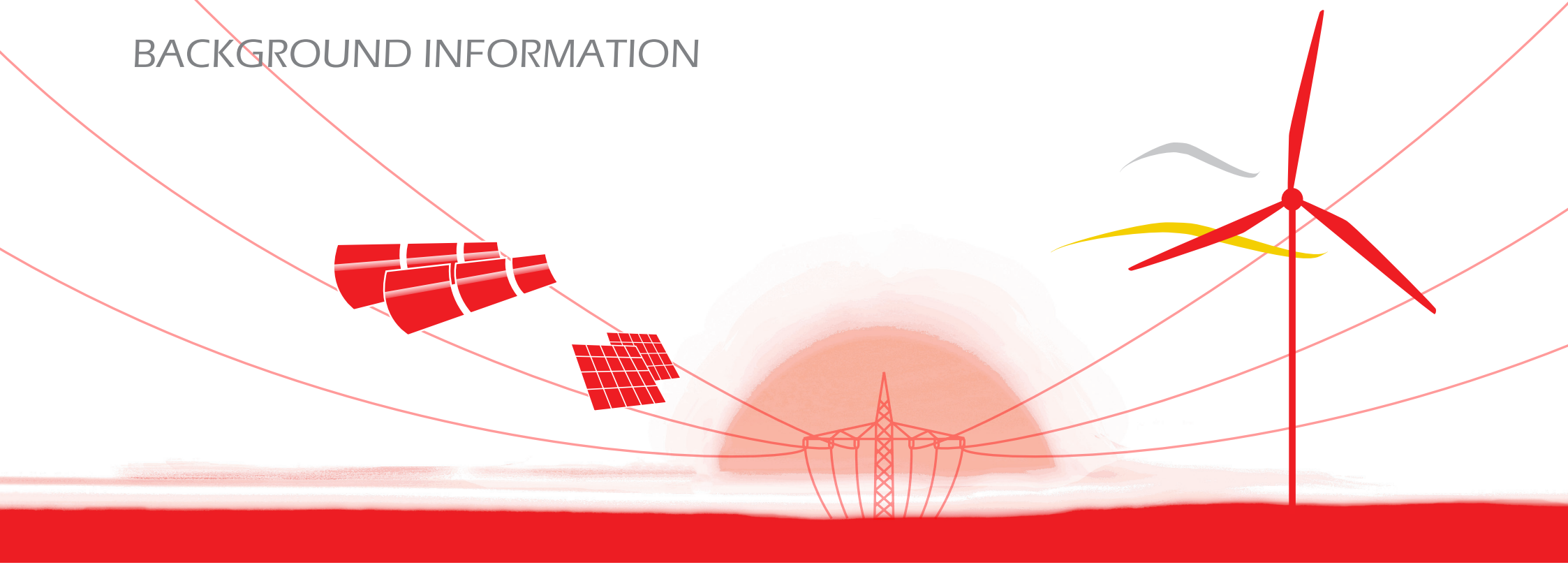
# SOLAR & WIND INTEGRATION WORKSHOP

## BACKGROUND INFORMATION

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www.energynautics.com

www.solarintegrationworkshop.org
www.windintegrationworkshop.org

# Content


Wind Integration Workshop ..... 3
- Introduction ..... 3
- History ..... 3
- Facts & Figures: Development of the Wind Integration Workshop ..... 7
- Past Involvement of TSOs ..... 8
- Review: Wind Integration Workshop 2013, London/UK ..... 9

Solar Integration Workshop ..... 10

Workshops of 2014 ..... 11

Target Group & Pricing ..... 12
- Structure of Registration Fees ..... 12

Communicating the Workshops ..... 13
- Workshop Websites ..... 13
- Newsletters ..... 14
- Social Media ..... 14
- Online Event Lists ..... 14
- Leaflets ..... 14
- Advertisements ..... 14
- International Advisory Committees ..... 15

Workshop Quality ..... 16
- Quality Control & Feedback ..... 16

Sponsoring ..... 17
- Sponsor Packages “Wind Integration Workshop“ ..... 17
- Sponsor Packages “Solar Integration Workshop“ ..... 18

Sponsoring Discount & Logotype ..... 19
- Sponsoring Discount ..... 19
- Embedding your Logotype ..... 19

Past Sponsors ..... 20
- Sponsors “Wind Integration Workshop“ ..... 20
- Sponsors “Solar Integration Workshop“ ..... 21

Annex ..... 22

Wind Integration Workshop

## Introduction

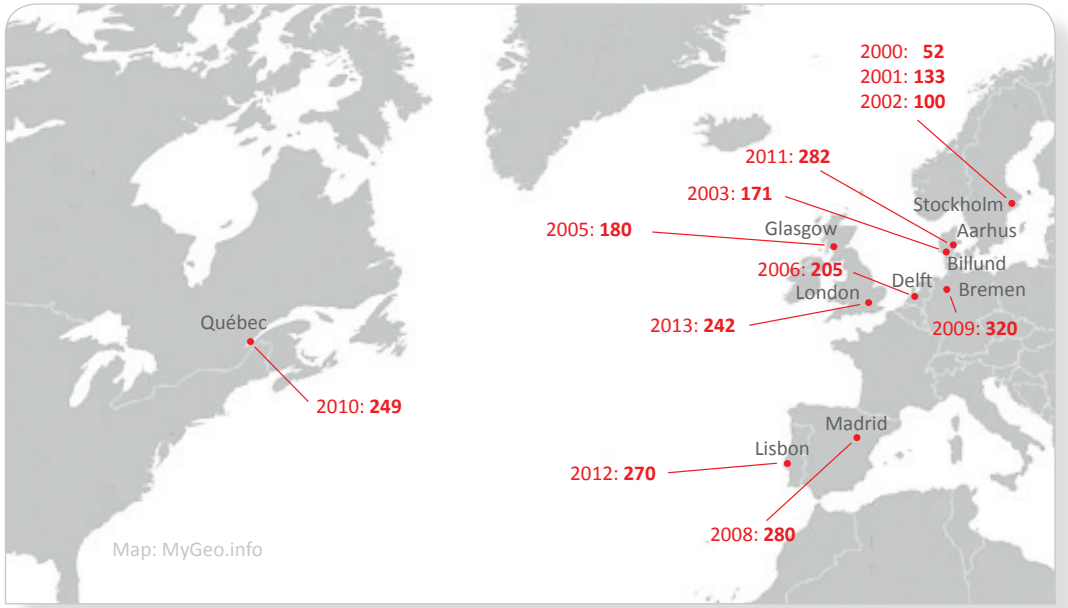
The “International Workshop on Large-Scale Integration of Wind Power into Power Systems as well as on Transmission Networks for Offshore Wind Power Plants” looks back to a year-long history. Its **main target** is to stimulate interdisciplinary thinking between wind energy & power transmission industries as well as universities by providing a platform for discussion and for sharing ideas and knowledge regarding the key issues in the field of large-scale integration of wind power.

This workshop idea forms the basis to determine the respective target groups, the way to address them and the pricing of the participation fees.

## History

In the fall of 1999, two Ph.D. students who were working at the Department for Electric Power Systems of the Royal Institute of Technology, Stockholm, Sweden spent many hours discussing the integration of wind power into power systems and possible applications of HVDC technology for offshore wind farms.

It soon became clear that these topics would interest and require a wider audience including experts from the wind industry.




Locations & number of participants “Wind“ / years 2000 - 2013

The result was the International Workshop on Feasibility of HVDC Transmission Networks for Offshore Wind Farms organized at the Royal Institute of Technology in spring 2000, and was repeated in 2001 and 2002.

> 2-day-workshop

> main topics

- Modeling of wind turbines
- European offshore supergrids
- Voltage-Source-Converter-based HVDC systems

> number of participants

2000: 52
2001: 133
2002: 100

The feedback after the 2002 workshop showed us that participants would appreciate a new location for future workshops – as Stockholm in March is not a very exciting place – but, above all, a wider approach to the topic.

At that point, Eltra, the former system operator of Western Denmark, became interested in supporting the event and the 2003 workshop moved to Billund in Denmark.

> new title for 4th workshop

in order to underline the importance of questions related to the large-scale integration of wind power into power systems

> highlight

field trip including a flight over the offshore wind farm of Horns Rev

> number of participants

2003: 171

> multiple parallel sessions

1999 beginning

2000

1st
International Workshop on Feasibility of HVDC Transmission Networks for Offshore Wind Farms
@ Royal Institute of Technology (KTH) Stockholm, Sweden

2001

2nd
see 1st

2002

3rd
see 1st

2003

4th
International Workshop on Large-Scale Integration of Wind Power and Transmission Networks for Offshore Wind Farms
@ Billund, Denmark

2004

Moving the workshop to Denmark was a real success and gave rise to the idea to organize each following workshop in a **different European country**.

> 5th workshop: cooperation of two universites

University of Strathclyde & Royal Institute of Technology (KTH)

Following the 5th workshop, the **organization** of workshops was **taken over by Energynautics**, a company founded by one of the "fathers" of the workshop, Thomas Ackermann, who had been the main organizer of this event from the very beginning.

> number of participants

2006: 205

> fieldtrip

by boat to the Egmond aan Zee Offshore Wind farm with challenging and memorable weather conditions

> high number of submitted abstracts

twice as high as previous workshop

> three parallel sessions

majority of the participants welcomed size and number of parallel sessions as a good working basis in Madrid and Bremen

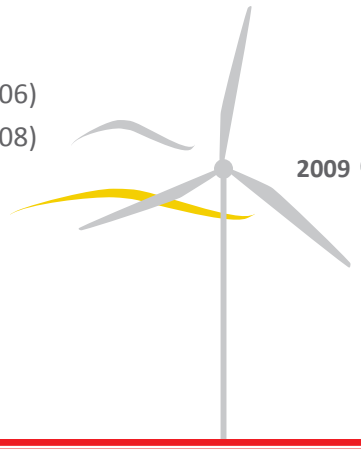
> number of participants

2008: 280 (+ 40% compared to 2006)

2009: 320 (+ 12% compared to 2008)

> 1-day wind tutorial

was offered in Bremen one day before the workshop



**2005** — 5th: International Workshop on Large-Scale Integration of Wind Power and Transmission Networks for Offshore Wind Farms @ University of Strathclyde, Glasgow, UK

**2006** — 6th @ Technical University Delft, the Netherlands

**2007**

**2008** — 7th @ Madrid, Spain

**2009** — 8th @ Bremen, Germany

The 9th workshop was held for the **first time outside of Europe**, in Québec City/Canada. Despite the long distance from Europe, the workshop was well attended.

> special Wind Dinner
at “La Cabane à Pierre“ – Sugar Shack

> number of participants
2010: 249

In 2011 we could celebrate the **10th anniversary of the Wind Integration Workshop** in Aarhus.

> number of participants
2011: Wind 282 / Solar 74

> start of the 1st Solar Integration Workshop
held right before the Wind Integration Workshop

> spectacular Wind Dinner overviewing Lisbon
at Restaurante Casa do Leão, offering a great networking opportunity for the participants

> solar & wind tutorials

> international diversity in London
242 participants from 28 different countries

> social event
boat trip on the River Thames at night

**Upcoming Events 2014**

The 13th Wind Integration Workshop will be held again in conjunction with the 4th Solar Integration Workshop.

- Location: Berlin, Germany
- Date: 10-13 November 2014

**2010** — 9th — International Workshop on Large-Scale Integration of Wind Power and Transmission Networks for Offshore Power Plants — @ Québec, Canada

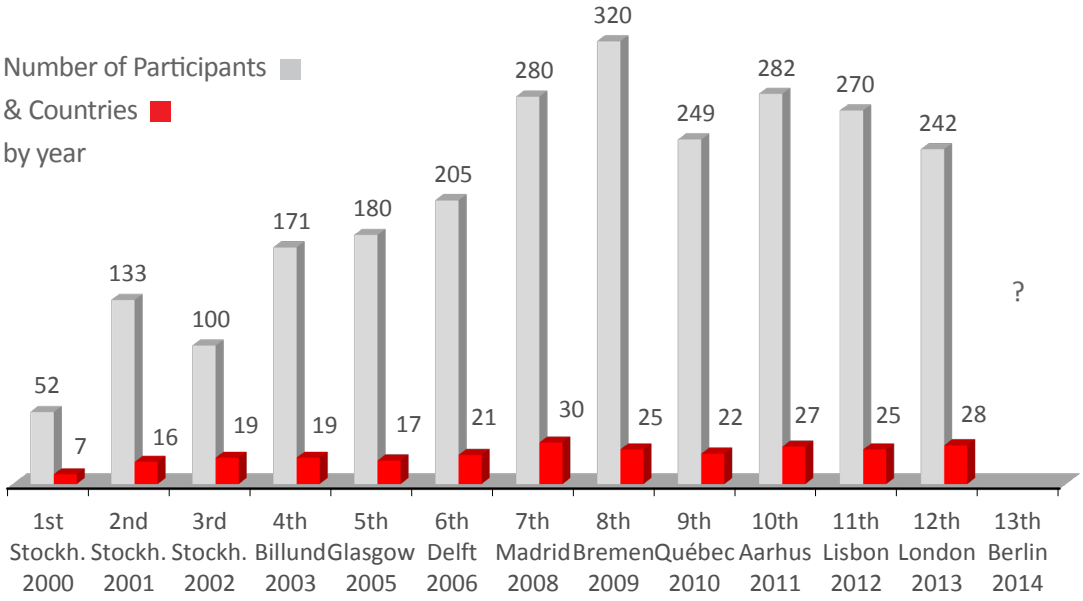
**2011** — 10th — @ Aarhus, Denmark

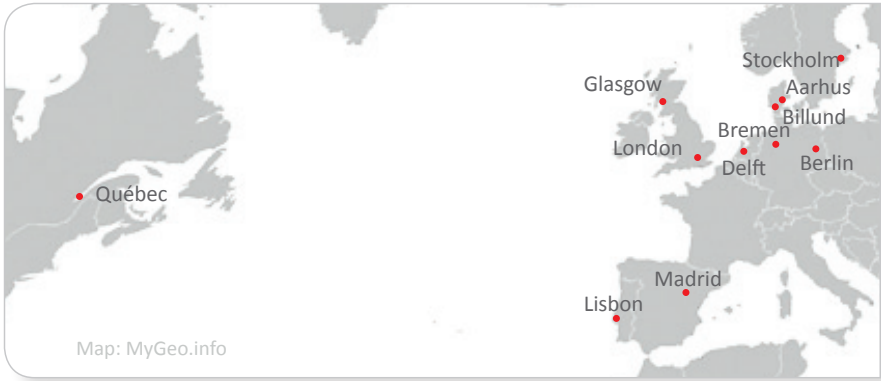
**2012** — 11th — @ Lisbon, Portugal

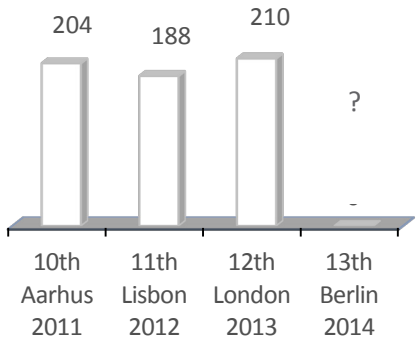
**2013** — 12th — @ London, UK

**2014** — 13th — @ Berlin, Germany

## Facts & Figures: Development of the Wind Integration Workshop




Number of submitted abstracts "Wind" by year

The affiliation of the participants has been showing a surprisingly even distribution during the past years.

This distribution confirms the organizers' intention to provide a combined forum for academic/scientific institutions and industry experts.

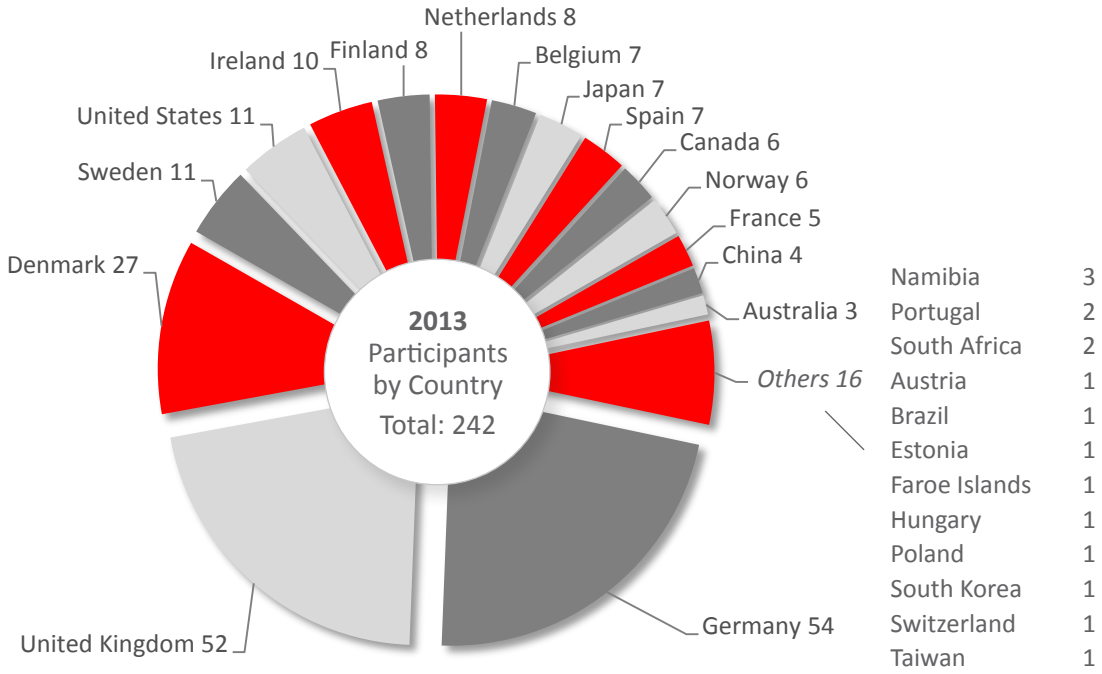
We expect that the distribution of participants will be similar in Berlin, 2014.

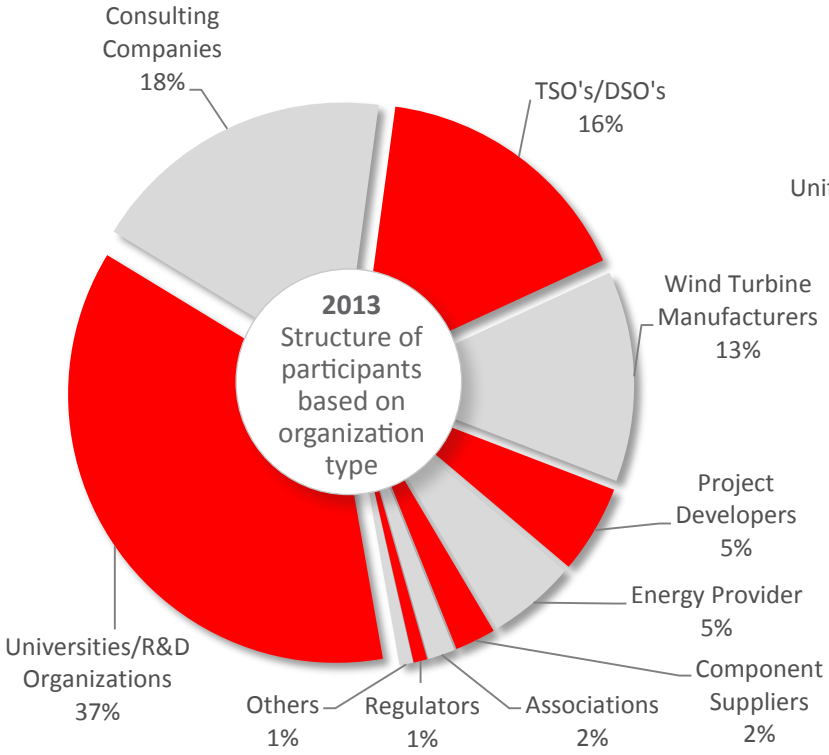
| | Madrid 2008 | Bremen 2009 | Québec 2010 | Aarhus 2011 | Lisbon 2012 | London 2013 | Berlin 2014 |
|---|---|---|---|---|---|---|---|
| Universities/R&D Organizations | 29% | 26,5% | 29% | 26% | 39% | 37% | |
| TSO's/DSO's | 21% | 19% | 26% | 17% | 15% | 16% | |
| Wind Turbine Manufacturers | 8% | 12% | 12% | 21% | 13% | 13% | |
| Consulting Companies | 11% | 8% | 15% | 16% | 15% | 18% | ? |
| Component Suppliers | 12% | 25,5% | 4% | 8% | 4% | 2% | |
| Project Developers | 15% | 9% | 7% | 8% | 5% | 5% | |
| Energy Management | 1% | 0% | 2% | 3% | 6% | 7% | |
| Associations | 3% | 0% | 1% | 1% | 3% | 2% | |

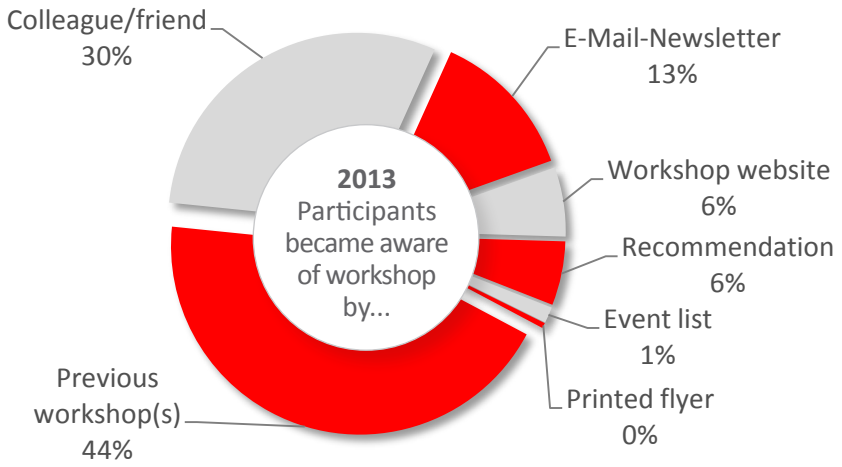
## Past Involvement of TSOs

The following table provides an overview of the involvement of TSOs at the past workshops:

| Location, Year | Role of TSO | Comment |
|---|---|---|
| Billund 2003 | Eltra (now Energinet.dk): Sponsor, Co-organiser for field trip, Presenter and Partner in Opening Session, Special Eltra Day | We organized the Eltra day for Eltra |
| Glasgow 2005 | Scottish and Southern Energy as well as Scottish Power: Sponsor, Presenter and Partner in Opening Session | |
| Delft 2006 | Tennet: Sponsor, Presenter and Partner in Opening Session | |
| Madrid 2008 | REE: Sponsor, Presenter and Partner in Opening Session | |
| Bremen 2009 | Presenter | |
| Québec 2010 | Hydro Québec: Sponsor, Co-organizer for field trip, Presenter and Partner in Opening Session | |
| Aarhus 2011 | Energinet.dk: Supporter, Co-organizer for field trip, Presenter and Partner in Opening Session, Special Energynet.dk day. | We organized the Energinet.dk day for Energinet.dk |
| Lisbon 2012 | REN: Supporter, Presenters and Partner in Opening Session | |
| London 2013 | National Grid: Sponsor, Presenters, Partner in Opening Session and dedicated National-Grid session | |


2013
Participants
by Country
Total: 242
Netherlands 8
Belgium 7
Japan 7
Spain 7
Canada 6
Norway 6
France 5
China 4
Australia 3
Others 16
Germany 54
United Kingdom 52
Denmark 27
Sweden 11
United States 11
Ireland 10
Finland 8
Namibia 3
Portugal 2
South Africa 2
Austria 1
Brazil 1
Estonia 1
Faroe Islands 1
Hungary 1
Poland 1
South Korea 1
Switzerland 1
Taiwan 1


2013
Structure of
participants
based on
organization
type
Consulting
Companies
18%
TSO's/DSO's
16%
Wind Turbine
Manufacturers
13%
Project
Developers
5%
Energy Provider
5%
Component
Suppliers
2%
Associations
2%
Regulators
1%
Others
1%
Universities/R&D
Organizations
37%

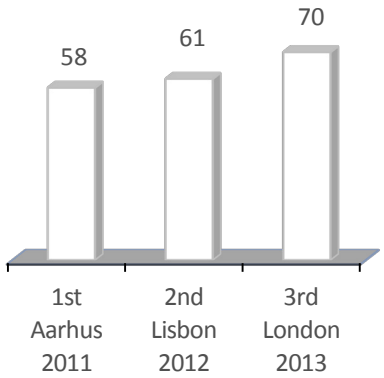

2013
Participants
became aware
of workshop
by...
Colleague/friend
30%
E-Mail-Newsletter
13%
Workshop website
6%
Recommendation
6%
Event list
1%
Printed flyer
0%
Previous
workshop(s)
44%

## Solar Integration Workshop

The increasing interest in solar integration issues motivated us to organize the first Solar Integration Workshop in Aarhus in 2011, welcoming 74 participants. The 2nd Solar Integration Workshop in Lisbon, with now 101 participants, was again scheduled right before the Wind Integration Workshop. For the 3rd edition last year in London 103 participants attended the workshop and we expect a slight increase for the Berlin Workshop as well.

Due to the continuing interest in the topic we will maintain a basic workshop structure of 1.5 days.

Locations & number of participants “Solar“ by year




Number of submitted abstracts “Solar“ by year

Solar Integration Workshop

2011 — 1st @ Aarhus, Denmark

2012 — 2nd @ Lisbon, Portugal

2013 — 3rd @ London, UK

2014 — 4th @ Berlin, Germany

## Solar & Wind Integration Workshop 2014

The 4th Solar Integration Workshop will be held again in conjunction with the 13th Wind Integration Workshop:

- Date & Location: 10-13 November 2014 in Berlin, Germany (Estrel Convention Centre)
- Expected number of participants: 100-150 Solar / 300-350 Wind

For the London Workshops 2013 we received about 210 wind abstracts/70 solar abstracts and allowed 122 wind papers/38 solar papers for presentations. We expect about the same number or a slight increase of abstracts for the Wind Integration Workshop as well as an increase in the number of abstracts for the Solar Integration Workshop.

| Day | Workshop Schedule |
|---|---|
| Sunday, 09 November | Solar Tutorials |
| Monday, 10 November | Solar Workshop – Day 1 |
| | 18:00 – 19:00: Solar Poster Reception |
| | Solar Workshop Dinner in the Evening |
| | 14:00: Start of Wind Tutorials |
| Tuesday, 11 November | until 12:00: Solar Workshop – Day 2 |
| | until 12:00: Wind Tutorials |
| | 13:00: Start of Wind Workshop – Day 1 |
| | 18:00 – 19:00: Wind Poster Reception |
| Wednesday, 12 November | Wind Workshop – Day 2 |
| | Wind Workshop Dinner in the Evening |
| Thursday, 13 November | Wind Workshop – Day 3 |
| Friday, 14 November | Field Trips |

The present schedule allows us to have a high number of presentations in the Solar as well as in the Wind Integration Workshop. In case the number and quality of submitted abstracts is reasonably high we would be prepared to organize a fourth parallel session.

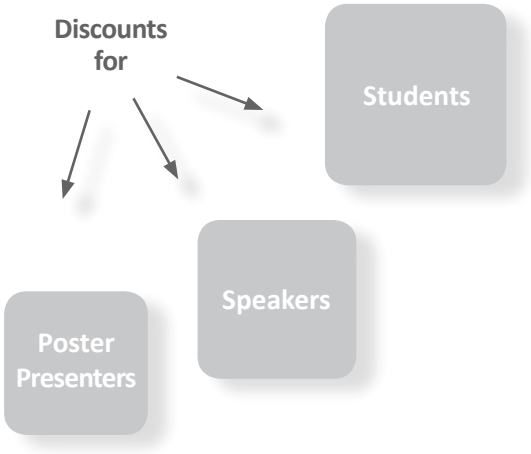
**Estrel Convention Centre:**
www.estrel.com/en

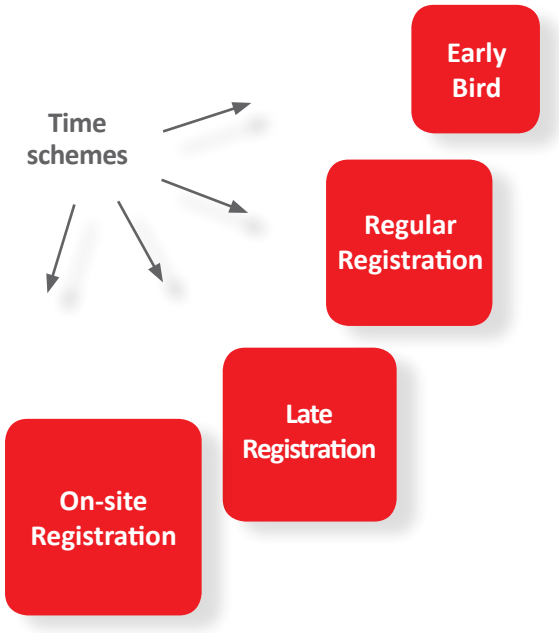
**For further details visit:**
www.solarintegrationworkshop.org

www.windintegrationworkshop.org

## Structure of Registration Fees

In order to win participants of every target group to form the inspiring **mixture** of speakers, poster presenters and regular visitors from different research sectors and institutions the registration fees are based on a mixed calculation to address the needs of every **target group** specifically: students, university staff, associations, N.G.O.s, public institutions, companies. Students may register for the highest discount as well as speakers and poster presenters. Regular participants are offered three different time schemes – early bird, regular registration, late registration. For last minute participants we also offer on-site registration.



## Communicating the Workshops

Although a large portion of the workshop participants are “repeaters” (about 40%) and learn about the workshop from colleagues or friends (about 30%) or personal recommendations (about 6%), we constantly strive for gaining new and more participants. Therefore, the workshop communication makes use of different communication channels:

- **Workshop Websites**

The basis for all information regarding the workshop are the websites www.solarintegrationworkshop.org and www.windintegrationworkshop.org. They compile information about the workshop’s history, past programs, proceedings and the information about the current program, venue, and accommodation opportunities.

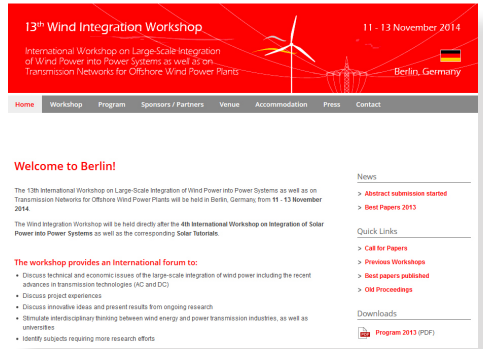
Throughout the whole workshop preparation period (January-October) the websites are viewed by:

| | Unique visitors per month | Unique visitors per day |
|---|---|---|
| **www.solarintegrationworkshop.org** | 1,800 - 4,000 | > 50 |
| **www.windintegrationworkshop.org** | 5,000 - 7,000 | > 160 |

The page views spread evenly over the time of the day (24h around the world!) and the days of the week (week/weekend = 4:3).

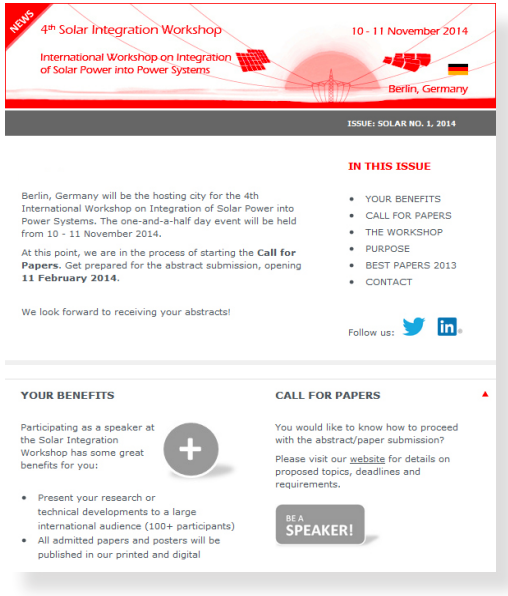


**Website Screenshots:**
Solar “Home“
Wind “Program“



- **Newsletters**

The main means of communication to disseminate the workshop are workshop newsletters, sent monthly/ fortnightly to about 16,000 potential visitors. It contains the current basic information linking to the workshop website for more detailed information.




- **Social Media**

Different aspects of the workshop are communicated on several social media platforms and their groups such as:
LinkedIn > http://www.linkedin.com/groups/Solar-Wind-Integration-Workshop-Renewables-4813626
Twitter > https://twitter.com/SolarWindIntWS

- **Online Event Lists**

The workshop date is listed on several renewable energy event lists and calendars.

- **Leaflets**

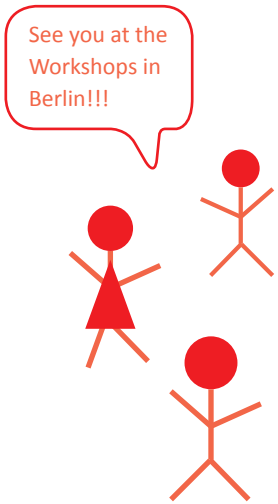
Paper leaflets/flyers are produced for distribution among interested institutions and participants.

- **Advertisements**

In addition, the workshop is communicated in advertisements in different printed magazines and online platforms.

- **International Advisory Committees**

The workshop's Solar Advisory Committee consists of 11 members from 7 different countries. The Wind Advisory Committee has now 22 members from 10 different countries. Besides giving general advice for content and topis of the workshop, and working as reviewers of submitted abstracts and papers during the Call for Paper process, they are acting as multipliers for the workshop idea and date. All members receive the paper leaflets and support the workshop communication.




## Solar

- Thomas Ackermann (Energynautics, Germany)
- Jens Bömer (Ecofys, Germany / TU Delft, the Netherlands)
- Bernhard Ernst (SMA Solar Technology, Germany)
- Debra Lew (Consultant, USA)
- Lise Nielson (Linie P, Denmark)
- Kirsten Orwig (Swiss Re America, USA)
- Dezso Sera (Aalborg University, Denmark)
- Charles Smith (UVIG, USA)
- Adrian Timbus (ABB, Switzerland)
- Julio Usaola (Carlos III Madrid University, Spain)
- Dirk Van Hertem (KULeuven, Belgium)

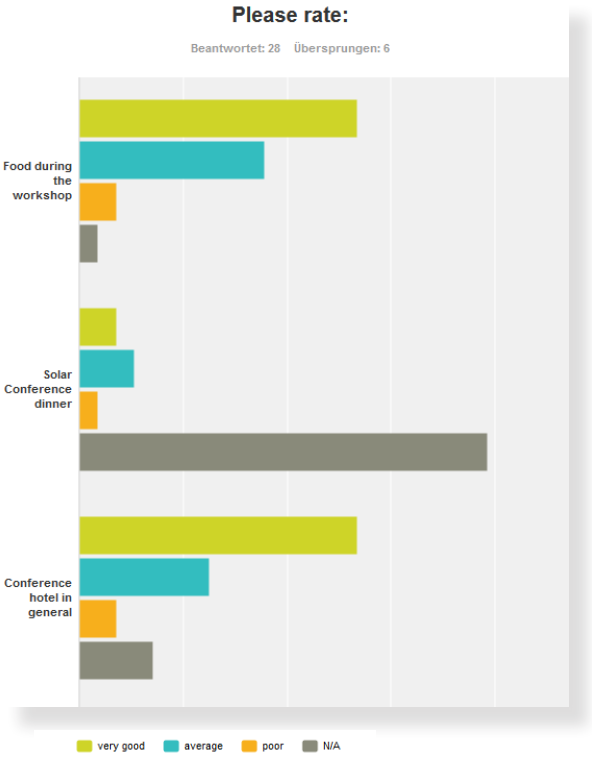
## Wind

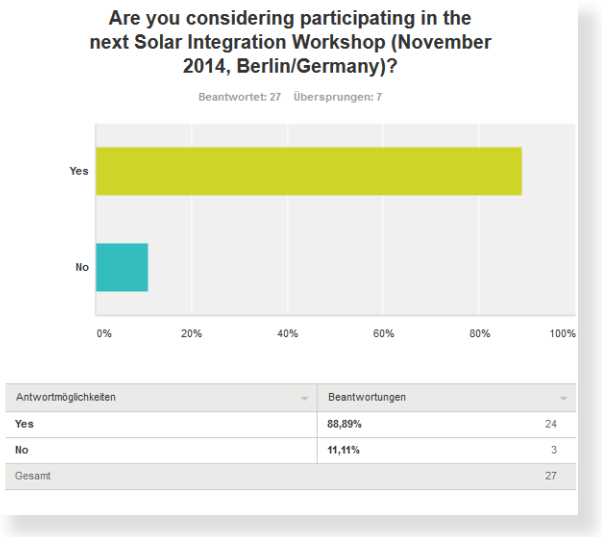
- Thomas Ackermann (Energynautics, Germany)
- Marc Bettzüge (University of Cologne, Germany)
- Sigrid Bolik (Repower UK, United Kingdom)
- Peter W. Christensen (Vestas, Denmark)
- Ana Estanqueiro (LNEG, Portugal)
- Alain Forcione (Hydro-Québec, Canada)
- Michael Nørtoft Frydensbjerg (Siemens Wind Power, Denmark)
- Paul Gardner (DNV GL - Energy, United Kingdom)
- Jutta Hanson (TU Darmstadt, Germany)
- Hannele Holttinen (VTT, Finland)
- Reza Iravani (University of Toronto, Canada)
- Lawrence E. Jones (Alstom Grid, USA)
- Julija Matevosyan (ERCOT, USA)
- Antje Orths (Energinet.dk, Denmark)
- Kirsten Orwig (Swiss Re America, USA)
- Eckard Quitmann (Enercon, Germany)
- Christian Rehtanz (TU Dortmund University, Germany)
- Jenny Riesz (University of New South Wales, Australia)
- Charles J. Smith (UVIG, USA)
- Poul Sørensen (DTU Wind Energy, Denmark)
- Troels Stybe Sørensen (Dong Energy, Denmark)
- Adrian Timbus (ABB, Switzerland)
- Frans Van Hulle (XP Wind, Belgium)

## Quality Control & Feedback

The participants of every workshop receive the opportunity to give their feedback after the event answering a number of questions regarding the quality of the workshop program, venue, location and organization.

The workshop team evaluates the answers thoroughly and initiates changes wherever applicable. Many new ideas are making its way to us this way.




| Antwortmöglichkeiten | Beantwortungen | |
|---|---|---|
| Yes | 88,89% | 24 |
| No | 11,11% | 3 |
| Gesamt | | 27 |

**Feedback Examples “Solar“:**
by surveymonkey.com

## Sponsor Packages "Wind Integration Workshop"

**Option 1:**

- Small company logo on Wind Workshop webpage, regular newsletters, flyers, proceedings, rollups etc.
- **One** participant of the sponsor can join the wind workshop free of charge (including wind dinner/excluding field trip)
- Up to 3 additional workshop proceedings free of charge
- One page advertisement in the proceedings in b/w.

Mega Sponsor

Sponsorship fee for this option: **Please contact us!**

Additional option: One page advertisement in the proceedings in colour will cost extra.

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**Option 2:**

- Large company logo on Wind Workshop webpage, regular newsletters, flyers, proceedings, rollups etc.
- **Three** participants of the sponsor can join the wind workshop free of charge (including wind dinner/excluding field trip)
- Up to 5 additional workshop proceedings free of charge
- One page advertisement in the proceedings in b/w

Giga Sponsor

Sponsorship fee for this option: **Please contact us!**

Additional option: One page advertisement in the proceedings in colour will cost extra.

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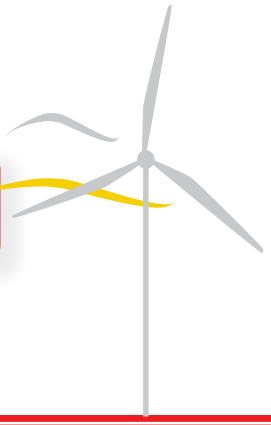
**Option 3:**

- Large company logo on Wind Workshop webpage, regular newsletters, flyers, proceedings, rollups etc.
- **Special additional arrangement e.g. logo on dinner menu**
- **Three** participants of the sponsor can join the wind workshop free of charge (including wind dinner/excluding field trip)
- Up to 5 additional workshop proceedings free of charge
- One page advertisement in the proceedings in b/w

Tera Sponsor

Sponsorship fee for this option starts at: **Please contact us!**

Additional option: One page advertisement in the proceedings in colour will cost extra.



## Sponsor Packages "Solar Integration Workshop"

**Option 1:**

- Small company logo on Solar Workshop webpage, regular newsletters, flyers, proceedings, rollups etc.
- **One** participant of the sponsor can join the solar workshop free of charge (including solar dinner/excluding field trip)
- Up to 3 additional workshop proceedings free of charge
- One page advertisement in the proceedings in b/w

Mega Sponsor

Sponsorship fee for this option: **Please contact us!**

Additional option: One page advertisement in the proceedings in colour will cost extra.

---

**Option 2:**

- Large company logo on Solar Workshop webpage, regular newsletters, flyers, proceedings, rollups etc.
- **Three** participants of the sponsor can join the solar workshop free of charge (including solar dinner/excluding field trip)
- Up to 5 additional workshop proceedings free of charge
- One page advertisement in the proceedings in b/w

Giga Sponsor

Sponsorship fee for this option: **Please contact us!**

Additional option: One page advertisement in the proceedings in colour will cost extra.

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**Option 3:**

- Large company logo on Solar Workshop webpage, regular newsletters, flyers, proceedings, rollups etc.
- **Special additional arrangement e.g. logo on dinner menu**
- **Three** participants of the sponsor can join the solar workshop free of charge (including solar dinner/excluding field trip)
- Up to 5 additional workshop proceedings free of charge
- One page advertisement in the proceedings in b/w

Tera Sponsor

Sponsorship fee for this option starts at: **Please contact us!**

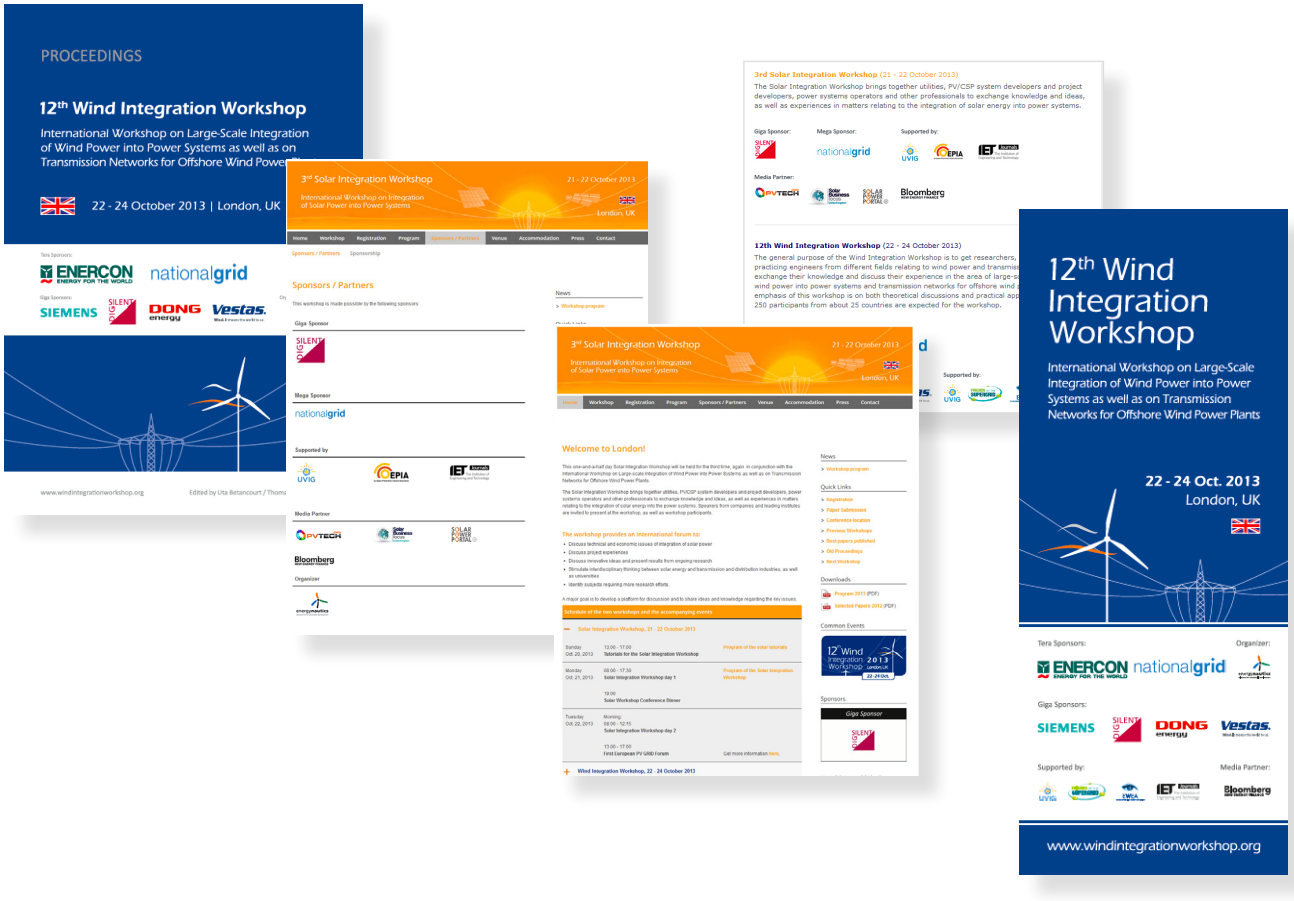
Additional option: One page advertisement in the proceedings in colour will cost extra.

## Sponsoring Discount

Sponsoring the Solar and the Wind Integration Workshop events will result in a **10% discount** in the total sponsoring fee for both workshops.

## Embedding your Logotype

See here some examples from last years' workshops on where your logotype could be positioned.

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# Annex

**Content of the Annex**

The following pages contain the program of the previous Solar & Wind Integration Workshop, held 2013 in London/UK.

## Solar:

- Tutorial
- Timetable
- Detailed Program

## Wind:

- Timetable
- Detailed Program

**Sunday, 14:00 – 14:45**

**Modelling, diagnostics, and monitoring for PV arrays**

*Dezso Sera (Aalborg University, Denmark)*

1. **Modelling**
    - PV cell models
    - Effects of environmental conditions
    - Model parameter determination
    - System modelling (series/parallel connection of cells)
    - Application - PV simulator
2. **Diagnostics and characterisation**
    - IV curve measurement
    - Main failure types and their effects on the IV curve
    - Series resistance measurement
    - Temperature measurement
    - Partial shadowing detection
3. **Monitoring**
    - Purpose
    - Structures and main methods

PV plant monitoring examples

**Sunday, 15:00 - 15:45**

**PV inverter structures, topologies, and control**

*Tamas Kerekes (Aalborg University, Denmark)*

1. **PV inverter structures**
    - Central, String, Module
    - Structures
    - Advantages, disadvantages
2. **PV inverter topologies and modulation**
    - Galvanic isolation
    - H-Bridge, HERIC, H5, NPC, etc.
    - PWM techniques
3. **PV inverter control**
    - Basic function
    - PV specific
4. **Ancillary service**

**Sunday, 16:15 – 18:00**

**Grid Requirements for PV Systems and Grid Interactive PV Inverters**

*Remus Teodorescu (Aalborg University, Denmark)*

1. **Grid Requirements for PV Systems**
    - LV grid interface international regulations
        - IEEE 1547, IEC61727, VDE0126, Forum Netztechnik / Netzbetrieb im VDE (FNN)
    - MV (DS) Grid Codes for PV (LVRT, grid support, etc.)
        - Spanish Grid Code O.P.12.2 (2008)
        - EON
    - EMI/EMC
        - EN61000-3-2, EN61000-3-3, EN61000-3-12, EN61000-6-1, EN61000-6-2, EN61000-6-3, EN61000-6-4
    - Anti-Islanding requirements
        - IEEE 1547, VDE0126, IEC62116, IEC61727
        - AI methods

2. **Grid Interactive PV Inverters**

*Pedro Rodriguez (Aalborg University, Denmark)*

- Grid disturbances generated by PV inverters
    - Voltage rise, harmonics, unbalance, dc injection, sags, flickers
- Voltage rise problem in rural and suburban networks
    - Voltage support methods based on P and Q, max. installed PV in a feeder
- Control methods for voltage harmonics compensations
    - Active power filters
- Control methods for voltage unbalance compensations
    - P sharing among phases, negative sequence Q injection
- Control methods for LVRT
    - DC voltage control under grid faults, reactive current injection
- Control methods for grid frequency
    - Synthetic inertia, primary control, secondary control
- Control methods for power oscillation damping PSS, modal analysis, control using P or Q

**Discussion**

**Solar Integration Workshop 2013 – Timetable**

| Sunday, 20 Oct. 2013 | | Monday, 21 October 2013 | | | Tuesday, 22 October 2013 | | |
|---|---|---|---|---|---|---|---|
| Tutorials | | Solar Workshop Day 1 | | | Solar Workshop Day 2 | | |
| | | 08:00 – 09:00 | Foyer C<br>1st floor | | 08:00 – 09:40 | Room<br>Bartholomew | Room<br>Harpley |
| | | | **Registration** | | | **SESSION 5a:**<br>International Market Issues | **SESSION 5b:**<br>PV Modelling |
| | | 09:00 – 09:10 | Room<br>Bartholomew & Harpley | | | *Coffee Break*<br>*09:40 – 09:50* | |
| | | | **OPENING:**<br>Welcome and Introduction | | | | |
| | | 09:10 – 10:50 | Room<br>Bartholomew & Harpley | | 09:50 – 11:00 | Room<br>Bartholomew | Room<br>Harpley |
| | | | **SESSION 1:**<br>Keynote Session | | | **SESSION 6a:**<br>Solar Forecasting II | **SESSION 6b:**<br>Future European Power System with a High Share of Renewables |
| | | | *Coffee Break & Poster Session*<br>*10:50 – 11:20* | | | *Coffee Break*<br>*11:00 – 11:30* | |
| | | 11:20 – 13:00 | Room<br>Bartholomew | Room<br>Harpley | 11:30 – 12:15 | Room<br>Bartholomew & Harpley | |
| | | | **SESSION 2a:**<br>Experiences with Large-Scale Integration of Solar Power into Power Systems | **SESSION 2b:**<br>Solar Power and Storage | | **SESSION 7:**<br>Closing Session - Podium Discussions | |
| | | | *Lunch 13:00 – 14:00*<br>*Hotel Restaurant* | | | *Lunch 12:15 – 13:15*<br>*Hotel Restaurant* | |
| 13:00 – 17:00 | Room Prescot<br>1st floor | 14:00 – 15:40 | Room<br>Bartholomew | Room<br>Harpley | 13:00 – 17:20 | Room<br>Trinity | |
| | **Solar Tutorials** | | **SESSION 3a:**<br>PV and Distribution Grids | **SESSION 3b:**<br>Power System Operation Issues | | **12th Wind Integration Workshop Day 1** | |
| | | | *Coffee Break & Poster Session*<br>*15:40 – 16:00* | | | *OR:* | |
| | | 16:00 – 17:20 | Room<br>Bartholomew | Room<br>Harpley | 13:00 – 17:00 | Room<br>Bartholomew & Harpley | |
| | | | **SESSION 4a:**<br>PV and Smart Grids | **SESSION 4b:**<br>Solar Forecasting I | | **First European PV GRID Forum** | |
| | | 19:00 | Restaurant at<br>Grange Tower Bridge Hotel | | | | |
| | | | **Solar Dinner** | | | | |

# MONDAY, 21 OCTOBER 2013

**08:00 – 09:00** **Registration**

**09:00 – 09:10** **Opening: Welcome and Introduction, Thomas Ackermann**

**09:10 – 10:50** **SESSION 1: KEYNOTE SESSION**

**> Session Chair** **Thomas Ackermann (Energynautics, Germany)**

**09:10 – 10:30** **Presentations (20 min. each):**

- **PV Positioning as a Major Player in the Electricity Sector - Market and Technology Trends**
  F. Thies (EPIA, Belgium) **(**SIW13-1045**)**
- **Large Scale PV Connecting to the Grid – UK Perspective**
  J. Roy (juwi Renewable Energies, United Kingdom)
- **PV Evolution and Coming Challenges from a German TSO Perspective**
  A. J. Gesino (TenneT TSO, Germany)
- **Italian experience with PV integration**
  R. Lama (Enel Distribution, Italy)

**10:30 – 10:50** **Discussions**

**10:50 – 11:20** **Coffee Break & Poster Session**

**11:20 – 13:00** **SESSION 2A: EXPERIENCES WITH LARGE-SCALE INTEGRATION OF SOLAR POWER INTO POWER SYSTEMS**

**> Session Chair** **Charles Smith (UVIG, USA)**

**11:20 – 12:40** **Presentations (16 min. each):**

- **Evaluation of Technical Solutions for a Large Scale Integration of PV in European Distribution Grids**
  M. Vandenbergh, V. Helmbrecht, D. Craciun (DERlab, Germany), H. Loew (BSW, Germany), R. Lama (Enel Distribution, Italy), R. Hermes (RWE Deutschland, Germany), M. Rekinger, G. Concas (EPIA, Belgium), P. M. Sonvilla (Eclareon, Germany) **(**SIW13-1035**)**
- **Inverter-Based Voltage Control with Reactive Power: Large-Scale Deployment Results**
  C. Dierckxsens, K. De Brabandere, O. Gammoh,(3E, Belgium), B. Bletterie (AIT, Austria), W. Deprez (Infrax, Belgium), Y. T. Fawzy (SMA Solar Technology, Germany), B. Uljanić, B. Blažič, (University of Ljubljana , Slovenia), A. Woyte (3E, Belgium) **(**SIW13-1026)
- **Examining the Development of Non-Controllable Photovoltaic and Decentralized Generation Capacity in the Context of Balancing the German Power System**
  K. Burges, M. Doering, R. Kuwahata, G. Papaefthymiou, (Ecofys Germany, Germany) **(**SIW13-1089**)**
- **Solar Power and the Future of the Grid**
  A. Galiteva (Renewables 100 Policy Institute, USA) **(**SIW13-1051**)**
- **Costs and Benefits of Fossil-Fueled Plant Flexibility**
  D. Lew, G. Brinkman, G. Stark (NREL, USA), G. Jordan, S. Venkataraman (GE Energy, USA), N. Kumar, S. Lefton (Intertek-APTECH, USA) **(**SIW13-1047**)**

**12:40 – 13:00** **Discussions**

**11:20 – 13:00 SESSION 2B: SOLAR POWER AND STORAGE**

**> Session Chair Julio Usaola (University Carlos III, Spain)**

**11:20 – 12:40 Presentations (20 min. each):**

- **Evaluating the Benefits of Storage in Low Voltage Distribution Systems with High PV Penetration**
  J.-D. Schmidt, E. Tröster (Energynautics, Germany) **(**SIW13-1093)
- **Domestic Photovoltaic Systems, Battery Storage, and the Economic Impact of Time-of-use Electricity Pricing**
  E. McKenna, M. Thomson (Loughborough University, United Kingdom) **(**SIW13-1010**)**
- **Increasing the Share of PV by a Factor of 2-3 over the Self-use Limit Through Urban Electricity-to-thermal Conversion Schemes**
  P. Lund, J. Mikkola (Aalto University, Finland) **(**SIW13-1046**)**
- **Modelling Concentrating Solar Power with Thermal Energy Storage for Integration Studies**
  M. Hummon, P. Denholm, J. Jorgenson, M. Mehos (NREL, USA) **(**SIW13-1037)

**12:40 – 13:00 Discussions**

**13:00 – 14:00 Lunch Break**

**14:00 – 15:40 SESSION 3A: PV AND DISTRIBUTION GRIDS**

**> Session Chair Jens Bömer (TU Delft, the Netherlands)**

**14:00 – 15:20 Presentations (20 min. each):**

- **The Impact of Low Voltage Disconnection of Distributed PV on Bulk Electricity System Reliability**
  A. Tuohy, A. Gaikwad, J. Taylor, D. Brooks (Electric Power Research Institute, USA) **(**SIW13-1030**)**
- **Meeting Utility Step Voltage Change Requirements by Providing Precise Voltage Control for a PV Plant on a Distribution Feeder**
  J. Diaz de Leon II (AMSC, USA), B. L. Agrawal (Arizona Public Service, USA) **(**SIW13-1012**)**
- **Quasi Steady-State Modelling of Low-Voltage Connected Photovoltaic Systems for Analysing Distribution Feeder Behaviour During Faults**
  B. G. Rawn (KU Leuven, Belgium), S. Torres Romo (Prolec GE, Mexico), M Gibescu, M. van der Meijden (Delft University of Technology, the Netherlands) (SIW13-1063)
- **Probabilistic Tool Based on Smart Meters Data to Evaluate the Impact of Distributed Photovoltaic Generation on Voltage Profiles in LV Grids**
  V. Klonari , F. Vallée (University of Mons, Belgium), O. Durieux (ORES, Belgium), J. Lobry (University of Mons, Belgium) **(**SIW13-1004**)**

**15:20 – 15:40 Discussions**

**14:00 – 15:40 SESSION 3B: POWER SYSTEM OPERATION ISSUES**

**> Session Chair Helge Urdal (Urdal Power Solutions, United Kingdom)**

**14:00 – 15:20 Presentations (20 min. each):**

- **Pool of Photovoltaic Systems Delivering Control Reserve**
  M. Jansen, M. Speckmann (Fraunhofer IWES, Germany), A. von Harpe, M. Hahler (Enerparc, Germany) **(**SIW13-1000**)**
- **Primary Frequency Control through Grid Connected Photovoltaic Active Generator**
  A. N. Azmi, M. Kolhe (University of Agder, Norway) **(**SIW13-1077**)**
- **PV Generation Capacity Reserve for Intermittency Mitigation and Revenue Maximization**
  K. Papastergiou (Formerly ABB Corporate Research, Sweden), N. Efkarpidis (ABB Corporate Research, Sweden) **(**SIW13-1042**)**
- **Active Power Reserves Evaluation in Large Scale PVPPs**
  **B.-I.** Crăciun, **T. Kerekes, D. Sera, R. Teodorescu (Aalborg University, Denmark), U. D. Annakkage (University of Manitoba, Canada) (SIW13-1078)**

**15:20 – 15:40 Discussions**

**15:40 – 16:00 Coffee Break & Poster Session**

| | |
|---|---|
| **16:00 – 17:20** | **SESSION 4A: PV AND SMART GRIDS** |
| **> Session Chair** | **Nis Martensen (Energynautics, Germany)** |
| **16:00 – 17:00** | **Presentations (20 min. each):** |

- **Active Distribution System Management**
  J. Alvarez Fernandez (Eurelectric, Belgium), J. Tello Guijarro (Gas Natural Fenosa, Spain), P. Mandatova (Eurelectric, Belgium), D. Trebolle (Gas Natural Fenosa, Spain) **(**SIW13-1091)
- **Assessing the Potential Role of Large-Scale PV Generation and Electric Vehicles in Future Low-Carbon Electricity Industries**
  P. Vithayasrichareon, G. Mills, I MacGill (University of New South Wales, Australia) **(**SIW13-1058)
- **A New Measurement Technology for Solar Integration from the U.S.A. ARPA-E Program**
  A. McEachern (Power Standards Lab, USA) **(**SIW13-1076**)**

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| **17:00 – 17:20** | **Discussions** |

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|---|---|
| **16:00 – 17:20** | **SESSION 4B: SOLAR FORECASTING I** |
| **> Session Chair** | **Manoël Rekinger (EPIA, Belgium)** |
| **16:00 – 17:05** | **Presentations (16 min. each):** |

- **Synthetic High-Frequency Solar Photovoltaic Data to Meet Grid Compliance**
  J. D. Frank, P. Beaucage, M. C. Brower, M. Grammatico (AWS Truepower, United States) **(**SIW13-1088**)**
- **Downscaling Solar Power Output to 4-Seconds for Use in Integration Studies**
  M. Hummon, A. Weekley, K. Searight, K. Clark (NREL, USA) **(**SIW13-1038)
- **PV Forecasting Confidence Intervals for Reserve Planning and System Operation**
  P. Kreutzkamp, O. Gammoh, K. De Brabandere (3E, Belgium), M. Rekinger (EPIA, Belgium) **(**SIW13-1034**)**
- **Cross-Correlation of Photovoltaic Output Fluctuation in Power System Operation for Large-Scale Photovoltaic Integration**
  Y. Ikeda (Kyoto University, Japan), K. Ogimoto (University of Tokyo, Japan) **(**SIW13-1023**)**

| | |
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| **17:05 – 17:20** | **Discussions** |

| | |
|---|---|
| **19:00** | **Solar Workshop Conference Dinner** |

# TUESDAY, 22 OCTOBER 2013

| | |
|---|---|
| **08:00 – 9:40** | **SESSION 5A: INTERNATIONAL MARKET ISSUES** |
| **> Session Chair** | **Eoghan McKenna (Loughborough University, United Kongdom)** |
| **08:00 – 9:20** | **Presentations (20 min. each):** |

- **The Market Value of Solar PV**
  L. Hirth (Vattenfall, Germany) **(**SIW13-1066)
- **Solar Integration in Australia's Electricity Market**
  J. Gilmore, B. Vanderwaal, I. Rose (ROAM Consulting, Australia) **(**SIW13-1021**)**
- **100% Renewables in Australia - Will a Capacity Market be Required?**
  J. Riesz, I. MacGill (University of New south Wales, Australia) **(**SIW13-1020**)**
- **Optimized Residential Loads Scheduling Based on Dynamic Pricing of Electricity: A Simulation Study**
  C. Ogwumike, A. Modibbo, M. Denai (Teesside University, United Kingdom) **(**SIW13-1069**)**

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|---|---|
| **09:20 – 9:40** | **Discussions** |

| | |
|---|---|
| **08:00 – 9:40** | **SESSION 5B: PV MODELING** |
| **> Session Chair** | **Bernd Weise (DIgSILENT, Germany)** |
| **08:00 – 9:20** | **Presentations (20 min. each):** |

- **PV Modelling for Generation Adequacy Studies**
  J. Usaola, V. Ramírez-Jusdado (Universidad Carlos III, Spain), T. Gafurov, M. Prodanovic (IMDEA Enery, Spain) **(**SIW13-1014**)**
- **Measurement Based PV Inverter Modelling and Verification**
  Z. Fan, T. Gehlhaar (Germanischer Lloyd, Germany), J. Huang, M. Liu (CEPRI, China) **(**SIW13-1001**)**
- **Technical Assessment of On-Load Tap-Changers in Flemish LV Distribution Grids**
  N. Efkarpidis, C. Gonzalez, T. Wijnhoven, D. Van Dommelen, T. De Rybel, J. Driesen (KU Leuven, Belgium) (SIW13-1013)
- **Variability Analysis and Cycling Impacts of Solar PV in the Southwest United States**
  **A. Tuohy, E. Lannoye (EPRI, Ireland), C. Hansen (Sandia National Laboratories, USA), N. Troy (Electroroute Market Access, Ireland)** (SIW13-1027)

| | |
|---|---|
| **09:20 – 9:40** | **Discussions** |
| **9:40 – 09:50** | **Break** |
| **09:50 – 11:00** | **SESSION 6A: SOLAR FORCASTING II** |
| **> Session Chair** | **Marissa Hummon (NREL, USA)** |
| **09:50 – 10:40** | **Presentations (16 min. each):** |

- **Metrics for Evaluating the Accuracy of Solar Power Forecasting**
  J. Zhang, B.-M. Hodge, A. Florita (NREL, USA), S. Lu, H. F. Hamann (IBM TJ Watson Research Center, USA), V. Banunarayanan (U.S. Department of Energy) **(**SIW13-1036**)**
- **Towards a Multi-time-scale Integrated Solar Forecast System**
  P. Beaucage, J. D. Freedman (AWS Truepower, USA), J. Zack (MESO, USA), J. Kleissl, B. Urquhart, I. Gohari (UC San Diego, USA), A. Kankiewicz (Clean Power Research, USA) **(**SIW13-1075**)**
- **Farm-scale Operational Solar Power Forecasting: Assessment of Hybrid Physical and Numerical Forecasting Methodologies**
  S. Siblot, B. Graff, A. Falgon, A. Ben Daoud, G. Bontron (Compagnie Nationale du Rhône, France) **(**SIW13-1056**)**

| | |
|---|---|
| **10:40 – 11:00** | **Discussions** |
| **09:50 – 11:00** | **SESSION 6B: FUTURE EUROPEAN POWER SYSTEM WITH HIGH SHARE RENEWABLES** |
| **> Session Chair** | **Phil Lawton (National Grid, United Kingdom)** |
| **09:50 – 10:40** | **Presentations (16 min. each):** |

- **Overview Over the Regulatory Approaches for the Integration of Solar Power in Europe**
  D. Fouquet, J. V. Nysten (Becker Büttner Held, Belgium) **(**SIW13-1008**)**
- **Quantifying the Cost of Integrating Photovoltaics into the Future European Union Electricity System**
  D. Pudjianto, P. Djapic, J. Dragovic, G. Strbac (Imperial College London, United Kingdom) **(**SIW13-1040**)**
- **Transmission Network Loading in Europe with High Shares of Renewables**
  T. Brown (Energynautics, Germany) **(**SIW13-1094**)**

| | |
|---|---|
| **10:40 – 11:00** | **Discussions** |
| **11:00 – 11:30** | **Coffee Break** |

| | |
|---|---|
| **11:30 – 12:15** | **SESSION 7: CLOSING SESSION-PODIUM DISCUSSIONS** |
| **> Session Chair** | **Charles Smith (UVIG, USA)** |
| **11:30 – 12:10** | |
| • | **What evolutionary changes are needed to system planning, system design and system operation practices to integrate 20 % electricity from PV in the future? What active role can PV plants play?**<br>Participants:<br>Jens Bömer (Ecofys, Germany / Delft University of Technology, Netherlands)<br>Nicholas Miller (GE Energy, USA)<br>Antje Orths (Energinet.dk, Denmark)<br>Manoël Rekinger (EPIA, Belgium)<br>Aidan Tuohy (Electric Power Research Institute, USA) |
| **12:10 – 12:15** | **Closing Remarks** |

## 12:15-13:15 Lunch

## 13:00 Start Wind Integration Workshop

## 13:00 Start of the First European PV GRID Forum

## Tuesday, 22 October

### Wind Workshop Day 1

| | |
|---|---|
| 9:00 – 13:00 | Foyer -2<br>**Registration** |
| | *Lunch 11:30 – 13:00 (Atrium -2)* |
| 13:00 – 15:10 | Room Trinity<br>**Opening & Session 1:** Keynote Session |
| | *Coffee Break 15:10 – 15:40 (Atrium -2)* |

| 15:40 – 17:20 | Room Trinity A | Room Trinity B |
|---|---|---|
| | **SESSION 2a:** Grid Integration Experiences | **SESSION 2b:** Flexibility and Economics of Integration |

| 17:30 | Atrium -2 |
|---|---|
| | **Poster Session & Reception** |

## Wednesday, 23 October

### Wind Workshop Day 2

| 8:00 – 9:40 | Room Trinity A | Room Trinity B | Minories 1st floor |
|---|---|---|---|
| | **SESSION 3a:** Voltage Control Issues | **SESSION 3b:** Offshore Wind Power Plants | **SESSION 3c:** Forecasting I |
| | *Coffee Break 09:40 – 10:10 (Atrium -2)* | | |
| 10:10 – 12:00 | Room Trinity A | Room Trinity B | Minories 1st floor |
| | **SESSION 4a:** Grid Code Issues | **SESSION 4b:** HVDC Connection Issues | **SESSION 4c:** Forecasting II |
| | *Lunch 12:00 – 13:00 (Atrium -2)* | | |
| 13:00 – 15:00 | Room Trinity A | Room Trinity B | Minories 1st floor |
| | **SESSION 5a:** Frequency Control Issues | **SESSION 5b:** National Grid's Perspective | **SESSION 5c:** Power System Balancing I |
| | *Coffee Break 15:00 – 15:30 (Atrium -2)* | | |
| 15:30 – 17:20 | Room Trinity A | Room Trinity B | Minories 1st floor |
| | **SESSION 6a:** Power System Issues | **SESSION 6b:** New Grid and Generator Technologies | **SESSION 6c:** Flexibility with Storage and Demand Side Management |

| 19:30 | Boat "Avontuur", Tower Pier at River Thames |
|---|---|
| | **Wind Dinner** |

## Thursday, 24 October

### Wind Workshop Day 3

| 8:00 – 9:40 | Room Trinity A | Room Trinity B | Minories 1st floor |
|---|---|---|---|
| | **SESSION 7a:** Grid Code and Power Quality Issues | **SESSION 7b:** AC Connected Offshore Wind Power Plants | **SESSION 7c:** Economic and Market Issues I |
| | *Coffee Break 09:40 – 10:10 (Atrium -2)* | | |
| 10:10 – 12:00 | Room Trinity A | Room Trinity B | Minories 1st floor |
| | **SESSION 8a:** Grid Integration Technologies | **SESSION 8b:** Modelling Issues | **SESSION 8c:** Economic and Market Issues II |
| | *Lunch 12:00 – 13:00 (Atrium -2)* | | |
| 13:00 – 15:00 | Room Trinity A | Room Trinity B | Minories 1st floor |
| | **SESSION 9a:** Wind Integration Studies | **SESSION 9b:** Offshore Grid Issues | **SESSION 9c:** Power System Balancing II |
| | *Coffee Break 15:00 – 15:30 (Atrium -2)* | | |

| 15:30 – 16:30 | Room Trinity |
|---|---|
| | **SESSION 10:** Closing Session - Podium Discussions |

# TUESDAY, 22 OCTOBER 2013

**09:00 – 13:00** **Registration**

**13:00 – 13:10** **Opening: Welcome and Introduction, Thomas Ackermann, Energynautics**

## 13:10 – 15:10 SESSION 1: KEYNOTE SESSION

**> Session Chair** **Thomas Ackermann (Energynautics, Germany)**

**13:10 – 14:50** **Presentations (20 min. each)**

- **Making the Low Carbon Future a Reality**
  N. Winser (National Grid & ENTSO-E)
- **Electricity Market Reform in Great Britain**
  J. Mills (Director EMR, Department of Energy & Climate Change [DECC], United Kingdom),
- **Future Energy Scenarios for Great Britain**
  M. Stewart (National Grid, United Kingdom)
- **The GB networks matching the Future Energy Scenarios**
  P. Sheppard (National Grid, United Kingdom)
- **Operability. The challenges arising in a low carbon world**
  P. Lawton (National Grid, United Kingdom)

**14:50 – 15:10** **Discussion**

**15:10 – 15:40** **Coffee Break**

## 15:40 – 17:20 SESSION 2A: GRID INTEGRATION EXPERIENCES

**> Session Chair** **Helge Urdal (Urdal Power Solutions, United Kingdom)**

**15:40 – 17:00** **Presentations (20 min. each)**

- **Analysis of High-Wind Events on the Power System of Ireland and Northern Ireland**
  D. Cashman, S. Power, A. Rogers, J. O'Sullivan (EirGrid, Ireland) (WIW13-1035)
- **Impact of High Wind Speed Shut-down in the Danish Power System**
  N. A. Cutululis, M. Litong-Palima (DTU, Denmark), M. H. Bjerge (Siemens Wind Power, Denmark), N. Detlefsen (Energinet.dk, Denmark), P. Sørensen (DTU, Denmark) (WIW13-1013)
- **Increased Wind Generation in Ireland and Northern Ireland and the Impact on Rate of Change of Frequency**
  K. Creighton, M. McClure, R. Skillen, J. O'Higgins, T. McCartan (SONI, United Kingdom), A. Rogers (EirGrid, Ireland) (WIW13-1084)
- **Active Network Management for Integrating Renewable Energy to the Distribution Network - A Commercial Perspective**
  A. Laguna-Estopier, S. Georgiopoulos, (UK Power Networks, United Kingdom) (WIW13-1231)

**17:00 – 17:20** **Discussion**

**15:40 – 17:20** **SESSION 2B: FLEXIBILITY AND ECONOMICS OF INTEGRATION**

**> Session Chair** **Hannele Holttinen (VTT, Finland) / Simon Müller (IEA, Belgium)**

**15:40 – 17:00** **Presentations (16 min. each)**

- **Evaluation of Power System Flexibility Adequacy - The Flexibility Assessment Tool (FAST2)**
  S. Müller (International Energy Agency, France) (WIW13-1239)
- **Flexibility Chart - Evaluation on Diversity of Flexibility in Various Areas**
  Y. Yasuda (Kansai University, Japan), A. R. Årdal (SINTEF, Norway), E. M. Carlini (Terna, Italy), A. Estanqueiro (LNEG, Portugal), D. Flynn (University College Dublin, Ireland), E. Gómez-Lázaro (University of Castilla-La Mancha, Spain), H. Holttinen, J. Kiviluoma (VTT, Finland), F. Van Hulle (XP WIND, Belgium), J. Kondoh (Tokyo University of Science, Japan), B. Lange (Fraunhofer IWES, Germany), N. Menemenlis (IREQ/Hydro-Québec, Canada), M. Milligan (NREL, USA), A. Orths (Energinet.dk, Denmark), C. Smith (UVIG, USA), L. Søder (Royal Institut of Technology/KTH, Sweden) (WIW13-1029)
- **Wind and Solar Curtailment**
  D. Lew, L. Bird, M. Milligan, B. Speer, X. Wang (NREL, USA), E. Carlini (TERNA, Italy), A. Estanqueiro (LNEG, Portugal), D. Flynn (University College Dublin, Ireland), E. Gomez-Lazaro (University of Castilla-La Mancha, Spain), H. Holttinen (VTT, Finland), N. Menemenlis (IREQ/Hydro-Québec, Canada), A. Orths (Energinet.dk, Denmark), C. Smith (UVIG, USA), L. Søder (Royal Institut of Technology/KTH, Sweden), P. Sørensen, A. Altiparmakis (DTU, Denmark), Y. Yasuda (Kansai University, Japan) (WIW13-1146)
- **Integration Costs and Marginal Value - Connecting two Perspectives on Evaluating Variable Renewables**
  F. Ueckerdt (Potsdam Institute for Climate Impact Research, Germany), S. Müller (International Energy Agency, France), L. Hirth (Potsdam Institute for Climate Impact Research/Vattenfall, Germany), M. Nicolosi (Connect Energy Economics, Germany) (WIW13-1241)
- **Wind Integration Cost and Cost-Causation**
  M. Milligan, B. Kirby (NREL, USA), H. Holttinen, J. Kiviluoma (VTT, Finland), A. Estanqueiro (LNEG, Portugal), S. Martín-Martínez, E. Gómez Lázaro (University of Castilla-La Mancha, Spain), I. Pineda (EWEA, Belgium), J. C. Smith (UVIG, USA) (WIW13-1232)

**17:00 – 17:20** **Discussion**

**17:30 – 19:00** Wind Poster Reception

## +WEDNESDAY, 23 OCTOBER 2013

**08:00 – 09:40** **SESSION 3A: VOLTAGE CONTROL ISSUES**

**> Session Chair** **Bernd Weise (DIgSILENT, Germany)**

**08:00 – 09:20** **Presentations (20 min. each)**

- **An Advanced Strategy of Decentralized Voltage Control for Wind Farm with DFIGs**
  H. Lee , J. Kim, B. Lee (Korea University, South Korea) (WIW13-1212)
- **Impact of Increasing Distributed Wind Power and Wind Turbine Siting on Rural Distribution Feeder Voltage Profiles**
  A. Allen, Y. Zhang, B.-M. Hodge (NREL, USA) (WIW13-1122)
- **Technical Capabilities and Challenges for Wind Power to Provide Voltage Support Services**
  L. M. Faiella (Fraunhofer IWES, Germany), N. A. Cutululis (DTU, Denmark), F. Van Hulle (XP Wind, Belgium) (WIW13-1134)
- **Voltage Control with Wind Power Plants: Current Practice with Type IV WTGs in the UK and Ireland**
  D. McMullin, K. Pierros (Enercon, Germany) (WIW13-1166)

**09:20 – 09:40** **Discussion**

| 08:00 – 09:40 | **SESSION 3B: OFFSHORE WIND POWER PLANTS** |
|---|---|
| **> Session Chair** | **Michael Frydensbjerg (Siemens Wind Power, Denmark)** |
| **08:00 – 09:20** | **Presentations (20 min. each)** |

- **The Kriegers Flak Offshore Wind Power Plant Grid-connection Solution – Influence on Short-term Voltage Stability of the Danish Transmission System**
  V. Akhmatov, A. Orths, P. Børre Eriksen, H. Abildgaard, M. Powalko (Energinet.dk, Denmark) (WIW13-1037)
- **Grid Integration of Offshore Wind Power Plants with Oil and Gas Installations – Operation Strategies and Frequency Control Issues**
  A. R. Årdal, S. D'Arco (SINTEF, Norway), K. Sharifabadi (Statoil, Norway) (WIW13-1058)
- **Steady State Control Strategy for a Meshed HVDC Grid with Wind Power Plants**
  K. Yunus, T. Thiringer, O. Carlson (Chalmers Unversity of Technology, Sweden) (WIW13-1221)
- **OptiArray from DONG Energy: An Automated Decision Support Tool for the Design of the Collection Grid in Large Offshore Wind Power Plants**
  M. Lindahl (Copenhagen Airports Resource Management Specialist, Denmark), N.-C. Fink Bagger, T. Stidsen (DTU, Denmark), S. Frost Ahrenfeldt, I. Arana (DONG Energy Wind, Denmark) (WIW13-1214)

**09:20 – 09:40** **Discussion**

| 08:00 – 09:40 | **SESSION 3C: FORECASTING I** |
|---|---|
| **> Session Chair** | **Bri-Mathias Hodge (NREL, USA),** |
| **08:00 – 09:20** | **Presentations (20 min. each)** |

- **Analysis of Variability and Uncertainty in Wind Power Forecasting: An International Comparison**
  J. Zhang, B.-M. Hodge (NREL, USA), J. Miettinen, H. Holttinen (VTT, Finland), E. Gómez-Lázaro (University of Castilla-La Mancha, Spain), N. Cutululis, M. Litong-Palima, P. Sørensen (DTU Wind Energy, Denmark), A. L. Lovholm, E. Berge (Kjeller Vindteknikk, Denmark), J. Dobschinski (Fraunhofer IWES, Germany) (WIW13-1115)
- **Impact of Weather Regimes on the Wind Power Ramp Forecast**
  A. Couto, P. Costa, L. Rodrigues, V. Lopes, A. Estanqueiro (LNEG, Portugal) (WIW13-1048)
- **Design and Evaluation of an Advanced Short-term Wind Ramp Prediction System**
  J. Zack (AWS Truepower, USA) (WIW13-1148)
- **Integration of Wind Power Measurements into the Assimilation Process of the Model COSMO-DE of the German Weather Service - Creating the Forward Operator**
  A. Wessel, B. Mey, J. Dobschinski (Fraunhofer IWES, Germany), S. Declair, R. Potthast (DWD/German Weather Service, Germany) (WIW13-1049)

**09:20 – 09:40** **Discussion**

**09:40 – 10:10** **Coffee Break**

| 10:10 – 12:00 | **SESSION 4A: GRID CODE ISSUES** |
|---|---|
| **> Session Chair** | **Ana Estanqueiro (LNEG, Portugal)** |

**10:10 – 11:30 Presentations (16 min. each)**

- **The Power System Will Need More! - How Grid Codes Should Look Ahead**
  E. Quitmann, E. Erdmann (Enercon, Germany) (WIW13-1069)
- **The FRT Requirements for Wind Power Plants in the ENTSO-E Network Code on Requirements for Generators - TSOs' and Manufacturers' Views on Requirements, Capabilities of Wind Power Plants and Technical Challenges Related to the NC RfG – short version**
  J. Fortmann (REpower Systems, Germany), R. Pfeiffer (Amprion, Germany), E. Haesen (ENTSO-E, Belgium), F. Van Hulle (XP Wind, Belgium), F. Martin (Siemens Wind Power, Denmark), H. Urdal (National Grid, United Kingdom), S. Wachtel (GE Energy Consulting, Germany) (WIW13-1072)
- **Recent and Planned Changes in the Standards and Network Codes for the Grid Connection of Wind Power in Germany**
  F. Scheben, J. Moeller (M.O.E. Moeller Operating Engineering, Germany) (WIW13-1100)
- **Quantification of Losses Regarding Active Power Injection Due to New Grid Code Requirements**
  S. Grunau, F. Gärtner, F.-W. Fuchs (University of Kiel, Germany) (WIW13-1068)
- **Assessment of the Frequency Settings from Distributed Generation in Germany for the Prevention of Frequency Stability Problems in Abnormal System Conditions**
  G. Papaefthymiou, R. Kuwahata, M. Doering, K. Burges, J. C. Boemer (Ecofys Germany, Germany) (WIW13-1236)

**11:30 – 12:00 Discussion**

| 10:10 – 12:00 | **SESSION 4B: HVDC CONNECTION ISSUES** |
|---|---|
| **> Session Chair** | **Nicholas Miller (GE Energy, USA)** |

**10:10 – 11:30 Presentations (20 min. each)**

- **Requirements for HVDC Connections and DC Connected Power Park Modules in its Role for a Smarter and Greener Transmission System**
  W. Winter (TenneT TSO, Germany), P. Bertolini (RTE, France), W. Fischer (50Hertz Transmission, Germany), C. Longás Viejo (REE, Spain), M. Norton (EirGrid, Ireland), H. Urdal (National Grid, United Kingdom), E. Haesen, A. Székely (ENTSO-E, Belgium) (WIW13-1172)
- **HVDC Connected Offshore Wind Power Plants: Review and Outlook of Current Research**
  J. Glasdam (DONG Energy Wind Power / Aalborg University, Denmark), L. Zeni, M. Gryning (DONG Energy Wind Power / DTU, Denmark),, J. Hjerrild, Ł. Kocewiak, B. Hesselbæk, K. Andersen, T. Sørensen, (DONG Energy, Denmark), M. Blanke, P. E. Sørensen, A. D. Hansen (DTU, Denmark), C. L. Bak, P. C. Kjær (Aalborg University, Denmark) (WIW13-1086)
- **An Assessment of Converter Modelling Needs for Offshore Wind Power Plants Connected via VSC-HVDC Networks**
  J. Glasdam (DONG Energy / Aalborg University, Denmark), L. Zeni (DONG Energy / DTU, Denmark), J. Hjerrild, Ł. Kocewiak, B. Hesselbæk (DONG Energy, Denmark), P. E. Sørensen, A. D. Hansen (DTU, Denmark), C. L. Bak, P. C. Kjær (Aalborg University, Denmark) (WIW13-1087)
- **Multiterminal-HVDC Scaled Test Bench for Offshore Wind Transmission Systems Emulation**
  A. Egea-Álvarez, O J. Rull- Duran, Gomis-Bellmunt, A. Sudria-Andreu (CITCEA-UPC, Spain) (WIW13-1091)

**11:30 – 12:00 Discussion**

| 10:10 – 12:00 | SESSION 4C: FORECASTING II |
|---|---|
| > Session Chair | Arne Wessel (Fraunhofer IWES, Germany) |

**10:10 – 11:30 Presentations (16 min. each)**

- **Development of Innovative Weather and Power Forecast Models for the Grid Integration of Weather Dependent Energy Sources**
  M. Siefert, J. Dobschinski (Fraunhofer IWES, Germany), R. Hagedorn, K. Lundgren (DWD/German Weather Service, Germany), A. Wessel (Fraunhofer IWES, Germany), D. Majewski (DWD/German Weather Service, Germany) (WIW13-1147)
- **The U.S. Wind Forecasting Improvement Project: Results From the Southern Study Area**
  J. Zack (MESO, USA), J. Freedman (Atmospheric Sciences Research Center / formerly AWS Truepower, USA), J. Wilczak (NOAA, USA), J. Cline (U.S. Department of Energy, USA I. Flores (Electric Reliability Council of Texas, USA), J. Schroeder, B. Ancell (Texas Tech University, USA), K. Brewster (Oklahoma University, USA), K. Orwig (NREL, USA), S. Basu (North Carolina State University, USA), V. Banunarayanan (ICF International, USA) (WIW13-1233)
- **Analysis and Synthesis of Load Forecasting Data for Renewable Integration Studies**
  N. Steckler, A. Florita, J. Zhang, B.-M. Hodge (NREL, USA) (WIW13-1206)
- **Analysis of Variability and Predictability Challenges of Wind and Solar Power Generation**
  J. de Haan, W. Kling (Eindhoven University of Technology, the Netherlands) (WIW13-1138)
- **Are Forecasting Errors of Wind and Solar Power Statistically Dependent?**
  A. Braun, R. Fritz, S. Otterson (Fraunhofer IWES, Germany) (WIW13-1074)

**11:30 – 12:00 Discussion**

## 12:00 - 13:00 Lunch Break

| 13:00 – 15:00 | SESSION 5A: FREQUENCY CONTROL ISSUES |
|---|---|
| > Session Chair | Paul Gardner (GL Garrad Hassan, United Kingdom) |

**13:00 – 14:40 Presentations (16 min. each)**

- **Frequency Response of the US Eastern Interconnection under Conditions of High Wind Generation**
  N. Miller, M. Shao (GE Energy, USA), K. Clark (NREL, USA) (WIW13-1089)
- **Frequency Response Capability of the GB System in 2030**
  S. Kuenzel, L. P Kunjumuhammed, B. C. Pal (Imperial College London, United Kingdom) (WIW13-1053)
- **Synthetic Inertia Control Strategy for Double-fed Induction Generator Wind Turbine Generators Using Energy from DC Capacitor**
  J. Zhu, H. Urdal, D. Young (National Grid, United Kingdom) (WIW13-1165)
- **Quantifying the Aggregate Frequency Response from Wind Generation with Synthetic Inertial Response Capability**
  L. Ruttledge, D. Flynn (University College Dublin, Ireland) (WIW13-1097)
- **Role of Wind Power in the Primary Frequency Response of an Interconnection**
  Y. Zhang, V. Gevorgian, E. Ela (NREL, USA), V. Singhvi, P. Pourbeik (EPRI, USA) (WIW13-1234)
- **Cost-effective Primary Frequency Response at High Asynchronous Generation Levels**
  J. Kiviluoma (VTT, Finland), F. van Hulle (XP Wind, Belgium), A. Gubina (University College Dublin, Ireland), N. Cutululis (DTU Wind Energy, Denmark) (WIW13-1101)

**14:40 – 15:00 Discussion**

| 13:00 – 15:00 | SESSION 5B: NATIONAL GRID'S PERSPECTIVE |
|---|---|
| > Session Chair | Jonathan Horne (MPH Renewable Energy & Power System Consultants, United Kingdom) |
| 13:00 – 14:40 | Presentations (20 min. each) |

- **Integrated Offshore Transmission**
  B. Stojkovska, F. Natukunda, S. Ilesanmi (National Grid, United Kingdom) (WIW13-1159)
- **Managing Uncertainty and Variability of the Wind Resource**
  A. Richards (National Grid, United Kingdom) (WIW13-1191)
- **Demand Side Response Potential to Mitigate the Rate of Change of Frequency**
  N. Gargov, A. Dahresobh, V. Hamidi (National Grid UK, United Kingdom) (WIW13-1213)
- **Offshore Generation and Transmission in Great Britain - A Review of the Connection Process and Technical Performance Requirements**
  A. Johnson (National Grid , United Kingdom) (WIW13-1121)
- **System Strength Considerations in a Converter Dominated Power System – How Can it be Modelled Effectively?**
  H. Urdal (National Grid, United Kingdom), C. Ivanov (ENTSO-E, Belgium), A. Dahresobh, R. Ierna, J. Zhu, D. Rostom (National Grid, United Kingdom) (WIW13-1179)

| 14:40 – 15:00 | Discussion |
|---|---|

| 13:00 – 15:00 | SESSION 5C: POWER SYSTEM BALANCING I |
|---|---|
| > Session Chair | Hannele Holttinen (VTT, Finland) |
| 13:00 – 14:40 | Presentations (20 min. each) |

- **The Role of Nordic Hydropower to Handle Variations in the Future European Electricity System**
  L. Göransson, J. Goop, M. Odenberger, F. Johnsson (Chalmers University of Technology, Sweden) (WIW13-1194)
- **Available Active Power Estimation of Wind Power Plants with 3-Second Data**
  D. Schneider, S. Tietz, M. Siefert, M. Speckmann (Fraunhofer IWES, Germany) (WIW13-1062)
- **Impacts of Wind Integration on System Using Dynamic Reserves - Case Study**
  N. Menemenlis, M. Huneault (IREQ/Hydro-Québec, Canada), A. Robitaille (Hydro-Québec, Canada) (WIW13-1125)
- **Balancing Options for Renewables Integration in Japan - Data Availability that Would Enable Evaluation**
  R. Kuwahata (Ecofys, Germany), Y. Yasuda (Kansai University, Japan) (WIW13-1092)
- **Power Balance Provision through Coordinated Control of Modern Storage Heater Load**
  H. Qazi, D. Flynn (University College Dublin, Ireland) (WIW13-1046)

| 14:40 – 15:00 | Discussion |
|---|---|

| 15:00 – 15:30 | Coffee Break |
|---|---|

**15:30 – 17:20** **SESSION 6A: POWER SYSTEM ISSUES**

**> Session Chair** **Ralph Pfeiffer (Amprion, Germany)**

**15:30 – 16:50** **Presentations (20 min. each)**

- **Considerations of Future Small Signal Stability in GB Networks**
  L. Vilde, V. Hamidi, (National Grid, United Kingdom) (WIW13-1220)
- **Mitigation of Subsynchronous Resonance in a DFIG-based Wind Power Plant Connected to Series-compensated Lines Using StatCom**
  B. Li, H. Xie (ABB China, China), M. M. de Oliveira, C. Heyman, M. Monge (ABB, Sweden) (WIW13-1025)
- **Loss of Stability Margin Assessment during Wind Power Plant Operation in High Impedance Grids**
  V. Diedrichs (Jade University of Applied Sciences, Germany), A. Beekmann, K. Busker, S. Nikolai (Enercon, Germany), H. Lorenzen (Jade University of Applied Sciences, Germany) (WIW13-1143)
- **Evaluation of Wind Power Plants with Variable Speed Wind Turbines for Power Oscillation Damping based on Residues**
  J. Morató (Parsons Brinckerhoff, United Kingdom, formerly with DTU, Denmark), T. Knüppel (DTU, Denmark), J. Østergaard (DTU, Denmark) (WIW13-1243)

**16:50 – 17:20** **Discussion**

**15:30 – 17:20** **SESSION 6B: NEW GRID AND GENERATOR TECHNOLOGIES**

**> Session Chair** **Antje Orths (energinet.dk, Denmark)**

**15:30 – 16:50** **Presentations (20 min. each)**

- **Analysis of DC Collector Grid for Offshore Wind Power Plants**
  M. De Prada-Gil, J. L. Domínguez-García, F. Díaz-González, (Catalonia Institute on Energy Research, Spain), M. Aragüés-Peñalba (CITCEA-UPC, Spain), O. Gomis-Bellmunt (Catalonia Institute on Energy Research/CITCEA-UPC, Spain), D. Berenguel-Centeno, M. Martins, G. Fullana (Alstom Wind, Spain) (WIW13-1124)
- **A Novel Protection Strategy for Internal Faults for HVDC Connected MVDC Collection Grids for Wind Farms**
  J. Ehnberg, T. Nordlander (Pöyry Swedpower, Sweden), A. Holm (Vattenfall R & D, Sweden) (WIW13-1005)
- **Suprapower, a New Project Towards High Power Wind Generators Using Superconductivity**
  M. Noe (Karlsruhe Institute of Technology, Germany), G. Sarmiento Muñoz (TECNALIA, Spain) (WIW13-1177)
- **Proposal of a Wind Power Plant Consisting of Series Connected Wind Turbine Generators**
  S. Nishikata, K. Suzuki, F. Tatsuta (Tokyo Denki University, Japan) (WIW13-1128)…

**16:50 – 17:20** **Discussion**

**15:30 – 17:20** **SESSION 6C: FLEXIBILITY WITH STORAGE AND DEMAND SIDE MANAGEMENT**

**> Session Chair** **David Oram (National Grid, United Kingdom)**

**15:30 – 16:50** **Presentations (20 min. each)**

- **Evaluation of Energy Storages for the Optimization of Wind Energy Integration Based upon Different Forecast Errors Scenarios**
  S. Klaiber, O. Warweg, S. Nicolai, P. Bretschneider (Fraunhofer IOSB-AST, Germany) (WIW13-1228)
- **Pumped Hydro and Compressed Air Energy Storage at High Wind Penetrations**
  C. O'Dwyer, D. Flynn (University College Dublin, Ireland) (WIW13-1104)
- **Assessing Smart Grids Projects Capability to Promote Variable Renewable Energy Sources Integration through Demand Side Response**
  J. Osorio, M. Matos Fernandes (REN, Portugal) (WIW13-1196)
- **Joint Operation for Mitigating the Power Variability in Balance Circles Included Wind and Cogeneration Units using Heat Storage Tank**
  L. Varga (E.ON, Hungary), G. Mádi-Nagy (Eötvös Universty/IP Systems, Hungary) (WIW13-1042)

**16:50 – 17:20** **Discussion**

**19:30 – 22:30** Wind Workshop Conference Dinner

# THURSDAY 24 OCTOBER 2013

| 08:00 – 09:40 | SESSION 7A: GRID CODE AND POWER QUALITY ISSUES |
|---|---|
| > Session Chair | Eckard Quitmann (Enercon, Germany) |

**08:00 – 09:20 Presentations (16 min. each)**

- **Overview, Status and Outline of the New Revision for the IEC 61400 -21 – "Measurement and Assessment of Power Quality Characteristics of Grid Connected Wind Turbines"**
  B. Andresen (Siemens Wind Power, Denmark), P. Sørensen (DTU, Denmark), F. Santjer (DEWI, Germany), J. Niiranen (ABB, Finland) (WIW13-1150)
- **Grid Code Requirements and their Consequences for PGU's Protection Concepts**
  F. Kalverkamp, M. Meuser, J. Bünger, (FGH, Germany), R. Luxenburger (OMICRON, Germany) (WIW13-1082)
- **Negative Sequence Current Contribution of DFIG Wind Turbines during Asymmetrical Grid Faults**
  C. Wessels, M. Ruben, M. Laubrock (Nordex Energy, Germany) (WIW13-1044)
- **Aspects of Relevance of Wind Power in Power System Defense Plans**
  K. Das, A. Daniela Hansen, P. Sørensen (DTU Wind Energy, Denmark) (WIW13-1140)
- **Modeling and Mitigation of Harmonics and Harmonic Resonance Involving Wind Inverters**
  J. Sun (Rensselaer Polytechnic Institute, USA) (WIW13-1118)

**09:20 – 09:40 Discussion**

| 08:00 – 09:40 | SESSION 7B: AC CONNECTED OFFSHORE WIND POWER PLANTS |
|---|---|
| > Session Chair | Peter W. Christensen (Vestas, Denmark) |

**08:00 – 09:20 Presentations (20 min. each)**

- **Triton Knoll Offshore Wind Power Plant Transient Studies: Modelling and Study of Transient Effects of Long AC Cable Systems and Reactor Compensation for a Grid Connection**
  K. L. Koo, Z. Emin (Parsons Brinckerhoff, United Kingdom), S. Wijesinghe, D. Griffiths (RWE NPower Renewables, United Kingdom) (WIW13-1190)
- **Management of Low Frequency Resonances for Large Scale Offshore Wind Power Plants with Long AC Cable Connections**
  R. Hodges, S. Dixon (TNEI Sevices, United Kingdom), G. Bathurst (RongXin Power Engineering, United Kingdom) (WIW13-1151)
- **Harmonic Mitigation Methods in Large Offshore Wind Farms**
  L. Kocewiak (DONG Energy, Denmark), S. K. Chaudhary (Aalborg University, Denmark), B. Hesselbæk (DONG Energy, Denmark) (WIW13-1130)
- **Design, Testing, Installation and Operation of Three-core Export Cables for Offshore Applications**
  J. Karlstrand (JK Cablegrid Consulting, Sweden), O. Unosson (Oscar Unosson, Sweden) (**WIW13-1018)**

**09:20 – 09:40 Discussion**

| 08:00 – 09:40 | SESSION 7C: ECONOMIC AND MARKET ISSUES I |
|---|---|
| > Session Chair | Debra Lew (NREL, USA) |

**08:00 – 09:20 Presentations (20 min. each)**

- **Wind Power Plant Behaviour in a Pay-as-bid Curtailment Market**
  G. Hawker, L. Kane, K. Bell (University of Strathclyde, United Kingdom) (WIW13-1063)
- **The Role of Wind and Solar PV in Mitigating the Impact of Uncertainty in the Australian Electricity Industry**
  P. Vithayasrichareon, J. Riesz, I. MacGill (University of New South Wales, Australia) (WIW13-1207)
- **Frequency Control Ancillary Services - Is Australia a Model Market for Renewable Integration?**
  J. Riesz, I. MacGill (Centre for Energy and Environmental Markets, Australia) (WIW13-1030)
- **A New AS Market to Deal with Wind Power Forecasting Errors: Efficiency Assessment and Analysis of its Capability to Free up More Regulating Power**
  W. de Boer (DNV-KEMA, the Netherlands), G. Dekker (DNV, Norway), J. Frunt, M. Duvoort (DNV-KEMA, the Netherlands) (WIW13-1039)

**09:20 – 09:40 Discussion**

**09:40 – 10:10 Coffee Break**

| 10:10 – 12:00 | SESSION 8A: GRID INTEGRATION TECHNOLOGIES |
|---|---|
| > Session Chair | Nicolaos Cutululis (DTU Wind Energy, Denmark) |

**10:10 – 11:30 Presentations (20 min. each)**

- **Large Scale Grid Integration of Renewable Technologies on Weak Networks - Challenges & Solutions**
  M. Tabrizi, Y. Cheng, M. Sahni (PWR Solutions, Germanischer Lloyd, USA), Z. Fan, T. Gehlhaar (Germanischer Lloyd, Germany) (WIW13-1036)
- **Online Method for the Estimation of the Short Circuit Ratio with Small Grid Perturbation**
  D. Obradovic, A. Szabo (Siemens, Germany), P. Egedal, K. B. Danielsen, B. Andresen, M. Stoettrup (Siemens Wind Power, Denmark) (WIW13-1059)
- **Dynamic Line Rating and Ampacity Forecasting as the Keys to Optimise the Grid Connection of RES – Results of the EU Funded TWENTIES Demonstration: Netflex.**
  H.-M. Nguyen (University of Liège, Belgium), P. Schell (Ampacimon, Belgium), J.-L. Lilien (University of Liège, Belgium) (WIW13-1229)
- **The Gate-Controlled Series Capacitor for Reactive Compensation of Line-Commutated HVDC**
  M. Jafar, Y. Yang, G. Dekker (Det Norske Veritas, Norway), T. Langeland (DNV-Kema, Norway), M. Molinas (Norwegian University of Science & Technology, Norway) (WIW13-1198)

**11:30 – 12:00 Discussion**

| 10:10 – 12:00 | **SESSION 8B: MODELLING ISSUES** |
|---|---|
| **> Session Chair** | **Eckehard Tröster (Energynautics, Germany)** |
| **10:10 – 11:30** | **Presentations (20 min. each)** |

- **Implementation of Draft IEC Generic Model of Type 1 Wind Turbine Generator in PowerFactory and Simulink**
  H. Zhao, Q. Wu, P. Sørensen (DTU, Denmark), J. Bech, B. Andresen (Siemens Wind Power, Denmark) (WIW13-1065)
- **Development and Validation of a GE Type-III EMTP-RV Wind Turbine Model for Hydro-Québec's Studies**
  P. Prud'Homme, M. Fecteau, M. Asmine (Hydro-Québec, Canada), G. Drobnjak (GE Energy Consulting, Germany), E. Gursoy (GE Energy Consulting, Turkey), G. Turmel (IREQ/Hydro-Québec, Canada) (WIW13-1227)
- **Optimal K-Factor and Active Current Reduction during Fault-Ride-Through of Converter-Connected Generating Units for Power System Stability**
  B. Weise (DIgSILENT, Germany) (WIW13-1114)
- **Network Fault Response of Wind Power Plants in Distribution Systems during Reverse Power Flows (Part II)**
  J. C. Boemer (TU Delft, the Netherlands), B. G. Rawn (KU Leuven, Belgium), M. Gibescu, M. A. M. M. van der Meijden (TU Delft/TenneT TSO, the Netherlands), W. L. Kling (Eindhoven University of Technology, the Netherlands) (WIW13-1216)

**11:30 – 12:00** **Discussion**

| 10:10 – 12:00 | **SESSION 8C: ECONOMIC & MARKET ISSUES II** |
|---|---|
| **> Session Chair** | **Jenny Riesz (University of New South Wales, Australia)** |
| **10:10 – 11:30** | **Presentations (20 min. each)** |

- **Costs and Benefits of Fossil-Fueled Plant Flexibility**
  D. Lew, G. Brinkman, G. Stark (NREL, USA), G. Jordan, S. Venkataraman (GE Energy, USA), N. Kumar, S. Lefton (Intertek-APTECH, USA) (WIW13-1149)
- **The Economics of Energy Storage in the UK, Germany and US**
  A. Cheung (Bloomberg New Energy Finance, USA)
- **Cost Benefit Analysis for Reinforcement of the Transmission System to Accomodate Growing Numbers of Renewable Generation in the United KIingdom**
  E. Ganendra, P. Espie (SKM, United Kingdom) (WIW13-1225)
- **Macro Economic Evaluation of Proof Methods for the Delivery of Balancing Reserve by Wind Farms**
  M. Jansen, M. Speckmann, D. Schneider, M. Siefert (Fraunhofer IWES, Germany) (WIW13-1070)

**11:30 – 12:00** **Discussion**

## 12:00 - 13:00 Lunch Break

| 13:00 – 15:00 | **SESSION 9A: WIND INTEGRATION STUDIES** |
|---|---|
| **> Session Chair** | **Charles Smith (UVIG, USA)** |

**13:00 – 14:28 Presentations (22 min. each)**

- **Summary of Experiences and Studies for Wind Integration – IEA Wind Task 25**
  H. Holttinen (VTT, Finland), A. Robitaille (Hydro-Québec, Canada), A. Orths (Energinet.dk, Denmark), I. Pineda (EWEA, Belgium), B. Lange, (Fraunhofer IWES, Germany), E. Carlini (Terna, Italy), O'Malley, J. Dillon (University College Dublin, Ireland), J. O. Tande (SINTEF, Norway), A. Estanqueiro (LNEG, Portugal), E. Gómez-Lázaro (University of Castilla-La Mancha, Spain), L. Søder (Royal Institute of Technology KTH, Sweden), M. Milligan (NREL, USA), C. Smith (UVIG, USA) (WIW13-1106)
- **Integration of Offshore Wind Power to the U.S. Grid**
  M. Korytowski (University of Pittsburgh, USA), J. Fodiak (Xero Energy, United Kingdom), J. Daniel (ABB, USA), G. Reed (University of Pittsburgh, USA), N. Scott (Xero Energy, United Kingdom) (WIW13-1090)
- **Strategies for Alleviating Large Wind Power Curtailments in China**
  L. Yao, Y. Li, Z. Zhang, Y. Chi, J. Wu (China Electric Power Research Institute CEPRI, China) (WIW13-1047)
- **Frequency Issues of Island Power Systems with High Penetration of Hydroelectric and Wind Power**
  J.-D. Schmidt, E. Tröster (Energynautics, Germany), G. Papaioannou, J. Hanson (TU Darmstadt, Germany) (WIW13-1244)

**14:28 – 15:00 Discussion**

| 13:00 – 15:00 | **SESSION 9B: OFFSHORE GRID ISSUES** |
|---|---|
| **> Session Chair** | **Jens Fortmann (Repower, Germany)** |

**13:00 – 14:30 Presentations (18 min. each)**

- **Proving Offshore Wind Power Plants "Do What It Says on the Tin" in the Context of Challenging Grid Code Requirements for Frequency and Voltage Regulation**
  M. Horley, K. Smethurst (National Grid, United Kingdom) (WIW13-1158)
- **Technical and Economic Evaluation of a North Sea Grid**
  T. Drees, C. Linnemann, H. Schuster, A. Moser (RWTH Aachen, Germany), T. Panke, B. Burstedde (University of Cologne, Germany) (WIW13-1144)
- **Damping Power System Oscillations by VSC-Based HVDC Networks: A North Sea Grid Case Study**
  M. Ndreko, A. van der Meer (TU Delft, the Netherlands), B. G. Rawn (KU Leuven, Belgium), M. Gibescu, M. van der Meijden (TU Delft/TenneT TSO, the Netherlands) (WIW13-1188)
- **Design Considerations for Offshore Wind Power Plants Intra-Array Architectures**
  P. Rollings, A. Hardcastle (SKM, United Kingdom) (WIW13-1186)

**14:30 – 15:00 Discussion**

**13:00 – 15:00 SESSION 9C: POWER SYSTEM BALANCING II**

**> Session Chair Kamran Sharifabadi (Statoil, Norway)**

**13:00 – 14:30 Presentations (18 min. each)**

- **Active Power Control Features in the Wind Turbine Controller**
  E. Bossanyi (GL Garrad Hassan, United Kingdom), A. Ghorashi (Garrad Hassan America, USA) (WIW13-1181)
- **Assessment of the Impact of Primary Frequency Support on DFIG Wind Turbine Loads**
  B. Barahona Garzon, R. You (Tsinghua University, China), A. D. Hansen, N. A. Cutululis, P. Sørensen (DTU Wind Energy, Denmark) (WIW13-1133)
- **Flexibility Screening Tool – Development and Deployment**
  E. Lannoye (EPRI International, Ireland), A. Tuohy (EPRI, USA) (WIW13-1105)
- **Wind Powered Industrial Processes - Assessment of Additional Wind Power Integration by Flexible Processing**
  J. Käufler, R. Pohl, S. Deiringer (SYNLIFT Systems, Germany) (WIW13-1028)
- **Real-Time Tariffs for Electric Vehicles in Wind Power based Power Systems**
  H. Morais (Technical University of Denmark, Denmark), T. Sousa, M. Silva, P. Faria, Z. Vale (GECAD/IPP, Portugal) (WIW13-1199)

**14:30 – 15:00 Discussion**

**15:00 – 15:30 Coffee Break**

**15:30 – 16:30 SESSION 10: CLOSING SESSION-PODIUM DISCUSSIONS**

**> Session Chair Helge Urdal (Urdal Power Solutions, United Kingdom)**

- **15:20 - 16:25 Podium discussions**
  **Topic: Can adequate confidence be established within the industry to act decisively and in collaboration to solve new problems which have only been identified through analysis and have not yet been experienced? Will the rapidly changing future allow time to wait for the experience before acting?**
  Participants:
  Ralph Pfeiffer (Amprion, Germany)
  Eckard Quitmann (Enercon, Germany)
  Sridhar Sahukari (DONG Energy Wind Power, United Kingdom)
  James Toal (Independent Consultant, Scotland, United Kingdom)
  Stephan Wachtel (GE, Germany)

- **16:25 - 16:30 Closing Remarks, Thomas Ackermann, Energynautics**