O. Johansson, O. Johansson-Stenman and H. Svedsäter (2015): Keeping others in our mind or in our heart? Distribution games under cognitive load., *Experimental Economics*. [[PDF](#)]

Holtmark, B. (2015): [Quantifying the global warming potential of CO₂ emissions from wood fuels](#), *GCB Bioenergy*, Volume 7, Issue 2, pages 195–206. [[PDF](#)]

Isaac, T. and P.G. Piacquadio (2015): [Equity and Efficiency in an Overlapping Generation Model](#), *Social Choice and Welfare*. Vol. 44, p. 549-565 [[PDF](#)]

Rosendahl, K.E. and H. Storrøsten (2015): [Allocation of emission allowances: impacts on technology investment](#), *Climate Change Economics*. Vol.06, Issue 03, August 2015.

Rosendahl, K.E. and J. Strand (2015): [Emissions Trading with Offset Markets and Free Quota Allocations](#), *Environmental and Resource Economics*. Volume 61, Issue 2, pp 243-271 [[PDF](#)]

Storrøsten, H. B. (2015): [Prices vs. quantities with endogenous cost structure and optimal policy](#), *Resource and Energy Economics*, Vol 41, August 2015, Pages 143-163

Westskog, H., T. Winther and H. Sæle (2015): [The effects of In-Home Displays — Revisiting the Context](#). *Sustainability*, Vol 7, Issue 5, pp. 5431-5451

Winther, T. and H. Wilhite (2015): [An analysis of the household energy rebound effect from a practice perspective: spatial and temporal dimensions](#). *Energy Efficiency*, Vol. 8, Issue 3, pp. 595-607

Zeeuw, Aart de (2015): [International environmental agreements](#), *Annual Review of Resource Economics*, 7, 151-168

Books and article in books

(http://www.cree.uio.no/publications.html#Other_publications)

Førsund, F. (2015): [Hydropower Economics \(Authors: F. Førsund\). Second Edition. New York; Springer Science & Business Media](#)

Green, R.J. (2015): Markets, Governments and Renewable Energy in (ed.) C. Donovan, [Renewable Energy Finance](#), pp. 105-129, London, *Imperial College Press*, ISBN 978-1-78326-776-7

Staffell, I., I.G. Hamilton and R.J. Green (2015): Risk The Residential Energy Sector in (eds.) I. Staffell, D.J.L. Brett, N.P. Brandon and A.D. Hawkes, [Domestic Microgeneration: Renewable and Distributed Energy Technologies, Policies and Economics](#), pp. 18-48, London, Routledge, ISBN 978-0-415-81041-8

CREE working paper

(http://www.cree.uio.no/working_papers.html)

Aune, F. R., A. C. Bøeng, S. Kverndokk, L. Lindholt and K. E. Rosendahl(2015): Fuel efficiency improvements – feedback- mechanisms and distributional effects in the oil market, [CREE working paper no 11](#)

Aune, F. R., R. Golombek, H. H. Le Tissier, S. Jaehnert, S. Völler and O. Wolfgang(2015): Mot et grønnere Europa: Virkninger av EUs klimapolitikk for 2030, [CREE working paper no 01](#)

Aune, F. R., R. Golombek and H. H. Le Tissier(2015): Phasing out nuclear power in Europe, [CREE working paper no 05](#)

- Bråten, R. H., and P. Martinsson(2015):** Experimental measures of household decision power, [CREE working paper no 02](#)
- Bråten, R. H., E. Berge, H. Wiig, D. Kambewa and S. Khaila(2015):** Using trust games to predict tree planting in Malawi, [CREE working paper no 03](#)
- Bye, B. , T. Fæhn and O. Rosnes(2015):** Residential energy efficiency and European carbon policies: A CGE-analysis with bottom-up information on energy efficiency technologies, [CREE working paper no 18](#)
- Böhringer, C. , B. Bye , T. Fæhn and K. E. Rosendahl(2015):** Targeted carbon tariffs – Carbon leakage and welfare effects, [CREE working paper no 09](#)
- Böhringer, C. , N. Rivers and H. Yonezawa(2015):** Vertical fiscal externalities and the environment, [CREE working paper no 16](#)
- Ciccone, A. , R. H. Bråten and O. Røgeberg(2015):** Fairness preferences in a bilateral trade experiment, [CREE working paper no 10](#)
- Gerlagh, R. , and E. van der Heijden(2015):** Going Green: Framing effects in a Dynamic Coordination Game, [CREE working paper no 23](#)
- Golombek, R. , M. Greaker and M. Hoel(2015):** Innovation prizes for environmental R&D, [CREE working paper no 19](#)
- Golombek, R. , M. Greaker og S. Kverndokk(2015):** Virkemidler som kan fremme utvikling og bruk av miljøteknologi, [CREE working paper no 13](#)
- Harstad, B.(2015):** Investment Policy for Time - Inconsistent Discounters, [CREE working paper no 21](#)
- Hassler, J. , P. Krusell, A. Shifa and D. Spiro(2015):** Sovereign wealth funds and spending constraints in resource rich developing countries – the case of Uganda, [CREE working paper no 06](#)
- Heggedal, R. , and K. E. Rosendahl K.(2015):** On the rationale for directing R&D to zero emission technologies, [CREE working paper no 15](#)
- Hjort, I. C.(2015):** Innovation Prizes - For Environmental R&D in Presence of Lobbyism, [CREE working paper no 14](#)
- Hoel, M. , S. Kittelsen and S. Kverndokk(2015):** Pareto Improving Climate Policies: Distributing the benefits across generations and regions, [CREE working paper no 12](#)
- Holtmark, K. , and K. Midttømme(2015):** The dynamics of linking permit markets, [CREE working paper no 20](#)

Jaakkola, N. , and D. Spiro(2015): Finders, keepers?, [CREE working paper no 08](#)

Klemetsen, M. E.(2015): The effects of innovation policies on firm level patenting, [CREE working paper no 24](#)

Larsen, B. M., T. Winther, H. Wilhite and B. Halvorsen(2015): Revisiting household energy rebound: perspectives from a multidisciplinary study, [CREE working paper no 04](#)

Verlo, K. R.(2015): Kommersielle nettinvesteringer, [CREE working paper no 22](#)

von der Fehr, N.-H. M. .(2015): Natural Resources and Sovereign Expropriation, [CREE working paper no 07](#)

Weyer, I. S.(2015): Directed technical change in clean and dirty technologies: Is it possible to redirect R&D in a multi-region world?, [CREE working paper no 17](#)

Popular scientific articles

(http://www.cree.uio.no/publications.html#Popular_scientific_articles)

Aune, F. R., A. C. Bøeng, S. Kverndokk, L. Lindholt og K. E. Rosendahl (2015): Drivstoffeffektivisering – fører det til mindre bruk av olje?. *Økonomiske analyser*, 4/2015 S69-73 [[PDF](#)]

Aune, F. R. R. Golombek, H. H. Le Tissier, S. Jaehnert, S. Völler og O. Wolfgang (2015): Mot et grønnere Europa: Virkninger av EUs klimapolitikk for 2030. *Samfunnsøkonomen*, Nr 3 2015 [[PDF](#)]

Bruvoll, A. og H. M. Dalen (2015): Mange motiver i klimapolitikken. *Samfunnsøkonomen*, Nr 1 2015 [[PDF](#)]

Greaker M. og O. Rosnes (2015): Robuste norske klimamålsetninger. *Samfunnsøkonomen*, Nr 1 2015 [[PDF](#)]

Hagem C. (2015): Vindkraft *Samfunnsøkonomen*, Nr 3 2015 [[PDF](#)]

Harstad B. (2015): På jakt etter den beste utslipsavtalen. *Samfunnsøkonomen*, Nr 1 2015 [[PDF](#)]

Heggedal, T-R. and K.E. Rosendahl (2015): [Norsk klimapolitikk i et globalt perspektiv.](#) *Magma* 05/2015, 65-77

Other publications

(http://www.cree.uio.no/publications.html#Other_publications)

- Bjertnæs, Geir H. M. og C. Hagem (2015):** Utviklingen i energiforbruket.
Oppdragsrapport for OED I forbindelse med deres arbeid med [Energimeldingen](#).
- Boucekkine, R., P.G. Piacquadio, and F. Prieur (2015):** A Lipsetian Theory of Institutional Change [Aix-Marseille School of Economics working paper](#) No. 12/2015 [[PDF](#)]
- Brekke, K. A., A. Ciccone, T. R. Heggedal and L. Helland (2015):** Reference points in sequential bargaining: theory and experiment
[CESAR Working paper](#) No. 3/15
- Bye, B., C. Hagem, B. Halvorsen og B. M. Larsen (2015):** Effekter av virkemidler for å fremme energieffektivisering.
Oppdragsrapport for OED I forbindelse med deres arbeid med [Energimeldingen](#).
- Bye, B., S. Kverndokk and E. Verdolini (2015):** Summary of some ENTRACTE/CREE papers.
ENTRACTE Newsletter No. 3, Page 5-7 [[PDF](#)]
- Böhringer, C., K. E. Rosendahl and H. B. Storrøsten (2015):** [Mitigating Carbon Leakage: Combining Output-Based Rebating with a Consumption Tax](#) *CESifo Working Paper* No. 5459 (July 2015) [[PDF](#)]
- Böhringer, C., K. E. Rosendahl and H. B. Storrøsten (2015):** Smart hedging against carbon leakage [SSB Discussion Papers](#) No. 822 [[PDF](#)]
- Ciccone, A. (2015):** Environmental effects of a vehicle tax reform: evidence from Norway
[Memorandum](#) 3/15 [[PDF](#)]
- Gavenas, E., K. E. Rosendahl and T. Skjerpen (2015):** CO₂-emissions from Norwegian oil and gas extraction, [SSB Discussion Papers](#), NR 806 [[PDF](#)]
- Gerlagh, R., I. van den Bijgaart, H. Nijland and T. Michielsen (2015):** Fiscal policy and CO₂ emissions of new passenger cars in the EU, [CPB Discussion Papers](#), NR 302 [[PDF](#)]
- Golombek, R., F. R. Aune, H. Hallre, B. Knopf, B., P. Nahmmacher, E. Schmid (2015):** [Renewable energy supply in Europe addressing technological and political preconditions.](#)
Entracte Report
- Green, R.J. and T.-O. Leautier (2015):** Do costs fall faster than revenues? Dynamics of renewables entry into electricity markets, *TSE Working Papers*, n. 15-591, July 2015. [[PDF](#)]
- Hagem C., M. Hoel, B. Holtsmark and T. Sterner (2015):** Refunding Emissions Payments
[RFF Discussion paper](#) No. 15-05 [[PDF](#)]
- Kverndokk, S, S. Schjølset, J. B. Skjærseth, B. Tennbakk, J. Wolst, A. Bolle, A. M. Knudsen, L. E. Omland, D. R. Christensen, K. Kroepelien, and J. Stene (2015):** [Measures to reduce GHG-emissions in non-ETS sectors in Norway towards 2030 – the role of flexibility mechanisms in Europe](#) *THEMA Memo* 2015-06
- Horn. J.P.(2015):** [Fornybarsatsingen og lov om elsertifikater - en rettsøkonomisk analyse](#)
Privlus- Journal of private law, Nr 198-2015

Parchomovsky G. and E. Stavang (2015): [The Green Option](#) *Minnesota Law Review*, Vol 99, Nr 3-2015. [[PDF](#)]

Piacquadio, P.G. (2015): The Ethics of Intergenerational Risk, [Memorandum](#) 15/2015 [[PDF](#)]

Rosendahl, K. E. and O. Schenker (2015): [Efficiency, feasibility and effectiveness of various BTA designs](#). *Entracte-rapport*.

Conference and seminar presentations

Böhringer, C. (2015): SNOW Course Part II Ministry of Finance, Oslo, 3-4 Sep.

Böhringer, C. (2015): Two-day Course on GAMS and MPSGE for Applied General Equilibrium Analysis Ministry of Finance, Oslo, 20-21 Apr.

Bye, B. (2015): Om karbonlekkasje, Seminar for Nærings- og fiskeridepartementet. Farris Bad, Larvik, 5. May

Bye, B. (2015): Residential energy efficiency and European carbon Policies: A CGE-analysis with bottom-up information on energy efficiency technologies. Presentasjon på Staff seminar, Centre for Energy Policy, Strathclyde International Public Policy Institute (SIPPI), University of Strathclyde, Glasgow, 24 June

Bye, B. (2015): Residential energy efficiency and European carbon policies: A CGE-analysis with bottom-up information on energy efficiency technologies. ENTRACTE-workshop, Milano, 17 Feb.

Bye, B. (2015): Residential energy efficiency and European carbon policies: Lessons learned from a CGE-analysis. Workshop on Energy Efficiency Research/Policy Impacts, Scottish Government event, Glasgow, 23 June

Bye, B. (2015): Residential energy efficiency and European carbon Policies: A CGE-analysis with bottom-up information on energy efficiency technologies. CREE workshop, Lysebu, Sep.

Bye, B. (2015): The Impacts of Alternative Instruments on Environmental Performance: A firm level study of temporary and persistent effects Presentasjon på konferansen Economics of Innovation, Diffusion, Growth and the Environment, Grantham Institute, LSE, London 16-18 Sept

Bye, B. og B. Halvorsen (2015): Evaluering av effekter av virkemidler for å fremme energieffektivisering: En litteraturstudie. Foredrag Olje- og energidepartementet, 26 June

Ciccone, A. (2015): Environmental effects of a vehicle tax reform: evidence from Norway ESt Lunch Seminar, Department of Economics and Statistics, University of Turin, Italy, 5 Mar.

Ciccone, A. (2015): Environmental effects of a vehicle tax reform: evidence from Norway EAERE: European Association of Environmental and Resource Economists 2015, 24-27 June

- Ciccone, A. (2015): Fairness preferences in a bilateral trade experiment IMEBESS: Second International Meeting on Experimental and Behavioral Sciences, 15-17 Apr.
- Ciccone, A. (2015): Fairness preferences in a bilateral trade experiment ICCSS: International Conference on Computational Social Science, 8-11 June
- Espegren, K. A. (2015): CenSES Energy demand projections towards 2050 CREE researcher conference, Oslo 14-15.Sep.
- Fæhn, T. (2015): Holdt foredrag for statministeren Statsministerens kontor 03 Feb.
- Fæhn, T. (2015): INDCs and the Paris negotiations - Economic aspects for Europe/Norway - some questions and tools for analysis Bruker- og forsker-workshop, Forskningsparken, Oslo, 16. Sep.
- Fæhn, T. (2015): Kunnskapsgrunnlag for lavutslippsutvikling - Makroøkonomi og kostnader Statsministerens kontor, 3. Feb.
- Fæhn, T. (2015): Måltrettet karbontoll - Effekter på eksportadferd, karbonlekkasjer og velferd Cree lunch seminar, Frischsenteret, 18. Nov.
- Fæhn, T. (2015): Petroleum Prospects -Møte i programkomiteen Petrosam2 NFR ,Lysaker 13. Apr.
- Fæhn, T. (2015): Residential energy efficiency – A CGE-analysis with bottom-up information on energy efficiency technologies. Workshop on New Developments in CGE Modelling - . in Mannheim. 26./27. Nov.
- Fæhn, T. (2015): Targeted carbon tariffs and carbon leakage. WILL workshop SSB 20.Aug.
- Fæhn, T. (2015): Targeted carbon tariffs. Carbon leakage and welfare effects. European Association for Environmental and Resource Economists (EAERE) Conference 2015, Helsinki, Finland, 26. June
- Fæhn, T. (2015): Tre familier av likevektsmodeller i SSB. Foredrag for Finansdepartementets ledelse 18.May
- Førsund, F. (2015): Generation of pollutants, the material balance, and more BEEER conference NHH, Bergen 4-5 May
- Gerlagh, R. (2015): CO2 embedded in trade: trends and fossil fuel drivers CREE Seminar, Oslo,15 Sep.
- Gerlagh, R. (2015): CO2 embedded in trade: trends and fossil fuel drivers VAM Seminar, Milan, 14 May
- Gerlagh, R. (2015): Fiscal policy and CO2 emissions of new passenger cars in the EU Resources for the Future, Washington DC, 14 Apr.
- Gerlagh, R. (2015): Fiscal policy and CO2 emissions of new passenger cars in the EU 21st Annual EAERE Conference, Helsinki, 26 June

Gerlagh, R. (2015): Fiscal policy and CO2 emissions of new passenger cars in the EU 8th International Workshop on Empirical Methods in Energy Economics, College Park, 9 July

Gerlagh, R. (2015): Fiscal policy and CO2 emissions of new passenger cars in the EU Nederlandse Economendag, Amsterdam, 6 Nov.

Gerlagh, R. (2015): Fiscal policy and CO2 emissions of new passenger cars in the EU University of Maryland, Department of Agricultural Economics, College Park, 18 Feb.

Gerlagh, R. (2015): Passing through car acquisition taxes Nederlandse Economendag, Amsterdam, 6 Nov.

Golombek, R. (2015): Phasing out Nuclear Power in Europe The 33rd USAEE/IAEE North American Conference, The Dynamic Energy Landscape. Pittsburgh, Oct.

Golombek, R. (2015): Phasing out Nuclear Power in Europe. European Climate and Energy Policy Joint work shop organized by CICEP and CREE, Statistics Norway, Oslo, June

Golombek, R. (2015): Reguleringen av kapasitetsmarkeder. Konferanse om - Energimarkedet i EØS-området- nye rettslige og politiske utviklingstrekk-, arrangert av Nordisk institutt for sjørett ved UiO, UiO Energi og Energi Norge, Oslo, May

Greaker, M. (2015): A Kantian Approach to Sustainability. Seminar Department of Environmental Studies, New York University, New York City, 3 Nov.

Greaker, M. (2015): Innovation Prizes for environmental R&D Seminar Resources for the Future, Washington DC, 8 Oct.

Greaker, M. (2015): Network Effects and Environmental Externalities: Do Clean Technologies Suffer from Excess Inertia? Presentation at workshop Climate change research after Paris, Earth Institute, Columbia University, New York City, 25 Sep.

Greaker, M. (2015): The Fiscal Incentive of Cap and Trade: Permits May Be Too Cheap and Cost Efficiency May Fail. Seminar School of International and Public Affairs, Columbia University, New York City, 21 Sep.

Greaker, M. (2015): The Norwegian Electric Vehicle Experience Seminar Environmental Defense Fund, New York City, 22 Oct.

Green, R. (2015): Storage in the electricity market INREC Conference, Essen, 23 Mar.

Green, R. (2015): Storage in the energy market Offshore Energy Storage Conference, Edinburgh, 3 July

Green, R. (2015): Storage in the energy market -Super session- at IEEE Power and Energy Society meeting, Denver on the future economics of the grid, 29 July

Green, R. (2015): The long-run impact of electricity storage on prices and capacity International Association for Energy Economics International Conference, Antalya, 26 May

- Green, R. (2015): The value and impact of storage CIRED Electricity Distribution Conference, Lyon (invited Round Table); 17 June
- Grimsrud, K. (2015): Oil market effects of recent, planned and potential fossil fuel subsidies reforms. Presented at the 2015 Conference of the International Association for Energy Economics, North American Conference, Oct. 25-28
- Grimsrud, K. (2015): Petro 2 Global oil market model. Cree Lunsj, Oct. 7, Oslo Norway
- Grimsrud, K. (2015): Petro 2 Global oil market model. Rystad energy Oct. 6, Oslo Norway
- Grimsrud, K. (2015): PETRO2 oil market model at Statistics Norway - consequences for the oil market of improved efficiency in the transport sector . Internal PETROSAM seminar at the Norwegian Research Council for the project Petroleum Prospects for the Norwegian Economy as a Whole, 13 Apr.
- Grimsrud, K. (2015): PETRO2 oil market model at Statistics Norway - purpose and resource requirements. Internal presentation in a seminar on the model portfolio at Statistics Norway, 12 May
- Grimsrud, K. (2015): PETRO2 oil market model at Statistics Norway - characteristics of the model. Modelforum for the project Petroleum Prospects for the Norwegian Economy as a Whole, 13 May
- Hagem, C. (2015): Comments on - Delivering on 2°C target - Cicero, Oslo, 09. June
- Hagem, C. (2015): Presentation of the Unit for Energy and Environmental Economics "Research Department, Statistics Norway at NORAD, Oslo, 15 Oct.
- Hagem, C. (2015): Supply-side versus demand-side policies: carbon leakages and the green paradox Presentation at CREE-workshop, Oslo, 14-15 Sep.
- Hoel, M. (2015): Pareto Improving Climate Policies: Distributing the Benefits across Generations and Regions Annual Conference of the European Association of Environmental and Resource Economists, Helsinki, 24-27 June
- Hoel, M. (2015): Pareto-improving Climate Agreements New Developments in the Theory of International Environmental Agreements. Mannheim.
- Hoel, M. (2015): Risiko ved elsertifikatorordningen. CREE Dialogseminar, Oslo, 9 Nov.
- Kittelsen, S. A. C. (2015): Pareto Improving Climate Policies: Distributing the Benefits across Generations and Regions 37th Meeting of the Norwegian Association for Economists (Forskermøtet), University of Bergen 5-6 Jan.
- Kverndokk, S. (2015): Comments on competitiveness effects ENTRACTE final conference, Brussels, 25 Sep.
- Kverndokk, S. (2015): Forfatterens orientering om viktig ny kunnskap - Tiltak og virkemidler IPCC AR5-dag I Miljødirektoratet, 23. Mar.

- Kverndokk, S. (2015): Fuel efficiency improvements - feedback mechanisms and distributional effects in the oil market EAERE conference, Helsinki, 26 June
- Kverndokk, S. (2015): Inter- and intragenerational equity in climate finance BEEER Conference
- Kverndokk, S. (2015): Inter- and intragenerational equity in climate finance CREE seminar
- Kverndokk, S. (2015): Intra- and Intergenerational Equity in Climate Policy: A project from the Frisch Centre Miljø2015 konferanse
- Kverndokk, S. (2015): Intra- and Intergenerational Equity in Climate Policy Instituttseminar
- Kverndokk, S. (2015): Introduction to the project Implications of Paris Seminar on the Implications of Paris, Forskningsparken, Oslo, 16 Sep.
- Kverndokk, S. (2015): Klimafinansiering - hvordan bør den utformes hvis den er motivert av fordelingshensyn? CREE – CICEP brukerkonferanse
- Kverndokk, S. (2015): Pareto Improving Climate Policies: Distributing the benefits across generations and regions CESifo Area Conference on Energy and Climate Economics, Munich, 16 Oct. 2015
- Kverndokk, S. (2015): Recent trends on the economics of climate change David Pearce Memorial Workshop, London School of Economics, 10 Sep.
- Kverndokk, S. (2015): Rettferdige klimaavtaler CREE-seminar i Miljødirektoratet, 24. Mar.
- Kverndokk, S. (2015): Rettferdige klimaavtaler Frischsenterets 15 årsjubileum
- Kverndokk, S. (2015): Rettferdighet og fordeling i klimapolitikken, Vitenskapsteoretisk forum, NMBU, Ås, 4 Feb.
- Kverndokk, S. (2015): The Trade-off between Intra- and Intergenerational Equity in Climate Policy: Can carbon leakage be justified? Nasjonalt forskermøte for økonomer
- Nævdal, E. (2015): Catastrophes and expected marginal utility - how the value of the last fish in a lake is infinity and why we shouldn't care (much) Invitert bidrag til workshopen- Thresholds, Tipping Points and Random Events in Dynamic Economic Systems-, 27-28 July
- Nævdal, E. (2015): Catastrophes and expected marginal utility - how the value of the last fish in a lake is infinity and why we shouldn't care (much) Presentasjon European Association of Environmental and Resource Economists 21st Annual Conference, Helsinki, Finland, 24-27 June
- Nævdal, E. (2015): Catastrophes and Expected Marginal Utility - How The Value Of The Last Fish In A Lake Is Infinity And Why We Shouldn't Care (Much) Presentert på Institutt for Foretaksøkonomi, NHH, 5 Mar.
- Nævdal, E. (2015): Inertia risk, towards an improved model of catastrophic risk, Presentasjon på 22nd Ulvön Conference on Environmental Economics, 16-18 Jan.

- Nævdal, E. (2015): Inertia risk: Accounting for delayed impacts in catastrophic risk structures and implications for policy. Presentasjon på Samfunnsøkonomenes forskermøte, 5-6 Jan.
- Nøstbakken, L. (2015): Rettferdige klimaavtaler Seminar, UiB Bergen, 4 Nov.
- Nyborg, K. (2015): Atferdsøkonomi: Relevans for grønn skatt. Foredrag for grønn skattekommissjon, Finansdepartementet
- Nyborg, K. (2015): On Cost-Benefit Analysis HELED Journal Club.
- Nyborg, K. (2015): Reciprocal Climate Negotiators. Annual Meeting of the Norwegian Economists' Association. Bergen.
- Nyborg, K. (2015): Social and moral norms and environmental policy. PhD Workshop lecture, University of Manchester
- Nyborg, K. (2015): Social norms, morals and self-interest as determinants of pro-environment behaviours: the case of household recycling 21st Annual Conference of the European Association of Environmental and Resource Economists. Helsinki.
- Nyborg, K. (2015): Would you like to save the planet? On responsibility avoidance with third party interference Annual Conference of the Royal Economic Society, . Manchester.
- Nyborg, K. (2015): Would you like to save the planet? On responsibility avoidance with third party interference 3rd Toulouse Economics and Biology Workshop? Evolution and Morality?
- Piacquadio, P. (2015): A fairness approach to utilitarianism ISF seminar, Oslo, 9 Oct.
- Piacquadio, P. (2015): A fairness approach to utilitarianism Statistics Norway economic seminar, Oslo, 5 May
- Piacquadio, P. (2015): A Lipsetian Theory of Institutional Change Aix-Marseille School of Economics, Marseille, 18 June
- Piacquadio, P. (2015): The ethics of intergenerational risk Conference in Public Economics 14th Journèe Louis-Andre Gerard-Varet, Aix-en-Provence, 15-16. June
- Piacquadio, P. (2015): The ethics of intergenerational risk European Association of Environmental and Resource Economists 2015 conference, Helsinki, 24-27 June
- Piacquadio, P. (2015): The ethics of intergenerational risk Workshop on the ethics of social risk, Montreal, 18-19. Sep.
- Rosendahl, K. (2015): Does a renewable fuel standard for biofuels reduce climate costs? 35th Meeting of the Norwegian Association of Economists
- Rosendahl, K. (2015): Green Paradox and Technology Policy Workshop. Munchen.
- Rosendahl, K. (2015): Liberalizing Russian gas markets - an economic analysis IAEE-conference, Antalya (Tyrkia), May

Rosendahl, K. (2015): Mitigating carbon leakage: combining output-based rebating with a consumption tax EAERE-conference, Helsinki, June

Rosendahl, K. (2015): Smart hedging against carbon leakage Lunch seminar ETH, Zurich, Oct.

Rosendahl, K. E. (2015): Emissions trading with offset markets and free quota allocations EAERE-konferansen. Toulouse.

Rosendahl, K. E. (2015): Short run effects of bleaker prospects for oligopolistic producers of a non-renewable resource Lunsjseminar. Oldenburg.

Rosnes, O. (2015): SNOW - CGE-modell for energi- og klimaanalyser. Full-day Workshop for the Ministry of Finance, Oslo, 24 June

Voigt, C. (2015): Building consensus in the UN climate negotiations - the example of REDD+ Staff seminar. Auckland.

Voigt, C. (2015): REDDpluss - Building Consensus in the UN climate negotiations Faglunsj. Institutt for privatrett.

Voigt, C. (2015): Up in the Air - Aviation in the EU Emissions Trading Scheme and the Question of Sovereignty Faglunsj. Oslo.

Wilhite, H. L. (2015): New directions in research on energy consumption and reduction. Invited lecture, Department of Environmental Sciences, Aarhus University, Denmark, Nov.

Wilhite, H. L. (2015): New frontiers in applying social and material perspectives to research on energy consumption and savings. Invited lecture, University College London, UK, Apr.

Winther, T. (2015): Electricity and social science: Ongoing projects and key issues. Invited lecture, Durham Energy Institute (DEI) Symposium, Durham University, UK, Sept.

Winther, T. (2015): Energi, etikk og det gode liv Energiprojekt UiO - Blindern VGS

Winther, T. (2015): Hvorfor er kunnskap om mennesker viktig for bærekraftig utvikling Kick-off arrangement for samarbeid UiO og Blindern videregående skole. Oslo.

CREE in the news

([http://www.cree.uio.no/CREE in the news.html](http://www.cree.uio.no/CREE_in_the_news.html))

- Forskere uenige om betydningen av ny klimaavtale.

Sammen med 4 andre forskere blir CREE forsker Taran Fæhn (SSB) spurt om i hvilken grad det er grunn til å være fornøyd med den nye klimaavtalen.

forskning.no 14. Des. 2015

- Kvotehandling

CREE forsker Katinka Holtmark (UiO) forklarer hva klimakvoter er og hva som skal til for at de skal fungere.

[Klassekampen 10. Des. 2015](#)

- Sett pris på miljøet.

Lederen for Grønn skattekomisjon, Lars-Erik Borge, professor (NTNU), argumenterer for økt bruk av miljøavgifter. CREE forskerne Prof Michael Hoel (UiO), Prof Knut-Einar Rosendahl (NMBU) og Forsker Brita Bye, (SSB), var også en del av kommisjonen.

CREE forskerne Mads Greker (SSB), Snorre Kverndokk, (Frisch) og Rolf Golombek (Frisch) har bidratt med rapport til utvalget.

[NOU 2015: 15 fra utvalget](#)

[Dagens Næringsliv 09 Des. 2015](#)

- Zero: - Grønn rapport bør legges i skuffen.

Miljøorganisasjonen Zero mener Grønn skattekomisjon misforsto oppgaven.

[Aftenposten 09. Des. 2015](#)

- 8 ways in which economics can save the world.

Sammen med 7 andre internasjonale klimaforskere blir CREE forsker Bård Harstad (UiO) spurt om hvordan man skal løse klimautfordringene.

[Independent 06. Des. 2015](#)

- Satser på feil spill.

CREE forskeren Bård Harstad (UiO-ØI) viser hvordan lab-eksperimenter tyder på at mangelfull forståelse av spillteori kan gi klimahavari.

[Dagens Næringsliv 04 Des. 2015](#)

- Et forsvar for humaniora.

CREE forskeren Eric Nævdal (Frisch) har en kronikk til forsvar av humanistenes metode bruk. [Aftenposten 04 nov. 2015](#)

- Is there any point in trying to restrict fossil fuel supplies? A new paper says yes.

I denne artikkelen blir [CREE WP 11/2013](#) brukt som argument i en debatt om begrensning av tilbud av fosilt brensel. Working Paperet er laget av CREE forskerne T. Fæhn, C.Hagem, L.

Lindholt, S. Mæland og K. E. Rosendahl (NMBU), alle ansatt på SSB. [Vox ENERGY](#)

[ENVIRONMENT 29 Okt. 2015](#)

- Nå lukter det grønt i Moss.

CREE forskeren Snorre Kverndokk (Frisch) er intervjuet om synlighet av sammfunnsgevinster i forbindelse med det grønnere budsjettet i Moss kommune. [Moss Dagblad 07 Okt. 2015](#)

- Biodieselavgiften fjernes.

CREE forskeren Bjart Holtmark (SSB) deltar på NRK P2 Dagsnytt Atten sammen med representanter fra SV og Venstre i «Fjerner biodieselavgiften». [NRK P2 Dagsnytt Atten 02](#)

[Okt. 2015](#)

- Debatt rundt SSB/CREE rapporten:

[Residential energy efficiency and European carbon policies A CGE-analysis with bottom-up information on energy efficiency technologies](#)

skrevet av CREE forskerne Brita Bye (SSB) , Taran Fæhn (SSB) og Orvika Rosnes (SSB)
[Teknisk Ukeblad Sept. 2015](#)

- Derfor sparer ikke vi nordmenn på strømmen.

CREE forskeren Tanja Winther (UiO) har et innlegg i Aftenposten om nordmenn adferd i forhold til strømsparing. [Aftenposten 19 Juni 2015](#)

- Ved Førdefjorden har Miljødirektoratet godtatt den billigste deponiløsningen.

CREE forskerne Mads Greaker (SSB) Michael Hoel (UiO) har et innlegg i Aftenposten der de argumenterer for at tillatelsen til gruvedrift med deponering av avgangsmasse i Førdefjorden er gitt på sviktende grunnlag. [Aftenposten 11 Juni 2015](#)

- Grønne sertifikater.

CREE forsker Cathrine Hagem (SSB) deltok i Dagsnytt 18 i innslag om tilskuddsordning for grønne sertifikater. [Dagsnytt 18 09 Juni 2015](#)

-Forklaringsproblem.

CREE forskerne Christoph Böhringer (Universität Oldenburg) og Knut Einar Rosendahl (NMBU) blir nevnt i innlegg om grønne sertifikater og vindmøller. Innlegget er skrevet av Bård Bjerkholt. [DN 09 Juni 2015](#)

- Vil beskatte miljøsynderne.

CREE forskeren Michael Hoel (UiO) tror det blir vanskelig å finne en klimaløsning uten å beskatte miljøsynderne. [Universitas 21 mai 2015.](#)

- Innvendinger mot elbiler.

CREE forsker Bjart Holtsmark (SSB) blir nevnt i flere innlegg om Elbiler og elektrisk kraft. [Diverse innlegg om elbiler fra 2013-2015.](#)

- Slik kvittet Sornappriya seg med oljefyren.

I en artikkel om forbudet av oljefyrer kommenterer CREE forsker Bente Halvorsen (SSB) folks lave vilje til å gjennomføre Enøk-tiltak. [E24 07 Mai 2015.](#)

- Kraftløst forslag.

CREE forsker Finn R. Førsum (professor emeritus UiO) uttrykker at det ikke finnes empirisk dekning for at offentlig eie skader verdiskaping og produktivitet. [DN Mar./Apr. 2015.](#)

- Den nye klimadebatten.

Sammen med andre forskere har CREE forskere et innlegg om Norges klimaavtale med EU. [DN 21.Mar. 2015.](#)

- Oslo foran Norge på klim tiltak.

Henviing til [SSB/CREE arbeid](#) i artikkel som sammenligner Statens og Oslos klimastrategi. [DN 23.Feb. 2015.](#)

- Prisras støper om oljemakarkedet.

CREE forsker Daniel Spiro (UiO) er intervjuet av SVT om oljeprisfallet. [SVT Nyheter 12 Feb. 2015.](#)

-Rea på olja (Salg av olje)

CREE forsker Daniel Spiro (UiO) er med på en paneldebatt om oljeprisfallet i SVT Nyheter. [SVT Nyheter 10 Feb. 2015.](#)

-Klimamål

CREE forsker Cathrine Hagem (SSB) intervjuet om stortingsmeldingen om klima på NRK radio. [NRK P2 03 Feb. 2015.](#)

-Holdt foredrag for statsministeren.

CREE forskerne Taran Fæhn (SSB) og Michael Hoel (UiO) holdt foredrag for statsministeren om forskjellige miljøøkonomiske problemstillinger. [03 Feb. 2015.](#)

- Narrespillet.

CREE forskeren Taran Fæhn (SSB) intervjues om klimapolitiske virkemidler i «Narrespillet». Finansavisen 10 Jan. 2015.