

# RENEWABLE ENERGY INTEGRATION

## HOW TO INTEGRATE RENEWABLE ENERGY INTO THE GRID

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16 – 17 January 2012, Singapore



Expert Course Faculty

### Dr Hugh Outhred

Hugh has 30+ years' experience in energy markets in research, consulting & teaching



### Dr Maria Retnanestri

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# RENEWABLE ENERGY INTERGRATION

16 - 17 January 2012, SINGAPORE

## Course Overview

This course will provide a comprehensive discussion of renewable energy resources, the associated conversion technologies for electricity generation, and renewable energy integration into large main-grid and small remote electricity industries.

The course will introduce the concept that renewable energy integration can be viewed as a process of technological and societal innovation and acculturation, and discuss technical, economic, social and environmental aspects of that process. Two case studies will be used to illuminate the nature of the process in large, main-grid and small remote electricity industries respectively.

Participants will learn about the concepts and language used in discussing renewable energy resources, technologies and integration into electricity industries. This will help them understand the motivation and logic of their counterparts whether they work for renewable energy project developers, the electricity industry, government policy-making bodies or electricity industry regulators.

## Course Learning Outcome

**An essential & comprehensive course on renewable energy integration, covering resources, technologies for electricity generation and integration into large main-grid and small remote electricity industries. The course will discuss technical, economic, environmental and social aspects.**

- Key renewable energy resources and associated conversion technologies for electricity generation
- The contribution that renewable energy can make to energy security, climate change mitigation and enhanced sustainability
- Electricity industries as complex technological systems comprising *hardware, software & orgware*
- Renewable energy integration as a process of technological and societal innovation and acculturation
- Temporal aspects of renewable energy integration from short-term operation to long-term investment, including forecasting for renewable energy generation
- Locational aspects of renewable energy integration – connection requirements and network augmentation or extension at distribution and transmission levels
- Insights from large main-grid case study (wind & solar energy integration in the Australian National Electricity Market) and small, remote community case study (renewable electricity supply for off-grid rural communities in Indonesia)

## Who Should Attend

Professionals from the renewable energy, electricity and gas industries, regulatory bodies, government, banks, brokers, lawyers, consultants, industry advisors and major energy users.

## Unique Features with **powerEDGE** Training

- Pre-Course Questionnaire to help us focus on your learning objectives
- Detailed Course & Reference Manual for Continuous Learning and Sharing
- Practical Exercises & Case Examples to better understand the principles
- Limited class size to ensure One-to-One Interactivity
- Assessment at the end of the course to help you develop a Personal Action Plan

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## Course Outline

### Renewable energy resources and conversion technologies for electricity generation

- Renewable energy resources in the global context – what are the key resources and where are they located?
- Renewable energy electricity generation technologies – what are their characteristics, and development trajectories and how do they compare to non-renewable generation technologies?

### Renewable energy, energy security, climate change and enhanced sustainability

- What contributions can renewable energy make to energy security and climate change mitigation?
- What interactions are there with other key issues – such as food and water security and material constraints?
- How can we assess sustainability? What are reasonable expectations?

### Electricity industries as complex technological systems

- The complex technological systems that implement the energy conversion chain from primary energy resources to end-use energy forms via electrical energy
- Hardware, Software and Orgware aspects of technological systems

### Renewable energy integration as a process of technological and societal innovation and acculturation

- What do we mean by technological and societal innovation and acculturation?
- How can we apply these ideas to renewable energy integration?
- How do integration challenges vary with renewable energy type, electricity industry scale and national context? What has been the experience to date?
- Can “smart grid” concepts help in renewable energy integration?

### Temporal aspects of renewable energy integration

- Temporal characteristics of renewable energy resources and electricity generation and the associated issues for renewable energy integration
- The role of forecasting in predicting future renewable energy generator behaviour: what aspects are uncertain and to what extent are they predictable?
- The role of complementarity in managing temporal issues – between renewable energy generators and with respect to other electricity industry resources
- The role of system operators, energy markets and frequency-related ancillary services in managing temporal issues

### Locational aspects of renewable energy integration:

- Connection requirements for renewable energy generators
- The effects of network losses and network flow constraints
- Network augmentation or extension at distribution and transmission levels
- The role of Network Control Ancillary Services in managing network impacts
- The role of governments and regulators in resolving network-related issues

### Economic aspects of renewable energy integration

- Portfolio standards & tradeable renewable energy certificates
- Feed-in Tariffs
- Other policy measures such as carbon pricing

### Planning procedures and safety issues for renewable energy projects

- Planning approval processes for renewable energy projects and “best practice” guidelines
- Safety issues associated with renewable energy projects – mechanical failure, fire and electrocution

### Large main-grid electricity industry case study: Wind & solar energy integration in the Australian National Electricity Market

- Renewable energy generator status in the NEM – scheduled, semi-scheduled or non-scheduled; market or non-market
- The role of energy and frequency control ancillary service (FCAS) spot and derivative markets in managing temporal variability and uncertainty in the NEM
- The role of the National Transmission Network Development Plan and network service provider planning in predicting and coordinating future large-scale developments
- Cash flows associated with the National Electricity Market – spot energy and FCAS markets and associated derivative markets
- The Australian Wind Energy Forecasting System and supplementary techniques to predict large rapid changes in wind energy generation

### Small, remote electricity industry case study: Renewable electricity supply for off-grid rural communities in Indonesia (presented by Dr Maria Retnanestri,)

- Holistic, interdisciplinary approach to off-grid remote community energy service delivery (diffusion and acculturation of investment, installation, operating & project management expertise)
- Renewable energy project deployment and acculturation into remote community culture
- The role of a local utility in maintaining the sustainability of remote community energy service delivery
- The importance of maximising local autonomy

## Your Expert Faculty

### Dr. Hugh Outhred

In a 35-year research career, Hugh Outhred (PhD) has contributed to electric power system analysis and control, the theory of electricity industry restructuring and electricity market design, renewable energy technology, renewable energy integration, energy sector policy and sustainability policy. He has taught nearly 100 short courses on electricity industry restructuring and sustainability in a range of countries since 1988.

In 1993 and 1994 he co-authored a report on electricity industry restructuring for the California Energy Commission that highlighted the complexity of electricity restructuring in that context.

In 1995 and 1996 he led a project for the Australian National Grid Management Council to undertake electricity-trading experiments according to the proposed National Electricity Market trading rules prior to their formal implementation.

From 2004 to 2007, he was the founding Presiding Director of the Centre for Energy and Environmental Markets at the University of New South Wales. From 2009 to 2011, he was a Lead Author for the International Panel on Climate Change (IPCC) Special Report on Renewable Energy Sources and Climate Change Mitigation, published in 2011.

Hugh has been a Fulbright Senior Fellow at the University of California Berkeley, USA and has held visiting positions at Massachusetts Institute of Technology in the USA, the University of Liverpool in Britain and the Universidad Pontificia Comillas in Spain.

He has been a Board member of the Australian Cooperative Research Centre for Renewable Energy and an Associate Director of the Centre for Photovoltaic Devices and Systems at the University of New South Wales. He was a member of the NSW License Compliance Advisory Board and a member of the National Electricity Tribunal throughout their existence from 1997 to 2000 and 1998 to 2006 respectively.

Hugh Outhred (PhD), a Fellow of the Australian Institute of Energy & was, prior to his retirement in 2007, Presiding Director of the Centre for Energy & Environmental Markets at the University of New South Wales, Sydney Australia.

### Dr. Maria Retnaestri

Dr. Maria Retnanestri is a Visiting Fellow in the School of Electrical Engineering and Telecommunications at the University of New South Wales.

She holds the degrees of Bachelor of Electrical Engineering (STTNAS Jogjakarta), Master of Engineering Science in Electrical Engineering (UNSW) and PhD in Electrical Engineering (UNSW).

In her PhD research, Maria Retnanestri developed the I3A (Implementation, Accessibility, Availability and Acceptability) Framework to investigate overall sustainability of renewable energy projects, considering their institutional, financial, technological, social and ecological sustainability dimensions. From 2008 to 2011, she then further developed and applied this research to identify ways to overcome barriers to renewable energy for sustainable development in Indonesia with financial support from an Australian Development Research Award.

With that financial support, she conducted more than 20 workshops, seminars, public lectures, field visits and study tours in Indonesia involving various kinds of renewable energy stakeholders in knowledge sharing and capacity building activities.

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### REGISTRATION FORM

	Early Bird Ends 1 Dec 2011	Normal	Savings
2 Day Programme	SGD \$2199	SGD \$2399	SGD \$200

### 4 ways to Register

- Online: [www.poweredgeasia.com](http://www.poweredgeasia.com)
- Email: [info@poweredgeasia.com](mailto:info@poweredgeasia.com)
- Phone: (65) 6747 0775
- Fax: (65) 67478737

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- ✓ Smart Grids
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