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The start of a new semester!

A new semester has just started and the Bergen Energy Lab has a lot of exciting events in store for this autumn!

With two events already completed, and many more to come, I'm excited for the autumn semester in the Bergen Energy Lab. On the 13th of September, we arrange a Half-Day Seminar on Efficient and Sustainable Electricity Markets in cooperation with the Norwegian School of Economics (NHH). Read about it on page 3, and make sure to register by following [this link](#)! The event is open for all and free of charge.

This semester we have started to serve waffles during our Tuesday lunch meetings to accompany the highly interesting presentations. Read more about upcoming events on page 2.

Read also summaries from the two events already completed on page 4 and 5, respectively the kick-off meeting with Eva Britt Isager and Sølve Sundbø and the history of Hywind with Finn Gunnar Nilsen.

Last but not least, don't miss the interview with former Energy Master Graduate Kristine Domaas Klemetsen on page 7.

Hans-Kristian Ringkjøb



Upcoming events

Many highly interesting events are coming up in the Bergen Energy Lab. Please keep an eye on <http://www.uib.no/en/energy/calendar> for additional events and eventual changes in the program.

This semester we have started to serve waffles during our Tuesday lunch meetings to accompany the highly interesting presentations. In that sense, we need some people who can volunteer to roast waffles before one or more of the meetings. Please send an e-mail to energylab@uib.no if you would like to contribute.

Please note that due to the NFR deadline the 6th of September, there will be no Tuesday lunch-meeting on the 5th of September.

September meetings

12. September – Lunch Meeting (12.00-13.00)

Tor Sørøvik (MI,UIB): Some research challenges for Photovoltaic Solar Energy – A collaboration with KNUST in Ghana

Helland-Hansen, GFI

13. September – Half-Day Seminar (11.30 – 15.45)

Efficient and Sustainable Electricity Markets

See more information below

19. September – Lunch Meeting (12.00-13.00)

Endre Tvinnereim (Uni Research): Storms, ice and conspiracies: Explaining what people in four European countries associate with climate change

Digsscore (Rosenbergsgaten)

26. September – Lunch Meeting (12.00-13.00)

Karina Garnes Reigstad (Bergen commune): Renewable cluster in Bergen

Realfagsbygget, TBC



Half-day seminar - Efficient and Sustainable Electricity Markets

Date and location

September 13, 1130-1545

NHH, Kristian Gerhard Jensen Centre

Electricity markets are presently under transformation, due in part to the transition towards renewable energy sources. Renewables, like wind and sun, are to a large extent more variable and less predictable than traditional energy sources, and this creates a demand for more flexibility by other players in the market. The EU Winter Package proposes changes to the design of European wholesale and retail electricity markets, seeking to accommodate the increased share of intermittent renewables in an efficient manner, while at the same time providing a fair deal for consumers.

This seminar will discuss some of the challenges in designing efficient and sustainable electricity markets. The focus of the seminar is both on the national and European wholesale markets as well as local retail markets and distribution grids.

The event is open for all and free of charge, but registration is mandatory. Please register by using the following [form](#).

Program

1130 – 1215 Lunch and mingling

Wholesale Markets

1215 – 1245 Pricing and congestion management in coupled European wholesale markets
Mette Bjørndal, NHH

1245 – 1315 Abuse of competition law in pursuit of the single European electricity market
Christian Bergqvist, University of Copenhagen

1315 – 1345 Restructured Wholesale Electricity Markets: A New Design for a New Millennium
Benjamin Fram, NHH

1345 – 1415 Coffee break

Retail Markets and Distribution Grids

1415 – 1445 Can demand response help reduce future distribution grid investments?
An economic study of peak shaving in the Norwegian distribution grid: SEMIAH pilot in Engene, Southern Norway
Jonathan Wood, NHH

1445 – 1515 Prosumers in Norway - with focus on solar energy
Ann-Mari Løberg Knudsen, BKK

1515 – 1545 Prosumers and distributed energy resources: New challenges for network tariffs
Jørgen Bjørndalen, DNV GL – Energy



Autumn 2017 kickoff meeting

On the first Bergen Energy Lab event of the semester, Eva Britt Isager from Bergen Kommune (City of Bergen) and Sølve Sondbø from Hordaland County Council held two very interesting presentations about climate plans and actions in Bergen and Hordaland.

[Eva Britt Isager](#) is the head of the climate section in Bergen Kommune. The climate section is responsible for climate and environmental work in the municipality of Bergen, including organizing and coordinating activities as well as developing climate and energy action plans for Bergen. [The green strategy for Bergen](#) was approved by the City Council on September 21st 2016, and aims for Bergen to become the greenest city in Norway.

Already in three years, in 2020, Bergen aims to reduce direct greenhouse gas emissions by 30 % compared to 1991-levels. Furthermore, in 2030 Bergen will be a fossil-free city, and in 2050 it will be a 1.5-degree city following UN standards.



Eva Britt Isager, Bergen Kommune (Photo: Bergen Energy Lab)

Reaching these goals will be demanding, and requires massive efforts. Current emissions come from transport (58 %), heating (16 %), waste management (25 %) and agriculture (1 %). Several strategies and measures within these sectors have already been proposed, including prohibiting the use of oil-fired stoves for heating by 2020, implementing carbon capture and storage on the waste incineration plant by 2025, promoting zero-emission transport by providing good access to renewable fuels (charging stations, hydrogen filling stations and biofuel filling stations) and many more.

After Eva Britt's presentation on Bergen Kommune, the scope was broadened to look at climate plans at a regional level. [Sølve Sondbø](#), the head of Climate and Natural Resources at the Hordaland County Council, spoke about cutting emissions in the Hordaland County with a specific focus on ferries.

More than half of the greenhouse gas emissions from Hordaland county council are from industrial activities, including the largest singular Norwegian greenhouse gas emitter, the Statoil Mongstad Oil Refinery and Gas Power Plant. Of the emissions the County Council can influence, 99 % are from bought services such as ferries, buses and speed-boats. Ferries are the largest of these, corresponding to 43 % of the County Council's own emissions.

In 2016, the County Council held a tender for all the 17 ferry connections they are responsible for in Hordaland (of a total of 19 connections). In order to compete for these contracts, a minimum cut of 55 % on CO₂-emissions and 25 % on energy use was required. Further cuts in CO₂



and energy use were also taken into account in the final decision.



Sølve Sundbø, Hordaland County Council (Photo: Bergen Energy Lab)

Four ferry operators won contracts with zero/low emission technology, cutting about 90 % of CO₂ emissions and 65 % of energy use. In sum, the ferry tender cuts 40 % of the greenhouse gas emissions the County Council can influence, which represents a reduction of about 51 000 tons of CO₂ per year. This corresponds to about 6 % of all road emissions in Hordaland.

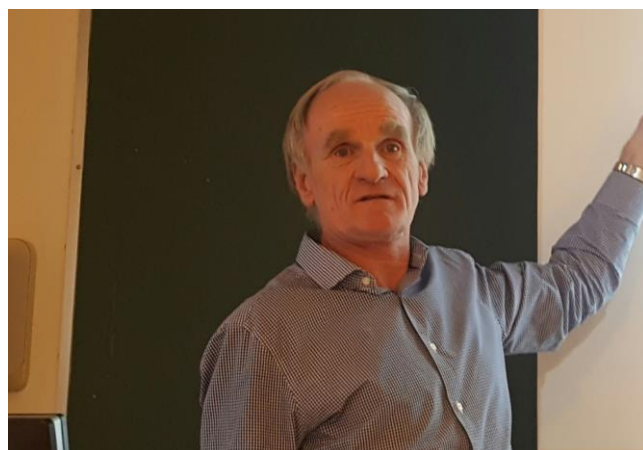
Finally, the County Council pointed out that they give grants to master theses on climate which are relevant for the County Council Climate plan. More information and the application form can be found [here](#) (in Norwegian).

Finn Gunnar Nielsen (GFI) – The story of Hywind

Finn Gunnar Nielsen was the head of the R&D project where the first full-scale prototype of a floating wind turbine was developed. He held a talk at Bergen Energy Lab the 29th of August, telling the story of Hywind from the idea was born to the world's first floating wind farm currently being installed in Scotland.

The idea of the Hywind offshore floating wind turbine was born as early as in 2001, when two employees of Statoil, Dag Christensen and Knut Solberg, were out sailing. They saw a buoy floating in the water, and drew a sketch on a napkin of how the buoy could be 100 meters tall and with rotating blades on top. Statoil used the next eight years to turn the sketch into the first full-scale floating wind turbine the world had seen.

Finn Gunnar Nielsen, head of the R&D project where Hywind was developed, spoke about the numerous challenges faced during the development stage. An offshore floating wind turbine is a complex and challenging dynamic system, exposed to a harsh environment with loads from winds, waves and currents. Mooring line dynamics and structural dynamics are complicated, and an intricate control system is necessary to control the operation of the turbine and the movements of the floating structure.



Finn Gunnar Nielsen, GFI (Photo: Stian Backe)

In 2005, the Hywind concept was demonstrated through model scale experiments in Trondheim. The model scale of 1:47 came with some challenges, as not all parameters can be scaled linearly. The masses scale with the power of three, leading to difficulties related to the weight of the different parts. For example the nacelle,



housing a fully functioning pitch control unit, could only weigh a couple of kilograms.



Finn Gunnar receives the "Energy Globe"

The full-scale 2.3 MW Hywind demonstration unit was deployed in June 2009, about 10 kilometres west of Karmøy in Norway.

It is still there today, and has endured harsh conditions with wind gusts up to 40 m/s and significant wave heights of 10.5 meters. Finn Gunnar and Statoil won the 2010 edition of the "Energy Globe", for the success of their Hywind pilot project.

The success of Hywind also led to the world's first floating wind farm currently being installed off the coast of Scotland. Statoil's "Hywind Scotland" pilot farm is made up of five 6 MW wind turbines and aims to demonstrate the feasibility of future commercial offshore floating wind farms. It will start delivering electricity to the grid during 2017, powering about 22 000 households. The five structures were assembled at Stord during May this year, and all five have now been successfully towed across the North Sea and installed on-site in Scotland. An idea that originally was thought of as "crazy" turned out to be the future for Statoil.



The Hywind demo (Image: [Statoil](#))



Alumni Interview: Kristine Domaas Klemetsen

By: Alice Casagrande Cesconetto

Kristine Domaas Klemetsen was one of the first graduates from the master's programme in Energy at UiB. She wrote a master thesis about the wake effects at the Sheringham Shole wind farm, in cooperation with the company Aquiloz. Now she works as an Energy Engineer at GK in Bergen, contributing to large energy reductions in industrial buildings.



Kristine Domaas Klemetsen (Photo: Private)

Tell us a little bit about your background?

I was from early on interested in the environment, climate change and renewable energy, and I found both a bachelor and a master program to suit my interests. I studied Energy Technology at Høgskolen i Bergen (now called Høgskolen på Vestlandet), where a course in energy sources resulted in a great interest in wind energy. With the Norwegian energy system in mind, I thought that wind energy was a natural choice for future development, as large scale hydro-power is already much exploited, and as the combination of hydro-power and wind power removes problems related to power production variations from wind farms.

With Norway's long coast, great offshore wind measurements and exceptional offshore knowledge from the oil industry, I thought offshore wind power seemed to have the most potential. Also, with much of Europe depending on fossil fuel, the opportunity for Norway to operate as a "battery

bank" and as a renewable energy exporter seemed a natural future prospect.

After writing a bachelor thesis on wake effects in offshore environments I was keen to learn more about wind energy, especially offshore.

What do you think of the program/what were your best experiences?

My class was the first to take the master program at UiB/HiB, so I suspect we got some extra attention. I'm not sure if the subjects I took in 2012/2013 are the same as students specializing on wind energy are taking today, but in my experience, the focus was set a little too strongly on meteorology and oceanography. I took most of my subjects with master students from meteorology and oceanography, and was missing a stronger focus on wind energy. This might have changed as the number of wind energy students (hopefully) increased (I was alone in this specialization). There was a small course (5 ECTS) on offshore wind that I greatly enjoyed, and I hope this is still offered. The two energy courses ENERGI200 and ENERGI210 were quite general, and had more focus on fossil fuels than I would prefer. The faculty was very helpful when it came to finding a company to take in a master student and to co-supervise, this I was grateful for.

Could you tell us a little bit about your master thesis?

The subject of wake effects was almost randomly given to me and my classmates from the company we wrote the bachelor thesis with/for (GexCon AS at Fantoft in Bergen). The subject was so interesting that I also wanted to focus my master



thesis on it. My master thesis entitled “Wake effects at Sheringham Shoal offshore wind farm” let me work with real data measurements from the offshore wind farm. I was comparing the wake effects found in the dataset from Sheringham Shoal to a well-known wake model (Larsen model). During the work it became clear that the available dataset from Sheringham Shoal did not have enough measurements (the dataset was only for 8 months) to properly validate the model, but the wake effects are clearly seen in the dataset. Understanding wake effects is very important when designing the layout of a large windfarm, especially offshore, as it can result in a great loss of power production if not properly considered.

(A “wake” is the area behind a wind turbine that has decreased kinetic energy, and increased turbulence. When the wake from one turbine hits another nearby turbine the power production of said turbine will decrease, as wind speeds are lower, and the increased turbulence will result in more fatigue, and thus added maintenance costs and possibly shortened lifespan.)

Most importantly: which advice you would give to the current students at UiB/HiB?

My best advice to current students would be to fully exploit the knowledge and resources at hand at the faculty, and to think thoroughly when choosing a topic for the master thesis. One year is a long time spent on one topic. I decided to write my thesis in cooperation with a company, something I am very glad about, and can recommend. Writing with a company is a great way to create a network, and may even lead to a job. Last, and perhaps obvious, advice would be to start applying for jobs long before graduation, and apply for relevant summer jobs if possible.

What is your current position? Could you tell us a bit about your current job?

After searching for a job for quite a while, I found my place at GK in Bergen, as an Energy engineer.

I am mostly working with mapping energy consumption in industrial buildings, and counsel owners on how to reduce their energy consumption, often through “Energimerking”. I also often preform an Energy assessment (“Energivurdering”) of ventilation and cooling units, and in newly planned buildings I make sure that the building upholds current energy demands (set by TEK10/TEK17) and advice on how to reach these demands.

Has the master in energy at UiB been useful in your job? How so?

Not directly, but experience with independent work, writing reports, long-term assignments, presentations and so on will always come in handy.

Would you recommend others to work with energy? Why?

Of course! To me, it is very rewarding to have the opportunity to contribute to energy reduction in industrial buildings. The potential is at times surprisingly high. Every kWh saved by energy efficiency, or produced by new renewable energy, is a step in the right direction. I hope there will be a demand for people educated in energy for many decades to come.

How do you picture the energy future?

I expect to see a great demand for renewable energy in the future, not only as electricity will be produced from renewables instead of fossil fuels, but also as the transport sector changes to battery/hydrogen/bio-fuel. I think energy storage in batteries (for homes and low consuming/short distance transportation) and hydrogen (high consuming/long distance transportation) will play a big role in the future. Energy efficiency has a great potential to reduce the average energy consumption, and will probably be even more focused on in the future. Nuclear power production with Thorium as “fuel” instead of Uranium may also be a part of future power production.

