



Welcome

Welcome!

Welcome to the second MEDOW newsletter!

This issue reports on our network training and mid-term review meetings in Leuven and Brussels in January, and shares the secondment experiences of some of our researchers.

We also welcome our final three recruited researchers, Qing Mu, Agustí Egea and Domenico Ricchiuto.

The MEDOW (Multi-Terminal DC Grid for Offshore Wind) project is investigating DC (direct current) grids for transmitting offshore wind power. MEDOW researchers are working on the technology that we hope will form the basis of a future European 'supergrid'.

In MEDOW, 17 early career researchers work with staff from 11 industry and academic partner organisations with collective expertise on the manufacturing, design, operation and control of multi-terminal DC grids.

Please pass the newsletter to those who you think will be interested and ask them to contact me to join the mailing list.

A newsletter will be issued 3-4 times per year and will aim to communicate not only news from MEDOW but also news of interest to the wider research community and the public, so contact me if you have news from the DC grids, HVDC, offshore wind, power electronics or renewable energy communities that can be included in the next issue.

Cath Roderick
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Training and Events

Whenever possible, our 'network training activities' will be open to researchers from outside the network so as to ensure that as many people as possible benefit from the project.

Want to take part?

Email Cath Roderick
RoderickCH@cardiff.ac.uk

Network training & Mid-Term Review meeting in Leuven and Brussels January 2015

As an 'Initial Training Network', we aim to give our researchers wide-ranging training in the technical and supporting skills that they need to embark upon successful and productive research careers in the private sector as well as in academia.

Our last meeting took place in January in Belgium. You can see reports on what we did on our [website](#).

The following activities were open to researchers from outside the network. It was a really positive experience for our researchers to be joined by other researchers from KU Leuven.

Monday 19 January (Leuven)

Time & Project management for Researchers

Tuesday 20 January (Brussels)

Industry day with Elia System Operator, including talks from key staff members and a National Control Centre site visit.

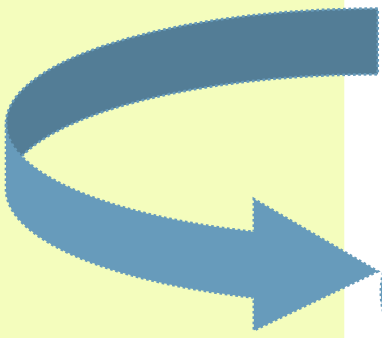
Thursday 22 January (Leuven)

Assembly Meeting—MEDOW work packages will present their objectives and results.

Lecture on recent developments in HVDC by Dr Norman MacLeod of Parsons Brinckerhoff

Friday 23 January (Leuven)

Seminars on topics related to DC grids from the MEDOW



Our next network event will be a wind power summer school open to researchers from outside the network; check our [website](#) for details soon!

Mid-Term Review Meeting with the European Commission



In Brussels in January, MEDOW had its mid-project review meeting with our Project Officer from the European Commission, Thierry Colin, and an external expert technical reviewer, Miroslav Chomát of the Academy of Sciences of the Czech Republic.

This is a very important meeting for an ITN when an EU representative and an external reviewer take a critical look at project progress and the research work of our fellows. It brought all our trainees and their supervisors to central Brussels and was kindly hosted by our partner Elia System Operator; thank you to Elia staff for your organisation!

All of the MEDOW researchers presented themselves and their progress to the group, and their supervisors were there to join their discussions with Thierry and Miroslav.

We felt that the meeting went very well, and were really pleased to receive such positive and helpful feedback from our guests. Our Project Officer pointed out that the recruited researchers (who submitted anonymous pre-meeting questionnaires to the Commission) seem happy with their experiences and training within the MEDOW network.

The positive comments we received were a reflection of the time and hard work that network members have put in to the project.



Recruited Researchers

Recent appointments

Our three final researchers, all post-doctoral 'Experienced Researchers', have started work

Agustí Egea has started work as Experienced Researcher based at China Electric Power Research Institute.

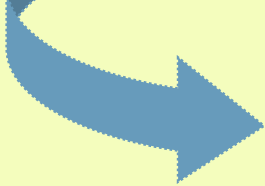
He joins us from the Technical University of Catalonia (UPC), where he received his BEng, MSc and PhD in 2008, 2010 and 2014 respectively. His PhD thesis is entitled "Multiterminal HVDC transmissions systems for offshore wind".

Domenico Ricchiuto has started work at Alstom Renovables and joins us from the network technologies department of ENEL Distribuzione, Italy.

Domenico received his MSc in Electrical Engineering in 2010 from the Politecnico di Bari, Italy. In May 2014 he received his PhD degree. As part of his PhD studies he spends six months with Aalborg University, Denmark. His PhD thesis is entitled: "Control and Interconnection Issues of AC and DC Microgrids".

Qing Mu joins MEDOW from China Electric Power Research Institute. Qing is based at Cardiff University.

Qing obtained his PhD in 2013 with a thesis entitled: "Multi-rate highly efficient simulation on multiple VSCs". His PhD work dealt with the problems facing large-scale integrated AC/DC system simulation.



You can see profiles of all our
researchers on our [website](#)

Secondments

MEDOW is an Initial Training Network.

One of our researchers' main training activities is 3 or 4 month secondments to other network partner organisations.

Cardiff University ESRs Jorge Gonçalves and Tibin Joseph have just arrived in Beijing for their secondment at China Electric Power Research Institute (China State Grid).

Tibin says: "The people here are very helpful and responsive, we have had a good two weeks and are looking forward to the rest of our time here. Also, we presented our work and requirements to CEPRI staff. It was a group of 15-20 people, chaired by Dr. Yalou Li. We got a good response and initial directions which were really helpful."

Right: Jorge and Tibin with CEPRI colleague Julia at their introductory training of ADPSS, a real time power systems simulation software .

Below: Jorge and Tibin at the CEPRI HQ!



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DTU Wind ESR Jayachandra Naidu is currently in Belgium on a 3 month secondment at Elia System Operator, with close collaboration with KU Leuven, from January to April 2015

Jayachandra says: "Before arriving in Belgium, I had couple of telephone meetings with Arnaud Attanasi and Johan Rimez from Elia, which helped me to streamline my research work at Elia. However, I felt it would be interesting to collaborate with Robert Renner, ESR at KU Leuven, after I had the chance to discuss his work at the MEDOW summer meeting in Porto last year. Our thesis advisors, Nikos and Dirk have also encouraged us to work on ancillary services from wind power plants to DC grids which motivated me to plan my collaboration with KU Leuven as well. Dirk has also encouraged me to collaborate with another PhD student, Pieter Tielens, who is also working on the similar research area.

Dirk helped me to get accommodation at the historic KU Leuven residence, Groot Begijnhof, which is a very good place to stay in Leuven. Registering at KU Leuven has helped me to get easy access to University facilities, such as the healthcare system and a few softwares (DigSILIENT, MATLAB) necessary for my project. My daughter (1 year 3 months) fell sick several times here (because of her first winter in Europe) and I was easily able to book a doctor's appointment using the University student healthcare system.

I like the work environment at Elia which is very encouraging to focus on the work. I would like to express my thanks to Arnaud and Johan for their continuous support. Based on the work done at Elia, I have sent an Abstract for CIGRE Canada conference 2015 and am planning to send one more paper abstract for Wind Integration Workshop-2015 sponsored by Elia. The research collaboration with Robert and Pieter is also advancing in a positive manner. We are expecting to write a joint technical paper soon.

Overall, it is a very good opportunity for me to work at Elia and KU Leuven within the first year of my PhD. Thanks to MEDOW for giving me this opportunity. Overall, I have enjoyed working at Elia and KU Leuven with the continuous support from Dirk, Johan and Arnaud."

Right: Jayachandra at Groot Begijnhof Residence on a sunny day in March 2015 with his wife Divya and their daughter Keerthisri



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Cardiff University ESR Gen Li has just returned to Wales from a 4 month secondment to China Electric Power Research Institute (China State Grid).

I learned a lot in the past 4 months in CEPRI Beijing. The secondment was on technical expertise, management skills and engineering training.

I undertook a project on *Multi-terminal DC grid for large scale renewable energy transmission in West China in 2030-2050*. Through this project, I got to know the present situation of China's power grid and its future planning. Knowledge on grid codes, power system operation, modeling and simulation was studied. Also, China is the biggest market of HVDC technologies and wind power generation in the world. This will help me to extend the application of the research outcomes and enhance my career prospects.

I met some top researchers in CEPRI and some universities. I even presented twice to Prof. Xiaoxin Zhou, the honorary president of CEPRI who is a member of the Chinese Academy of Sciences and IEEE Fellow. He is the proponent of the MTDC grid in West China. He agreed with my research plan of this project. Now I am working on it and responsible to him directly which is a great honour for me.

In a word, the secondment in CEPRI Beijing was useful, great and successful. I am looking forward my next secondment in Elia Brussels.

Right: Gen with Prof Xiaoxin Zhou





Research outputs

Recent publications by MEDOW researchers include:

11th International Conference on AC and DC Power Transmission (IET ACDC 2015), 10 - 12 February 2015, Birmingham, UK:

Impedance-based stability assessment of parallel VSC HVDC grid connections (Alejandro Bayo Salas)

Optimal DC reference voltage in HVDC grids (Robert Renner)

Capability curves of a VSC-HVDC connected to a weak AC grid considering stability and power limits (Agusti Egea)

13th International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power Plants Berlin, Germany, 11-13 November 2014:

Multi-infeed control of VSC-HVDC transmission system for offshore wind power plant integration (Muhammad Raza)

MEDOW also plans to participate actively in future large international conferences, including:

ACROSS BORDERS - HVDC SYSTEMS AND MARKETS INTEGRATION, 2015 CIGRE Symposium, 27-28 May 2015, Lund, Sweden

IEEE PowerTech2015, 29 June-02 July 2015, Eindhoven Netherlands

2015 IEEE Power & Energy Society General Meeting, 26-30 July 2015, Denver, United States

7th Conference on Power Electronics and Applications (EPE'15-ECCE Europe), 8-10 September 2015, Geneva, Switzerland

Take a look at the full list on our dissemination webpages at

www.medow.engineering.cf.ac.uk

Results

Research outputs

In February 2015, three MEDOW researchers presented their work at the 11th IET International Conference on AC and DC Power Transmission (ACDC 2015) in Birmingham, UK.

Robert Renner:

Optimal DC Reference Voltage in HVDC Grids

In a HVDC grid, power energy equilibrium must be guaranteed at every moment to prevent DC voltage increasing or decreasing to unacceptable values. Contrary to the frequency in an AC power system, DC voltage cannot be assumed to be the same throughout the system, since a DC voltage difference is necessary to have a current flow.

To operate HVDC grids as far as possible from DC voltage stability limits, the selection of the DC reference voltage and DC reference node are crucial factors. Robert's paper introduces a method to find the optimal DC voltage in a HVDC grid based on power flow and line resistances.

The method is implemented in the open-source software MatACDC and the results are verified by dynamic simulations in DlgSILENT, using a one area DC voltage restoration controller.

Results: IET ACDC 2015



Results:
IET ACDC 2015

Research outputs

Alejandro Bayo Salas:
Impedance-based Stability Assessment of Parallel VSC HVDC Grid Connections

The number of converters connected to the system is likely to increase. These devices may interact with each other through the network. TSOs are concerned about the impact of these interactions and its influence on stability. Alejandro's paper presents the stability analysis of a system with two converters.

The problem is studied in the frequency domain by using an impedance-based approach. A model for assessing the closed-loop stability of the complete system is developed.

This approach shows potential for studying the interactions in larger networks. The relative stability under different grid parameters is addressed. Simulation results show that the stability is compromised when a parallel converter is connected.



Results:
IET ACDC 2015

Research outputs

Agustí Egea-Alvarez:

Capability Curves of a VSC-HVDC Connected to a Weak AC Grid Considering Stability and Power Limits

The connection point of a VSC-HVDC for the transmission of RES electricity can be located far from the large generation plants, leading to a weak grid connection. Agustí's paper analyses the limitations on the power flow transfer through a VSC-HVDC system connected to a weak grid.

First, the impact of the angle and voltage stability limits and the VSC rating are examined. Then, the power transfer capability curves of a VSC connected to a weak grid of an SCR of 1.1 pu by means of an L-interface are calculated.

Finally, the impact of providing additional reactive power (Q) support is investigated through utilising a capacitor at the connection point. It is shown that an additional Q-support of 0.2 pu can maintain the transfer of full power without the need for oversizing the VSC.



Communication

So in which other ways does MEDOW communicate its work?

As a Marie Curie project, MEDOW has communication high on its agenda. We aim to communicate with as wide a variety of people as possible so as to share our work, to increase its impact and to let European taxpayers know how their money is being spent! We are keen to find news ways of sharing our project news, so do get in touch with us if you can help!



Public outreach

We have already taken part in a number of activities with people outside the research community including participating in a 'renewable energy project day' at a school in Cardiff and hosting a group of Spanish and Swedish school students at a workshop on 'HVDC Towards the Future' in Barcelona.



MEDOW in One Minute

Take a look at our bite-size explanation of MEDOW and life as a Marie Curie researcher on Youtube.

Facebook

<https://www.facebook.com/medowproject>

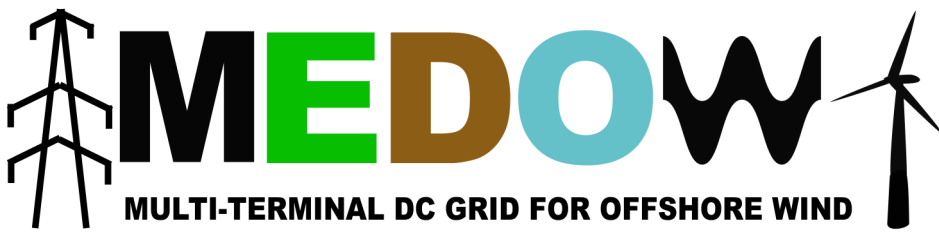
LinkedIn

Group: 'MEDOW'

In the press

Articles on MEDOW have recently targeted a wide range of audiences in renewable energy news-site re-News, in the national newspaper of Wales and on OffshoreWind.biz





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MEDOW Consortium


Members and roles

MEDOW is co-ordinated by Cardiff University and has four other university partners, five private sector partners and one associate partner.

Collectively, staff from the partners organisations have the wide-ranging experience and expertise to provide the appointed researchers with broad-ranging training in DC grid technologies.

All partners will host at least one researcher, and associate partner National Grid will provide training and steering to the consortium.

MEDOW partners:

-  Cardiff University (Co-ordinator)
-  Universitat Politècnica de Catalunya
-  Control Intel.ligent de l'energia
-  Alstom Renovables España
-  Universidade do Porto
-  EFACEC Engenharia e Sistemas
-  Katholieke Universiteit Leuven
-  Elia System Operator
-  Danmarks Tekniske Universitet
-  China Electric Power Research Institute
-  National Grid (Associated Partner)





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Useful Information

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A DC grid based on multi-terminal voltage-source converter is a newly emerging technology, which is particularly suitable for the connection of offshore wind farms. Multi-terminal DC grids will be the key technology for the European offshore 'supergrid'.

The project's anticipated achievements will greatly contribute to integrating offshore wind power into the onshore AC grids of European countries and to the European 'supergrid'.

Read more about supergrid at friendsofthesupergrid.eu

MEDOW offers a development path to researchers across Europe in the area of DC grids, in addition to fostering greater ties between industry and academia in this key development area.

The MEDOW project has received funding from the Seventh Framework Programme of the European Union under grant agreement number 317221.

**Deadline for contributions to next newsletter:
29 May 2015**

www.medow.engineering.cf.ac.uk



MEDOW is funded by the Seventh Framework Programme of the

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