

# Modelling and Control Challenges in Future Energy Systems: Uncertainties+Big-Data+Risk

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## 1. Abstract

Future power networks face several challenges: (i) liberalized markets and increased cross-border bulk power transfers to facilitate effectiveness of market mechanisms, (ii) massive penetration levels of renewable energy from highly variable generators and energy storage systems, both connected to the system using high power converters, (iii) enormous deployment of high power electronic devices (multi-terminal HVDC, FACTS, Active shunt and series compensations, etc.), (iv) colossal deployment of intelligent devices, meters, etc., and densely integrated ICT infrastructures and other more challenges... However, those challenges have two aspects which have a sensible impact on the modelling and control of future energy systems: (1) *Intensification uncertainties*: considering the generation side, a substantial proportion energy production from non-conventional renewable generation, largely stochastic and intermittent, virtually connected at all levels and various sizes. On the other side, time and spatial variation in loads together with its more complex composition is expected to highly increase load uncertainties. Also, other uncertainties are expected to surge: communication time delays, noise and loss, etc. (2) *Countless measurements, "Big Data"*: Traditionally SCADA (Supervisory Control and Data Acquisition), fault recording system, condition monitoring, etc. are being overlapped by smarter power systems providing many measurements, not just standard condition parameters; WAMS (*wide area monitoring systems*), advanced metering devices, bi-directional communication from mobile and stationary devices, internet based resources, environmental and social data sources, etc. These measurements resources are providing more a more data creating challenges on model creation and knowledge based controls.

The aim of this workshop is to present a general overview about the main challenges on modelling and control challenges in future energy systems. Many question will rise from this workshop, much of them have not being answered yet but at least are we asking the correct questions?

## 2. Seminar Duration

30 minutes

## 3. Audience:

Undergraduate and postgraduate students, researcher and academic staff with special interest in modelling and control of future energy networks.

### 3. Instructor Affiliation

#### FRANCISCO M. GONZALEZ-LONGATT PhD, SMIEEE, MIET, MCIGRE

Lecturer in Electrical Power Systems

Loughborough University

School of Electronic, Electrical and Systems Engineering

W2.63, Loughborough, LE11 3TU, United Kingdom

+44(0)150 9227061, [F.Gonzalez-Longatt@lboro.ac.uk](mailto:F.Gonzalez-Longatt@lboro.ac.uk)

Skype: fglongatt Twitter: @fglongatt

Website: <http://www.lboro.ac.uk/departments/eese/ourpeople/a-z/atozlist/francisco-gonzalez-longatt.html>

Personal Website: <http://www.fglongatt.org>

Vice-President

Venezuelan Wind Energy Association

Webpage: <http://www.aveol.org.ve>

Email: [fglongatt@aveol.org.ve](mailto:fglongatt@aveol.org.ve)

### 5. Instructor Biography



**Francisco M. Gonzalez-Longatt** is currently a Lecturer in Electrical Power System at Electrical Power System in School of Electronic, Electrical and Systems Engineering in Loughborough University. His academic qualifications include first Class Electrical Engineering of Instituto Universitario Politécnico de la Fuerza Armada Nacional, Venezuela (1994), Master of Business Administration (Honors) of Universidad Bicentennial de Aragua, Venezuela (1999) and PhD in Electrical Power Engineering from the Universidad Central de Venezuela (2008). He is former associate professor (1995-2009) and Chair (1999-2001) of the Department of Electrical Engineering of Universidad Nacional Politécnico de la Fuerza Armada Nacional, Venezuela (1995-2009). He is a former academic staff of Department of Aerospace, Electrical and Electronic Engineering at University of Coventry where he started as Lecturer in Electrical Engineering in 2012 and promoted to Senior Lecturer in Electrical Engineering in 2013. He was formerly with the School of Electrical and Electronic Engineering, The University of Manchester as

Postdoctoral Research Associate (2009-2011).

He is the author or editor of several books (Spanish and English) including editor of the book “*Power Factory Applications for Power System Analysis*”, Springer (2014), and He has written 9 book chapters, 10+ journal and magazine papers and 60+ conference papers. His work has over +370 citations and he has been the keynote speaker a several conferences. He was the session chair at [IECON 2013](#), [IEEE Powertech 2011](#), [IEEE ISGT Europe 2011](#), etc. He is a reviewer of the top conferences (PSCC 2014, IEEE PES GM 2013, IECON 2013, etc.) and journal papers research area (IEEE Transaction on Power Systems, IEEE Transaction on Smart Grids, IET Renewable Power Generation, Elsevier Renewable Energy, etc.)

He is Vice-President of *Venezuelan Wind Energy Association*, Senior Member of the Institute of Electrical and Electronic Engineering (IEEE), member of *The Institution of Engineering and Technology* - The IET (UK) and member of *International Council on Large Electric Systems* -CIGRE. He received the professional recognition as FHEA – Fellow of the Higher Education Academy in January 2014.

His research interest includes innovative (operation/control) schemes to optimize the performance of future energy systems. His research is or has been supported by *Royal Society* –UK. Two special research projects financially supported by the Royal Society deserve mention: “*Smart Multi-Terminal DC Micro-grids for autonomous Zero-Net Energy Buildings*” and “*Exploring beyond the Frontiers to Build a Smarter Grid (EBF2BSG)*”.