

100% Renewable Energy in Europe? Optimal combination of storage and balancing in a Renewable European Power System, transitional pathway between the current and the future energy system, application of mathematical tool to explore technical data?  
Interested – join the lecture!

Faculty of Electrical Engineering and International Office as well as Office of Students Professional Career in cooperation with the Academia Europaea - Wroclaw Knowledge Hub invite students, PhD students and academic teachers of Wroclaw University of Technology on a series of two lectures of Professor Martin Greiner, a member of the Academia Europaea, Aarhus University, Denmark, Department of Engineering and Department of Mathematics, considering developments of modern power system networks and use of mathematical tools in the assessment of the contribution of renewable energy sources

# Design of a fully renewable European energy system - challenges for system engineering, applied mathematics and physics of complex networks

*Martin O.W. Greiner, Denmark*

## Abstract:

Todays large-scale energy systems based on conventional resources will transform into a future system dominantly relying on fluctuating renewable resources. At the moment it is not really clear what will be the best transitional pathway between the current and the future energy system. In this respect it makes sense to think backwards, which means in a first step to get a good understanding of fully renewable energy systems, and then in a second step bridge from there to todays energy system. Based on state-of-the-art high-resolution meteorological and electrical load data, spatio-temporal modeling, and the physics of complex networks, fundamental properties of a fully renewable pan-European power system are determined. Amongst such characteristics are the optimal mix of wind and solar power generation, the optimal combination of storage and balancing, the optimal extension of the transmission grid, as well as the optimal ramp down of conventional power generation during the transitional phase. These results indicate that the pathways into future energy systems will be driven by an optimal systemic combination of technologies, and that economy and markets will have to follow technology. This talk will be presented in two parts. **The first part** focuses on the modeling of wind and solar power generation, their aggregation on various-length scales, and results drawn from it as to future storage and backup needs in the limit of a copper-plate like Europe. **The second part** addresses various complex-network aspects of future pan-European power transmission and an overall economic system analysis.

## Part 1

29.05.2014 (Thursday) – room 2.17, C-13, 11.15-13.00

## Part 2

30.05.2014 (Friday) – room 2.17, C-13, 11.15-13.00



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2010-till now Professor, Departments of Engineering and Mathematics, Aarhus University, Denmark.  
2001–2010 Senior Research Scientist, Corporate Research and Technology, Siemens AG, Munich, Germany.  
2000–2001 Visiting Professor, Duke University, Durham, USA.  
1995–2000 Research Scientist, Technical University and Max-Planck Institute for Physics of Complex Systems, Dresden, Germany.  
1995 Habilitation (Theoretical Physics), Justus Liebig University, Germany.

Member of the German Physical Society, the Academia Europaea, and the European Physical Society (Working Group Energy).

Current fields of interests include

- Fully renewable energy systems: modelling, design and planning of sustainable large-scale energy systems with a very large share of weather-dependent renewables.
- Turbulence, wind flows and wind farms: stochastic modelling, optimization and control.
- Physics and mathematics of complex networks: modelling of structure, dynamics and function of self-organizing networks, applications ranging from communication and electricity networks to social and biological networks.

With strong experiences both in academic and industrial cooperate research, the research competences range from very basic to very applied and reflect a unique understanding of both ends

Ca. 75 articles in refereed international journals, Ca. 50 papers in mostly refereed international proceedings, (uncountable number of) invited conference talks, colloquia and seminars.



**For organizational reasons participants of the meeting are kindly pleased to fill a short registration form available at website of the Office of Students Professional Career of Wroclaw University of Technology using sections Calendar of Events or directly at: <http://goo.gl/w9k1XQ>**



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