



## Contents

- 2 – People in the Energy Lab
- 3 – NORCOWE 2016 Conference
- 5 – New PhD - Valerie-Marie Kumer
- 6 – Interview with Joachim Reuder – Professor in experimental meteorology
- 8 – Interview with Ingvild Øijorden – Energy Master Alumnus
- 10 – Interesting energy news around the world

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## Welcome to the 2nd edition of the Energy Lab newsletter!

**During the month of September, major results from several years of research on offshore wind were presented at the successful NORCOWE conference in Bergen. In this issue of the Newsletter we choose to focus on offshore wind. We have a report from the conference, interviews with key people, discussion of prospects for the future for Norwegian companies and research groups, and interviews with one professor, one recently graduated PhD student and one energy master student - enjoy reading their perspectives! And as usual the Newsletter includes some selected miscellaneous energy news from around the world.**

The 29th of September, the University Board approved a proposed framework for organising the university priority area "Climate and Energy Transition" (Marine Research and Global Challenges are the other two). The dean of the faculty of Mathematics and Natural Sciences is now charged to work with all the other faculties to come back with a program and plan for this whole area in time for the board meeting on 1 December. This is a major milestone, and we are all looking forward to contributing.

### Feedback on the newsletter

We are still interested to hear your feedback about the newsletter (both positive and negative). You can find contact information on the left-hand side of this page. Please send us an e-mail!



## People in the Energy Lab

The Energy Lab consists of about 150 members. Below we present some of the people who have been involved in initiating the Energy Lab, and are also central members on a day-to-day basis. Since this newsletter emphasises on offshore wind energy, we also present some offshore wind specialist, but all affiliated with the host department GFI. By clicking on the members names below you can access their personal homepages.

The Energy Lab has also decided to establish a program committee. This will be in charge of deciding the program for half-day meetings in the Energy Lab, make a list of potential speakers and topics for the lunch-meetings. In addition will the members of the committee act as a contact person on their respective institutes/institutions. We are currently working on putting together the committee, which so far consists of; Tanja Barth (Chemical Institute), Martin Fernø (IFT), Norbert Lümmer (HiB), Håvard Haarstad (Department of Geography), Kristin Guldbrandsen Frøysa (GFI). This list will be expanded with members both internally from UiB and externally from other institutions. In addition Peter Haugan and Hans-Kristian Ringkjøb will assist and support the committee.

[Peter Haugan](#)



Professor at GFI

[Hans-Kristian Ringkjøb](#)



PhD-student at GFI

[Joachim Reuder](#)



Professor at GFI

[Kristin Guldbrandsen Frøysa](#)



Director of NORCOWE, 20 % position at GFI.

[Nils Gunnar Kvamstø](#)



Head of GFI

[Finn Gunnar Nielsen](#)



Professor at GFI

[Jan Asle Olseth](#)



Professor at GFI

[Friederike Urbassek Hoffman](#)



Senior Executive Officer, Research coordinator at GFI

[Meng Chieh Yang](#)



Practice researcher at GFI

[Ida Marie Solbrekke](#)



PhD-student at GFI



## NORCOWE 2016 Conference



The NORCOWE board – Back from the left: Nils Gunnar Kvamstø (UiB), John Dalsgaard Sørensen (AAU), Gudmund Olsen (Statoil), Klaus Johannsen (Uni Research), Stian Anfinsen (CMR), Jostein Mælan (StormGeo) Front from the left: Bjørn H Hjertager (UiS), Anne Marie M Seterlund (Statkraft), Birgitte Rugaard Furevik (MET Norway), Alf Holmelid (UiA) (chair), Kristin Guldbrandsen Frøysa (CMR) (Centre Director of NORCOWE) Photo: Marit Hommedal/NORCOWE

**After eight years, the Norwegian Centre for Offshore Wind Energy ([NORCOWE](#)) held their concluding conference in Bergen between the 14th and 16th of September. More than one hundred participants attended the conference, where results and highlights from the research achieved in NORCOWE were presented.**

On the occasion of NORCOWE's finalization in March 2017, a grand summarizing conference was held at Grand Hotel Terminus in Bergen. During the two day conference, major results from the focus areas of NORCOWE were presented. This included numerical weather prediction, met/ocean measurement campaigns, maintenance and operations, wind farm layout etc. There was a strong focus on PhD projects, innovations and spin-offs from the Centre, and the future challenges of offshore wind technology were also discussed.



Photo: Marit Hommedal/NORCOWE



The first day of the conference focused on the highlights of NORCOWE's research and looked at the impact the FME centre has had. On the second day, the conference got more into the technical details, with two parallel sessions on measurement and numerical weather prediction and wind-farm operation, maintenance, control and optimization.

On both days there were poster sessions, where people had the opportunity to network and to learn from all the different expertise that was gathered at the conference.

The final day of the conference, the 16<sup>th</sup> of September, included a site-visit to the Midtjøllet wind farm at Fitjar. Students from the master in energy at the University of Bergen also participated on this excursion.



Photo: Marit Hommedal/NORCOWE

The full program and most of the presentations from the conference can be found on NORCOWE's website [here](#).

**Arnfinn Christensen** has written an [article on Forskning.no](#) about offshore wind in Norway, where he has spoken with many of the participants on the NORCOWE conference. He discusses the potential Norway has of developing offshore wind energy, but asks why we are building the world's first test park of floating offshore wind turbines outside Scotland?

**Sysla Grønn** has also conducted an [interview](#) with Jostein Mælan from StormGeo, a company that has been an industry partner in NORCOWE and delivers meteorological data to about 40 wind farms in the North Sea basin.



## New PhD: Valerie-Marie Kumer

**The 13<sup>th</sup> of September Valerie-Marie Kumer successfully defended her PhD titled “The Potential of LiDAR Measurements for the Characterisation of Wind Turbine Wakes”.**

This text is a translated version of Valerie's PhD [announcement](#).

[Valerie-Marie Kumer](#) was born in Eisenstadt in Austria in 1989. After having graduated from the University of Wien in 2012, she moved to Bergen to start her PhD in the group of experimental meteorology at the Geophysical Institute in Bergen, in cooperation with NORCOWE.

Valerie-Marie Kumer's thesis explores "Light Detection and Ranging" (LiDAR) instruments for use in full-scale wake measurements.

Results from national and international measuring campaigns have shown that LiDAR instruments are useful both in the exploration of wind turbine wakes and in increasing the understanding of wake characteristics in the atmosphere.

In the dissertation, wake measurements were also analysed and presented as frequency spectra. Frequency spectra of speed variations in the wake are important for load calculations and used by engineers in the design of wind turbines.

Energy production in wind farms is largely dependent on the individual turbine performance, but since there are many turbines placed in the same region, it is impossible to have undisturbed wind conditions for all.

The turbines located in the shadow of the first turbines harvest less energy as they experience a lower wind speed. In the wake of a wind turbine the speed is reduced and the turbulence increased relative to the undisturbed wind in front of the turbine. Because of this, the location of the turbines is very important both for maximum

energy production, but also to have control of the forces on the turbines.

The location of the wind turbines are made on the basis of simulations with wake models. These models are often validated against experiments in wind tunnels, but today's wake models can be improved. To develop such improved wake models and to validate them, measures of wake effects behind real wind turbines are required. With better wake models we will be able to get more energy out of the wind farms.



Valerie-Marie Kumer (Photo: UiB)

[Sysla Grønn published an interview with Valerie-Marie Kumer the 28<sup>th</sup> of September.](#)



## Measuring the Atmospheric Boundary Layer

Joachim Reuder started working at GFI in 2005. He has been a professor in experimental meteorology since 2008, working mainly on boundary layer meteorology, orographic effects and solar UV radiation. Recently much of his work has been related to wind energy, and he has also been central in the development of the Energy Lab.



Professor Joachim Reuder (Photo: UiB)

### ***Tell us a bit about yourself?***

I have been interested in meteorology since I was a child. I took my master in meteorology at the University of Munich, and my PhD at the University of Cottbus. My PhD was related to atmospheric radiation and photochemical effects of radiation. Later on I started mainly to work with boundary layer meteorology, studying the lowest part of the atmosphere. About 10 years ago I came to research in wind energy and renewable energy when I was involved in the NORCOWE project, where GFI was mainly involved in wind and wave conditions for offshore wind.

### ***What is your research focus now?***

My current research focuses on the structure of the marine atmospheric boundary layer, and how it interacts with the wind field and the wind turbines. I'm interested in the wake effects, single turbine wake effects, the wake of wind farms, and how the wakes are modified by atmospheric stability.

### ***Why do you choose to focus on these topics?***

First, as a boundary layer meteorologist, I'm very interested in the lowest level of the atmosphere where wind turbines are located. I think it's a very

interesting field, especially offshore, where not so many activities have been done before.

The second reason is that during previous years there has been a good funding basis for doing this research. The Norwegian government and the research council have been focusing on this research, but now the signals show that they are rather unclear what should be the new focus. It seems as this research topic might not be the highest focused area in Norway.

### ***What research topics do you plan to focus on in the future?***

We only have gotten a few answers and we are far away from really understanding the system completely. The wind field over the ocean at altitudes of 200, 250 or maybe 300m is very poorly known, and newer turbines will reach such altitudes. This will require more measurements and more data interpretations. I will try to work with all the instrumentations, the know-how and the infrastructure we have created here at the institute.

Norway has had a rather strong position in offshore wind during the last few years, but there are also many activities in Germany, UK, Denmark, America, etc. However, I think Norway really has a leading position in marine operations and marine technology from oil and gas for over 30 or 40 years. This would be a perfect starting point, to bring this knowledge, experience and infrastructure into the offshore wind sector.

### ***How do you think your research can influence the world?***

I'm not usually thinking that big, but I think the main impact will be on the better understanding of the marine boundary layer, the interaction between wind and waves, and the establishment, test, and validation of new measurement strategies and measurement technologies.

### ***How do you picture the energy future? What are your vision/hopes?***

Of course I hope we will reduce the use of fossil fuels, because it's both bad for the climate and it's a waste of resources, which we can use



much more intelligently. So I'm rather sure that the future is renewable and green, and I'm also sure that both solar and wind will play a big role. Though, we are living in a globalized world with many uncertain factors, such as political situations, oil price, new inventions etc. The situation will look distinctly different from now within 10 or 20 years. We will see changes for sure.

***What do you think about the Energy Lab and what are your expectations of it?***

I think it's a great thing, and I have been a little bit involved in creating the Energy Lab. My main hope is that it will be a platform to keep the momentum we have at the moment, and maybe to accelerate the activities towards renewable energy and energy transition. The Energy Lab can be a platform here at the institute, between institutes in the university, and for all the interested people from the outside, also creating

a contact to the industry and public administration.

***What do you think should be the focus of energy education in the future (in Norway)?***

All people should be educated more in energy use and energy efficiency. For master and PhD level, we should also think about what these people are expected to do in the future or what they can do. It doesn't make sense to educate people in a direction or a field where they will not be able to work.

As we see here in the master program in energy, there is a need of both a solid foundation of the physics behind the various energy sources, and also on how to use the available resources in the technically best way.

I also think the Energy Lab makes it possible to let people think a little bit broader and get more information than only in their very specific area of interest.



Joachim in his office (Photo: Energy Lab)



## Studying the Environmental Consequences of Offshore Wind



Ingvild Øijorden (Photo: Energy Lab)

**Ingvild Øijorden recently finished her master in Renewable Energy with a specialization in Environmental Consequences of Renewable Energy. With a background in oceanography she wrote her master thesis on the influence of offshore wind farms on primary production in the North Sea.**

***Why did you choose to study the master in energy at UiB/HiB and why did you choose your specialization?***

During the last year of my bachelor degree in meteorology and oceanography I decided that I wanted to study renewable energy for my master degree. My interest for the climate and environment has always been the motivation for my choice of study and with a master in renewable energy at UiB I felt like I had more options to work

within a sustainable industry in my future career.

I chose to study environmental consequences of renewable energy so that I could combine my interest for renewable energy, oceanography, meteorology and environmental consequences of human activity.

***What do you think about the master in energy at UiB/HiB?***

The best thing about this master program is that there are so many specialization topics to

choose from. So if you have an interest in or background from an energy topic it is likely that you can study it here and do exciting research on it.

***What are your best experiences from this program?***

That must be finding interesting results when working on my master thesis. I also remember the field trip to Midtfjellet wind farm at Fitjar as exciting.



### **Tell us about your master thesis.**

My master thesis was on the less studied influence of offshore wind farms on primary production in the North Sea. Primary production is the production of new biomass by primary producers, which is at the bottom of the food chain. By the use of numerical modelling I investigated the effect of a reduced wind stress pattern from realistic offshore wind farms in the North Sea on physical parameters and primary production. When including the effect from wind farms I found that the total primary production in the North Sea was similar to the reference case, but the change in the geographical distribution was large. Because of this the primary production at given locations was shown to be highly affected by the change in wind stress due to offshore wind farms. This change in geographical distribution may influence higher trophic levels and cause conflicts between different regions in the North Sea.

### **Tell us about the theoretical framework you use in developing your research?**

I used the numerical model ECOSMO, a coupled bio-physical model. I developed a method further to include the effect from offshore wind farms by reducing the wind stress in the wake area of a wind farm. I used Fortran and Matlab for development and analysis.

### **How do you think your research can influence the world?**

There are few studies on environmental consequences of offshore wind farms on population level impact and more is needed. Hopefully my research can inspire others to study the topic in greater detail with a more detailed representation of the effect of wind farms on the ocean. If the change in geographical distribution of primary production is shown to be as large as was found in my study, the consequences for some regions may be large, potentially leading to political and economic conflicts.

### **What is the coolest finding of your research?**

The most interesting finding must be the large effect found on distribution of primary production in the North Sea

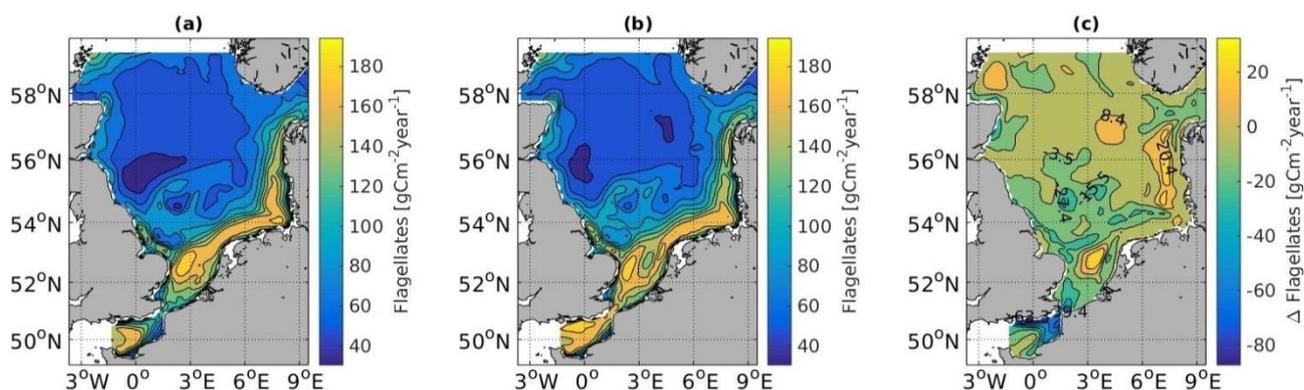
caused by change in wind stress downstream of wind farms.

### **How do you think this education can be used in your future career?**

Combined with my bachelor degree in meteorology and oceanography, I think this education gives me a broad spectrum of knowledge of energy, understanding atmosphere-ocean interactions and working with numerical tools and handling large sets of data, useful in many jobs.

### **How do you picture the energy future? What is your vision or hope?**

The energy future is a zero emission future. To reach this as soon as possible it is important to stay below the 1.5 to 2 degrees limit of global warming. For large parts of the world the future contains a mix of hydropower, solar and wind energy, hydrogen and biofuel. For some parts solar power will be an important part of the energy future and developing countries must take the shortcut directly to the cheaper and more sustainable renewable energy, with funding from developed countries. For Norway there will hopefully be a rapid growth in jobs within the renewable sector.



Annual vertically integrated distribution of primary production [ $\text{gCm}^{-2}\text{year}^{-1}$ ] by Flagellates in the North Sea for a) the reference run, b) the modified run influenced by wind farms present in the North sea in 2015 and c) the difference between the two runs (reference run-modified run).



## Energy news from around the world

### The US Presidential Election and the large-scale climate politics

From Energi & Klima ([Click here for the original news article](#))

In these days of presidential debates you can read about the two candidates' view on the politics of climate. Kjetil Lund from Statkraft has written a very interesting blog post published in Energi & Klima about the effect the outcome of the presidential election in the US will have on the world's climate. He explains why a victory to Hillary Clinton gives reason to be an optimist about the climate. However, he also speaks about what might happen if Trump wins, who believes climate change is a [hoax made up by the Chinese](#).

(Note: In Norwegian)

### China and the US have ratified the Paris agreement

From Reuters: ([Click here for the original news article](#))

On the 3<sup>rd</sup> of September China and the United States ratified the Paris agreement. This was a very important step, as 55 countries representing 55 % of global emissions must ratify the agreement for it to take effect. China and the US account for a bit below 40 % of the global emissions.

India has also announced that they will ratify the Paris agreement on the 2<sup>nd</sup> of October. India is the 3<sup>rd</sup> largest emitter in the world, accounting for about 4.1 percent of global greenhouse gas emissions. ([Times of India](#))

### Hinkley Point C nuclear station: an expensive solution to a cheap problem

From the London School of Economics and Political Science: ([Click here for the original news article](#))

This September the English government gave the green light to a new 18 billion pounds nuclear power plant, with a capacity of 3.2 GW and expected to provide electricity to 7 % of the country's population. The project involves EDF, France's largest utility, and China General Nuclear Power Group. The English government have signed a 35-year, inflation linked, contract for difference (CfD) — a price guarantee — with EDF, at £92.5/MWh (in 2012). In this post, Andrea Gandolfo looks at the costs of the nuclear plant and compares it to the cost of other cheaper alternatives such as variable renewables.

### The electric cars available today, how much they cost, and how far they go – in one chart

From VOX: ([Click here for the original news article](#))

Bloomberg New Energy Finance has released a chart showing the range vs price on today's and the future's electric cars. In this blog post, David Roberts discusses the chart and the state of electric vehicles today.

