

Introduction to Smart Grids

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Centre for Wireless Communications and Infotech Oulu
University of Oulu

LECTURERS



Dr. Janaka Ekanayake

received the B.Sc.Eng. Degree in Electrical and Electronic Engineering from the University of Peradeniya in 1990 and PhD in Electrical Engineering from University of

Manchester Institute of Science and Technology (UMIST), U.K. in 1995. He is presently attached to the Cardiff University, UK and is actively contributing to the research programmes of the Low Carbon Research Institute of the UK and the Institute of Energy of Cardiff University. Prior to that he was a Professor in the Department of Electrical and Electronic Engineering, University of Peradeniya. His research interests include power electronics, FACTS devices and renewable energy sources such as wind and small hydro schemes. He is a Chartered Engineer, Fellow of IET, Senior Member of IEEE and Member of the IESL. He has co-authored many journal and conference papers and three books. His recent books include Wind Turbine: Modelling and Control (published by John Wiley & Sons, 2009) and Distributed Generation (published by IET, 2010).



Dr. Kithsri M. Liyanage is attached to the Department of Electrical and Electronic Engineering, University of Peradeniya. He obtained his Dr.Eng.

Degree from University of Tokyo in 1991. He served as Dean of the Faculty of Engineering, University of Ruhuna, Director of the Information Technology centre, University of Peradeniya. He contributed in several ICT based applications especially towards the national policy development in electric energy and ICT education sectors at different stages of his carrier. Since September 2008, he is with the University of Tokyo as a Visiting Research Fellow on his sabbatical. During this period, he has been working on next generation power systems, especially on ICT applications. He has served as coordinator of and consultant to several ICT and power generation projects. He is a Chartered Engineer, and a member of IESL, IEEE, and IEE (Japan).

COURSE DESCRIPTION

This 3 day course consists of fundamentals of power systems, present and future challenges associated with the operation of power grids, challenges associated with the Smart Grid and supporting technologies for the realization of Smart Grids. It will introduce basics of power systems for those who are majoring communication engineering. Major challenges link with the operation of present power systems and future Smart Grids will be discussed next. A selected set of important technologies that will be found useful for the implementation of Smart Grids will be discussed finally.

AGENDA

Day 1: Fundamentals of Power Systems	
9:00 – 12:00	<p>Introduction to power systems</p> <ul style="list-style-type: none"> • Active and reactive power, three-phase systems • Generation – How generators work and different type of conventional generators • Transmission – AC and DC transmission • Distribution – grid substations, local distribution • Load profiles
13:00 – 16:00	<p>Power System operation</p> <ul style="list-style-type: none"> • Grid operation – balancing generation and supply; frequency response and reserve • Distribution system operation – DG connections and FIT • Energy Management Systems • Current and future markets
Day 2: Present and future challenges associated with the operation of power grids	
9:00 – 12:00	<p>Power system dynamics – Operational Challenges</p> <ul style="list-style-type: none"> • Power system stability issues • Transient stability • Dynamic stability • Voltage stability
13:00 – 16:00	<p>Renewable generation and grid connection</p> <ul style="list-style-type: none"> • Wind power generation – basics, different types of generators • PV generation – basics, grid interfaces • Grid code requirements • Grid support from renewable • Micro grids
Day 3: Supporting technologies for Smart Grids	
9:00 – 10:30	<p>Smart Metering/ Demand response</p> <ul style="list-style-type: none"> • Smart meter – components in brief • AMR, AMM etc. • Demand response and incentives for demand side participation • Building Energy management Systems
10:30 – 12:00	<p>HVDC in Smart Grids</p> <ul style="list-style-type: none"> • Why HVDC? • VSC and CSI HVDCs
13:00 – 14:30	<p>Energy Storage, EVs and V2G</p> <ul style="list-style-type: none"> • Energy Storage Systems • EVs and Hybrids • V2G
14:30 – 16:00	<p>WASA</p> <ul style="list-style-type: none"> • PMU • Applications • Smart Grid challenges