

# Knowledge Exchange Forum

Integrating Variable Renewable Energy  
into Power Grids

UN CITY / COPENHAGEN



/ OCTOBER 21 / 2014



# INTERGRATING VARIABLE RENEWABLE ENERGY INTO POWER GRIDS

Meeting a substantial share of electricity demand from renewable energy sources is now economically feasible for many countries. With drops in input prices, particularly for variable renewable energy (VRE) sources such as wind and solar, renewables have become an essential part of national energy plans and strategies. But as these sources provide an increasing share of national energy supply, they also introduce challenges for planners responsible for the reliability, adequacy and stability of power systems.

This event is targeted at helping countries that are interested in scaling up grid-connected VRE by facilitating a knowledge exchange on how this scale-up can be achieved while meeting reliability and affordability criteria. The event will look at the benefits, costs and obstacles from the points of view of a range of stakeholders, and consider the implications of new technologies and approaches available to planners and decision-makers.

Topics will include planning for adequacy and greater system flexibility; current and forthcoming technology options that facilitate power system operation at high levels of VRE; distributed generation options and issues; and implications for regulation and pricing in the context of different sector structures. Sessions will cover a range of country experiences, expert presentations, and moderated debates among stakeholders.

## ESMAP MISSION

The Energy Sector Management Assistance Program (ESMAP) is a global knowledge and technical assistance program administered by the World Bank. It provides analytical and advisory services to low- and middle-income countries to increase their know-how and institutional capacity to achieve environmentally sustainable energy solutions for poverty reduction and economic growth. ESMAP is funded by Australia, Austria, Denmark, Finland, France, Germany, Iceland, Lithuania, the Netherlands, Norway, Sweden, and the United Kingdom, as well as the World Bank.



TIME	SESSION	PARTICIPANTS
08:00	REGISTRATION	
09:00	INTRODUCTORY REMARKS	<b>Anita M. George</b> , Sr. Director, World Bank Group
09:15	<b>SESSION 1</b> <b>INTEGRATING HIGH LEVELS OF VRE: CAN YOU DO IT?</b>	
	<b>Opening Presentation</b> The Challenge: Sustainable VRE Scale-Up	<b>Dr. Robert Gross</b> Senior Lecturer, Imperial College Director, Center for Energy Policy & Technology Policy Director, Energy Futures Lab
	Operating Grids with High Levels of VRE: Can You Do It?	<b>Peter Jørgensen</b> Vice President, Energinet.dk, Denmark
	“What Can Regulators Do: Regulatory Reflections”	<b>Ronald Chauke</b> Head, Department of Electricity Regulatory Reform, NERSA, South Africa
	How Project Design Can Help to Integrate VRE into Power Systems: Taking Advantage of First Experiences	<b>Achim Neumann</b> Senior Energy Economist, KfW Development Bank, Germany
	<b>Q &amp; A and Remarks</b>	<b>Dr. Lawrence Jones</b> Vice President, Utility Innovations & Infrastructure Resilience, Alstom Grid North America, USA
10:45	COFFEE BREAK	
11:15	<b>SESSION 2   TED-STYLE TALKS</b> <b>OPERATING AND PLANNING HIGH VRE GRIDS</b>	<b>Moderator   Dr. Mark O’Malley</b> Founder & Director, Electricity Research Center, University College Dublin (UCD)
	Is it Really Possible to Integrate High Levels of VRE at Moderate Incremental Cost? Are the Integration Challenges Really so Country Specific?	<b>Simon Mueller</b> Energy Analyst, International Energy Agency (IEA)
	What are the Implications for Policy-Makers, Planners, and Regulators?	<b>Bandar Mutwali</b> Senior Engineer, King Abdullah City for Atomic and Renewable Energy (K.A.CARE), Saudi Arabia
	Grid Integration Studies: What Type of Studies are Needed and When?	<b>Dr. Thomas Ackermann</b> CEO, Energynautics GmbH
	Smart Grids Applications for VRE Integration	<b>Dr. Lawrence Jones</b> Vice President, Utility Innovations & Infrastructure Resilience, Alstom Grid North America, USA
	Preparing for High Levels of VRE: Taking Advantage of Previous Experiences	<b>Ernesto Huber</b> Deputy Director of Operations, CDEC-SIC, Chile
12:45	LUNCH	
14:00	<b>SESSION 3   SHORT TALKS ON REGULATION AND POLICY</b> <b>WHAT POLICY-MAKERS, AND REGULATORS NEED TO DO DIFFERENTLY IN A MOVE TO HIGH VRE</b>	<b>Moderator   Ron Binz</b> Principal, Energy Policy Consulting Senior Policy Advisor, Center for the New Energy Economy, USA
	Beyond Attracting Investment for Development of Renewables. What Else is Required to Achieve High Levels of Variable Renewable Integration?	<b>Ivan Saavedra Dote</b> Chief, Division of Electricity, Comisión Nacional de Energía (CNE), Chile
	Why Regulation, Policies and Markets Need to Change in Order to Integrate High Levels of Variable Renewables into Power Systems?	<b>Dr. Fereidoon P. Sioshansi</b> President, Menlo Energy Economics, USA
	Why are Grid Codes / Interconnections Standards so Important?	<b>Dr. Pham Quang Huy</b> Deputy General Director, Electricity Regulatory Authority of Vietnam (ERAV), Vietnam
	Industry Recommendations to Achieve a Scaling Up of VRE While Maintaining System Reliability and Keeping Integration Costs as Low as Possible	<b>Anne-Malorie Geron</b> Head of Energy Policy & Generation Unit, Eurelectric
	Industry’s Point of View: Are Grid Codes and Forecasting Requirements a Barrier or a Sign of Government Commitment to VRE?	<b>Carlos Gascó Travesedo</b> Energy Policy Senior Advisor, Prospective and Technology Division, IBERDROLA Renovables, Spain
	<b>Moderated Discussion and Q &amp; A</b>	

15:30 **COFFEE BREAK**

16:45	<b>SESSION 4   SHORT TALKS</b> <b>PERSPECTIVES FROM DYNAMIC MARKETS WITH AMBITIOUS VRE TARGETS: HOW TO LEAPFROG FROM PREVIOUS EXPERIENCES</b>	<b>Moderator   Dr. Marianne Fay</b> Chief Economist, Climate Change Group, World Bank Group
	Are Integrations Issues Perceived as an Immediate Issue Related to Integration with Renewables?	<b>Langiwe Hope Lungu</b> CEO, Energy Regulation Board, Zambia
	Are Additional Interconnection, Transmission, and Flexible Generation Needs Linked to Renewables Included in Medium/Long-Term Power Expansion Strategies?	<b>Hu Xiaofeng</b> Engineer, China Renewable Energy Engineering Institute (CREEI), China
	Can Emerging VRE Markets Leapfrog by Modernizing Electricity Grids? What are the Most Cost-Effective Technologies?	<b>Robert Towers</b> Economist, Sustainable Energy Team, Climate & Environment Department, Department for International Development (DFID), United Kingdom
	Are Utilities Concerned about the Impact of Distributed Generation and Low Utilization Factors of Existing Assets and Generation Costs?	<b>Guillermo Zuñiga Martinez</b> Commissioner, Comisión Reguladora de Energía (CRE), México
	Maximizing Economic Benefits of VRE. How Can We Increase Knowledge Sharing Among Regulators, Operators, and Utilities? Key Drivers, Questions, Concerns, Objectives	<b>Klas Heising</b> Head, Technology Cooperation in the Energy Sector Project, GIZ, Germany
	<b>Moderated Discussion and Q &amp; A</b>	

17:30 **CONCLUDING REMARKS**

**Rohit Khanna**  
ESMAP Program Manager, World Bank Group

18:00 **EVENT CLOSE**

## SPEAKER BIOS

### INTRODUCTORY REMARKS

#### ANITA M. GEORGE, Sr. Director, World Bank Group

Ms. George is Senior Director of the World Bank Group's Global Practice on Energy and Extractive Industries. In this position, she provides leadership and strategic direction to the Global Practice that fosters partnerships with key clients through lending, advisory and knowledge services. Before assuming this position on July 1, 2014, Ms. George was the Asia Pacific Regional Director for Infrastructure and Natural Resources at the International Finance Corporation (IFC). She has played several roles in the World Bank Group working in Asia, Africa, Middle East and Latin America. Besides her work with the Bank Group, she has headed Siemens Financial Services in India covering the telecommunications, power and transportation sectors, and has also served in management positions with the Steel Authority of India. Ms. George holds a dual Masters' degree in Business Administration and Economic Policy from Boston University. She is married and the mother of two children.



### SESSION 1

#### ROBERT GROSS, Senior Lecturer, Imperial College and Director, Center for Energy Policy & Technology

Dr Robert Gross is the Director of the Centre for Energy Policy and Technology at Imperial College London. He is also a Co-Director of the UK Energy Research Centre and the Policy Director at Imperial's Energy Futures Lab. He directs a substantial research programme and teaches at post graduate level. He has published extensively on energy policy and technology. In 2011 and 2012 he was Specialist Advisor to the UK Parliament's Energy and Climate Change Select Committee's enquiries into energy market reform (EMR). He was a member of the DECC academic advisory council on EMR. In 2008 he served as Specialist Advisor to the UK House of Lords Committee on the European Union enquiry into the feasibility of the 2020 targets for renewable energy. He has contributed to numerous UK government reviews and White Papers on energy policy and has undertaken research and consultancies for diverse organisations from the UK government funding councils and departments, utilities and oil companies, to the UNDP, World Bank and Greenpeace. He makes regular contributions to the popular debate on energy and has appeared in print and broadcast media including the BBC, Financial Times, The Guardian and Sky News.



#### PETER JØRGENSEN, Vice President, Energinet.dk, Denmark

Peter Jørgensen has been working in the Danish power supply industry for more than 25 years. Mr. Jørgensen has been responsible for planning of the Danish electricity system as well as opening of the electricity market. He has represented Denmark in the international TSO organisations Nordel, ETSO and ENTSO-E with respect to system development and electricity markets, and his current responsibilities include development of the international electricity infrastructure and electricity markets with focus on integration of renewable energy. Peter Jørgensen is also in charge of Energinet.dk's international consultancy services.



#### RONALD CHAUKE, Head, Department of Electricity Regulatory Reform, National Energy Regulator of South Africa

Mr Ronald Chauke joined the Department of Minerals and Energy (now the Department of Energy) as Programme/Project Manager in the Coal and Gas Directorate, working for 2 years on coal policy development. He also served as Secretariat of the South Africa-Mozambique Gas Commission. Subsequently, Ronald held the Policy Researcher position at the National Electricity Regulator (now the National Energy Regulator of South Africa), where he provided strategic and technical support to the regulator in terms of the development of both internal and external policies. Six months into the position Mr Chauke was seconded to the Office of the Board Member responsible for Petroleum Pipeline Regulation. Mr Chauke then joined the Department of Finance (i.e. National Treasury) as a Director for Energy and Telecoms and also served as a Strategic Advisor to the Minister of Finance and the Ministry of Energy. Ronald returned to the National Energy Regulator (NERSA) as Head of the Electricity Regulatory Reform Department. In this capacity, his work involves restructuring the electricity industry, reviewing regulatory practices and benchmarks with other regulatory authorities, managing and administrating the Grid Code from both Transmission and Distribution, providing technical assistance by creating an enabling environment for IPPs especially in the renewable energy sector.



#### **ACHIM NEUMANN, Senior Energy Economist, KfW Development Bank**

Achim Neumann is Senior Energy Economist in the Energy, Water and Agriculture Competence Centre at KfW Development Bank, based in Frankfurt, Germany. The Competence Centre provides sector specific expertise and strategic direction and knowledge and quality management to ten energy teams with different regional foci around the globe. Mr. Neumann's main topics are Renewable Energies, Electricity Grids and International Climate Finance, with a focus on the Clean Technology Fund. Before joining KfW in January 2013 he worked for 7 years at a medium-sized German utility company, where he served in the Energy Economy department and at the Distribution System Operator subsidiary. He also held a position as Economic Network Manager in the Grid Management department. He studied Economics at Augsburg University and Loughborough University, focusing on Environmental and Resource Economics and holds a diploma degree.



#### **DR. LAWRENCE JONES, Vice President, Utility Innovations & Infrastructure Resilience, Alstom Grid North America**

Dr. Lawrence E. Jones has over 20 years of experience in the energy industry. He joined Alstom Grid in 2000, and serves on the company's global Business Development team for Smart Grids and Smart Cities. He was previously Vice President for Regulatory Affairs, Policy and Industry Relations. He also served as Director of Strategy and Special Projects, Worldwide, in the Network Management Systems business and led its global Renewable Energy Integration activities. Dr. Jones is an advocate for the use of smart, clean, and renewable energy technologies around the world. In September 2010, he was appointed by the United States Department of Commerce's National Institute of Standards and Technology (NIST). He is co-founder and President of the Board of Directors of the Center for Sustainable Development in Africa (CSDA). Dr. Jones was the principal investigator of the 2010/11 Global Survey on Renewable Energy Integration in Power Grids funded by the Office of Energy Efficiency and Renewable Energy (EERE) at the US Department of Energy. He received the Renewable Energy World Network 2012 Excellence in Renewable Award for Leadership in Technology, and the Utility Variable-Generation Integration Group 2012 Achievement Award. Dr. Jones received his MSc, Licentiate and PhD degrees in Electrical Engineering from the Royal Institute of Technology in Stockholm, Sweden.



## **SESSION 2**

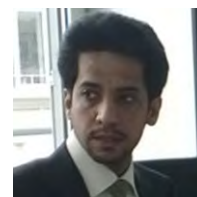
#### **SIMON MUELLER, Energy Analyst, International Energy Agency (IEA)**

Simon Müller is responsible for IEA work on the Grid- and System Integration of Renewables (GIVAR) program. He served as the analytical and managerial lead of the last GIVAR phase, a two-year project assessing the technical and economic implications of large scale wind and solar grid integration. In addition to a cost-benefit analysis of different flexibility options, the project assessed the current market design in a wide range of system contexts. He is also a principal author of the IEA publication Deploying Renewables 2011 – Best and Future Policy Practice, which provides a comparative assessment of the impact and cost-effectiveness of RE support policies. Before joining the IEA, Mr. Mueller worked for a technical cooperation project in the Mediterranean and the German Government. He holds a Master of Science (Diploma) in Physics from the University of Bremen.



#### **DR. FAHAD ABU-MOUTI, Head of Sustainable Grid Integration, King Abdullah City for Atomic and Renewable Energy (K.A.CARE), Saudi Arabia**

Dr. Fahad Abu-Mouti leads the Sustainable Grid Integration (SGI) team at King Abdullah City for Atomic and Renewable Energy (K.A.CARE). SGI team manages Saudi Arabia's initiative that studies the impact of integrating sustainable energy (Renewable and Nuclear) in Saudi Arabia's electric grid. Dr. Abu-Mouti formed the SGI team to address technical, institutional, and regulatory issues affecting the future of Saudi Arabia's sustainable electrical energy delivery system. Dr. Abu-Mouti established and developed relationships with key stakeholders to create initiatives that facilitate the shift towards a more sustainable electricity market. SGI team is currently leading a project to amend the Saudi grid code to accommodate renewable and nuclear integration. Dr. Abu-Mouti also serves as K.A.CARE's representative at the Grid Code Supervisory Committee (GCSC), and the national smart-grid committee. Dr. Abu-Mouti holds an Executive Certificate in Management and Leadership from MIT-Sloan of Executive Management, and he is an expert in economic and environmental operation of electric power systems with integrated alternative energy, energy policy, and smart-grids. Dr. Abu-Mouti has completed his PhD with distinction in Electrical and Computer Engineering from Dalhousie University, Canada.



**DR. THOMAS ACKERMANN, CEO, Energynautics GmbH**

Energynautics founder and CEO Thomas Ackermann received a Ph.D. from Royal Technical University (Kungliga Tekniska Högskolan) in Stockholm (Sweden). In addition, he holds a Master of Science in Physics from Otago University (New Zealand) and a degree of a Dipl.-Ing. der Fachrichtung Wirtschaftsingenieurwesen (combined degree in mechanical engineering and economics) from Technical University Berlin, Germany. The main focus of his research and consulting work is renewable energy and decentralized power generation in power networks including island power systems. He is the editor of the book "Wind Power in Power Systems" and co-editor of the series "Wind Energy Journal" (both published by Wiley and Sons). Dr. Ackermann founded Energynautics in 2000 to provide research and consultancy services in the renewables and electricity industry. With now over 20 years of world-wide experience with renewable energy technology and grid integration, Dr. Ackermann is often asked to provide advice to government departments and electricity service providers on the matter of power system design and operation, power system modeling as well as regulatory matters and grid code issues.

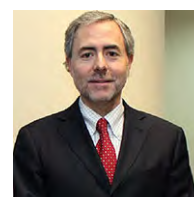


**DR. LAWRENCE JONES, Vice President, Utility Innovations & Infrastructure Resilience, Alstom Grid North America**

(see aforementioned)

**ERNESTO HUBER, Director of Operations, El Centro de Despacho Económico de Carga del Sistema Interconectado Central, Chile**

Mr. Huber is an Electrical Engineer from Universidad de Chile and holds a Master's degree in Business Administration from Universidad Adolfo Ibáñez. He has over 20 years of experience in the electricity sector in Chile, working primarily in generation and transmission companies. He is currently Professor of Electrical Engineering at the University of Chile and also teaches courses on Energy Economics at Universidad Santa María. In 1998, he was secretary of the Board of CDEC-SIC (Chile's Independent System Operator) and in 1999 began as Head of the Planning Operations Department. Since 2005, he has been serving as Deputy Director of Operations of CDEC-SIC.



**SESSION 3**

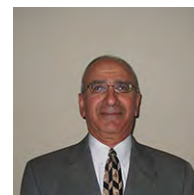
**IVAN SAAVEDRA DOTE, Chief, Electricity Division, Comisión Nacional de Energía (CNE), Chile**

Since September 2009, Mr. Ivan Saavedra Dote has served as the Chief of the Electrical Department in the National Energy Commission (the regulatory agency of Chile). In this position, he provides leadership to develop proposals for regulatory and standard changes. He is also responsible for managing the tariff processes of all regulated sectors of the electricity market, including generation, transmission and distribution of electricity. He represents CNE in many conferences in across South America and in Europe. Furthermore, Mr. Saavedra is charged with coordinating the technical and economic proposals for modifications of the legal regulations of transmission systems in Chile. Prior to his role as division chief, Mr. Saavedra served as an engineer for 8 years at CNE, where he implemented changes to the modeling of the electrical systems for planning and tariff processes, going from a simplified single nodal/single reservoir model to a more advanced and complex multi-nodal/multi-reservoir model, thus increasing the analytical capacity of the CNE to manage network congestion and long-term transmission and generation requirements for Chilean electrical systems. Mr. Saavedra studied Electrical Engineering at the Universidad Técnica Federico Santa María of Valparaíso, Chile.



**DR. FEREDOON SIOSHANSI, President, Menlo Energy Economics**

Dr. Fereidoon (Perry) Sioshansi is President of Menlo Energy Economics, a consultancy based in San Francisco, California serving the energy sector. He is also the editor & publisher of EEnergy Informer, a newsletter with international circulation, which is regularly featured in The Electricity Journal, Energy Spectrum (UK), IAEE Forum, EU Energy Policy Blog, and Breaking Energy. Dr. Sioshansi has worked at the Southern California Edison Company (SCE), the Electric Power Research Institute (EPRI), National Economic Research Associates (NERA), and Global Energy Decisions. He is on the Editorial Advisory Board of *The Electricity Journal* and serves on the editorial board of *Utilities Policy*. He has degrees in Civil Engineering (1972), Structural Engineering (1974) and including a Masters (1976) and Ph.D. (1978) in Economics from Purdue University, USA.





**DR. PHAM QUANG HUY, Deputy General Director, Electricity Authority of Vietnam (ERAV)**

Currently serving as Deputy Director General of the Electricity Regulatory Authority of Vietnam (ERAV), Dr. Pham Quang Huy previously worked as Director of the Power Market Development and at ERAV from 2006 to May 2014. His unit was responsible for power market development and power market operation supervision, including development of power market regulations, procedures, metering codes, and infrastructure regulations for electricity markets. Dr. Huy was also involved in development of the grid code, grid operation procedures (including dispatching, black-start and recovering steps) for the operation of Vietnam's national power system. His experience also includes a position as research associate in Electric Power System Department of the Vietnam Institute of Energy. Dr. Huy specializes in power market development, power system technical codes and Demand-Side Management (DSM). He earned his PhD in Electric Power Systems Management from Hanoi University of Technology in 2009. He received his Master's degree from Asian Institute of Technology in Bangkok, Thailand in 1999. Dr. Huy also completed a fellowship as research associate in the Paris-based Research Centre of the Electricity of France in the same year.



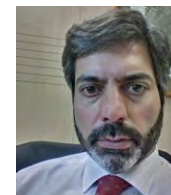
**ANNE-MALORIE GERON, Head of Energy Policy & Generation Unit, Eurelectric**

Anne-Malorie Géron is Head of Energy Policy and Generation at EURELECTRIC, a Brussels-based association representing electricity companies in Europe. EURELECTRIC is engaged in a continued dialogue with decision makers on the integration of electricity and gas markets and is advocating for a transition towards a decarbonized economy in accordance with a minimal cost approach and a market-based strategy. Anne-Malorie Géron graduated from College of Europe in 1995. Her field of specialisation is Law, energy regulation and international trade. She worked as a lawyer at EURELECTRIC from 1998 to 2001 and in 2002 she was promoted Head of the Markets unit, a position she actively held until June 2014 when she took on her current role as head of the energy policy and generation unit.



**CARLOS GASCÓ TRAVESEDO, Energy Policy Senior Advisor, Prospective and Technology Division, IBERDROLA Renewables, Spain**

Carlos Travesedo is currently a senior advisor on energy policy with the Prospective & Technology Division at IBERDROLA Renewables. He holds an Economy and Business Administration Degree from Universidad Autónoma of Madrid where he graduated in 1993. In 1996, he was hired as an Adviser to the Spanish Vice-President of the Government and Secretary of the Treasury. He was appointed in 1998 as Director of the Office of the Secretary of State for Economy, Energy. In addition, he has experience working as a Senior Renewable Electricity Analyst with the International Energy Agency.



**SESSION 4**

**LANGIWE HOPE LUNGU, CEO, Energy Regulation Board, Zambia**

Ms. Langiwe Hope Lungu has over 20 years experience in the energy and water sectors, particularly renewable energy and energy economics. She is currently serving as the Executive Director of the Energy Regulation Board (ERB) in Zambia. Prior to her appointment as Executive Director, Ms. Lungu headed the Renewable Energy section at the Zambian Ministry of Energy and Water Development. Ms. Lungu was instrumental in establishing the Energy Regulation Board (ERB) in 1997 while still serving as an energy economist in the Ministry responsible for Energy. She also played a critical role in the development of the first Zambian energy policy in 1994 as well as the revised policy in 2008. She served as a social economic expert on the team that developed the Rural Electrification Master Plan for Zambia, and played an essential role in highlighting the importance of the relationship of gender and energy in sustainable development in Zambia. Ms. Lungu also carried out research under the African Energy Policy Research Network in renewable energy and gender and energy.



**HU XIAOFENG, Engineer, China Renewable Energy Engineering Institute (CREEI), China**

Mr. Hu Xiaofeng is an engineer at the China Renewable Energy Engineering Institute. China Renewable Energy Engineering Institute (CREEI) is the technical regulator charged with overseeing hydropower, wind power, solar power generation industries in China. As entrusted by the State Council's relevant department, CREEI manages the renewable energy resources quota station and the National Renewable Energy Information Management Center. Mr. Hu Xiaofeng focuses on renewable energy and new energy development in China, particularly offshore wind power and biogas energy. He has participated in research on new energy policy and developmental planning in China for many years, including research on the national 12th Five-Year development Plan for wind power and bio-mass energy. In addition, he has contributed to various research projects about comprehensive development of renewable energy in China, including planning studies for wind power in Liangshan in Sichuan province, and biogas feasibility studies in Xi'an.



**ROBERT TOWERS, Lead Energy Economist, Sustainable Energy Team, Climate & Environment Department, Department for International Development (DFID), United Kingdom**

As the lead energy economist in DFID's Sustainable Energy team, Mr. Towers works to scale up sustainable, reliable, affordable energy which supports economic growth, improves the lives of the poorest and helps protect the global environment. The team manages a number of innovative policies and programmes aiming to leverage private finance, improve technical and institutional capacity of countries to deliver low carbon development, and improve climate finance infrastructure and impact. Bilateral programmes include; Climate innovation centres, Green mini-grids in East Africa, Climate public private partnership (CP3) and Results-based finance for energy access. Mr. Towers also provides leadership on fossil fuel subsidy reform, energy efficiency, green growth, geothermal energy and knowledge development projects. Prior to joining DFID Robert worked in a number of other UK Government departments including the Department for Energy and Climate Change, where he served as an economist for future electricity networks and systems balancing, and as an analyst for household energy efficiency and fuel poverty.



**GUILLERMO ZÚÑIGA MARTÍNEZ, Commissioner, Comisión Reguladora de Energía (CRE), México**

Mr. Zúñiga is an attorney admitted to practice law in Mexico from the Instituto Tecnológico Autónomo de México (ITAM) in 2001, with a Master Degree in Regulation from the London School of Economics (London, UK) and a Masters in Laws (LLM) from the University of Chicago. He specializes in Regulatory Policy, Hydrocarbons and Electricity Law, including Public Bidding Processes, Energy Contracts and Infrastructure Projects. Mr. Zúñiga spent 14 years in the public sector, holding several positions at the Energy Ministry, Mexican Petroleum (Pemex), Federal Commission of Electricity (CFE), and the Federal Competition Commission (CFC). He has been a Part-Time Professor at ITAM for almost 5 years, teaching courses on economic law and energy. Currently, Guillermo is the Commissioner of the Energy Regulatory Commission (CRE), and a Presidential appointee with Senate confirmation for a 5-year term.



**KLAS HEISING, Head, Technology Cooperation in the Energy Sector Project, GIZ, Germany**

Klas Heising, an economist by training, is a senior energy expert, who in more than 12 years in Latin America, has tackled various energy challenges, ranging from household energy, rural electrification, and grid-connected renewables. He is currently heading GIZ's Technology Cooperation in the Energy Sector project. His recent work program focuses on how to maximize the contribution of variable renewable energy to cost efficiency, energy security, and power system stability of energy systems.



**CONCLUSION**

**ROHIT KHANNA, ESMAP Program Manager, World Bank Group**

Mr. Khanna is Program Manager of the Energy Sector Management Assistance Program (ESMAP) at the World Bank. In this role, he oversees a portfolio of analytical and advisory activities in the energy sector. Mr. Khanna, an Indian national, joined the World Bank in 2000. Prior to assuming his current position, Mr. Khanna worked in the Global Environmental Facility and Clean Technology Facility at the World Bank. He has country experience with the Bank in Cambodia, Ghana, Uganda, Mozambique, Thailand, and South Africa, and was part of the team that developed the CTF investment program for concentrating solar power in the Middle East & North Africa. Before joining the Bank, he was a Programme Officer in the UN Environment Program and worked for Save the Children Federation in Bhutan. He graduated from the University of Delhi and has a Master's in Public Administration from American University.



**SESSION 1 | DR. LAWRENCE JONES**

**Vice President, Utility Innovations & Infrastructure Resilience, Alstom Grid North America**

(see aforementioned)

**SESSION 2 | DR. MARK J. O'MALLEY**

**Founder & Director, Electricity Research Center, University College Dublin**

Dr. Mark O'Malley is the Professor of Electrical Engineering at University College Dublin (UCD), founder and Director of the Electricity Research Centre, and Director of the newly established UCD Energy Institute, a multi-disciplinary, multi-institutional industry supported research institute, chaired by the Mr. David O'Reilly, former CEO and Chairman of Chevron. He is a founding member of the International Institute of Energy Systems Integration and is recognized as a world authority on Grid Integration of Renewable Energy. and has active research collaborations in Europe, the United States (US) and China. He is a Fellow of the Institute of Electrical and Electronic Engineers (IEEE) and a Member of the Royal Irish Academy. Dr. O'Malley is a member of the European Commission's Energy Advisory Group and International Collaboration Advisory Group for Horizon 2020 and the European Academy of Sciences Advisory Council Energy Panel. He has authored over 250 academic papers, supervised 19 PhDs to completion and currently as Principal Investigator has over €14M in research funding. He was the Irish representative on the International Energy Agency Research Task 25: Design and Operation of Power Systems with Large Amounts of Wind Power and was a lead author with responsibility for integration issues in the recent International Panel on Climate Change Special Report on Renewable Energy Sources and Climate Change Mitigation.



**SESSION 3 | RON BINZ**

**Principal, Energy Policy Consulting and Senior Policy Advisor, Centre for the New Energy Economy**

Ron Binz is a principal at Public Policy Consulting, specializing in energy economics and policy. Recent clients have included Tendril, Steffes Corporation, Posigen, Dow Solar, LBNL, NREL, Ceres, the Energy Regulatory Commission of Mexico, US DOE, EDF, Sunshare, and American Efficient. From 2007 to 2011 Mr. Binz chaired the Colorado Public Utilities Commission, which implemented the numerous policy changes championed by the Governor to bring forward Colorado's "New Energy Economy."

Mr. Binz is a non-resident Senior Fellow at the Brookings Institution. He is a member of the Harvard Electricity Policy Group, and recently served on the Keystone Energy Board and the Advisory Council to the Electric Power Research Institute (EPRI). He was an active member of the National Association of Regulatory Utility Commissioners, serving as Chair of NARUC's Task Force on Climate Policy. Mr. Binz earned a B.A. in Philosophy from St. Louis University in 1971 and an M.A. in Mathematics from the University of Colorado in 1977. Ron also completed course work for a Master's Degree in Economics from the University of Colorado.



**SESSION 4 | DR. MARIANNE FAY**

**Chief Economist, Climate Change Vice-Presidency, The World Bank**

Marianne Fay is the Chief Economist of the Climate Group of the World Bank. She co-directed the World Development Report 2010 on Development and Climate Change and led a recent World Bank report on Inclusive Green growth: the Pathway to Sustainable Development. She has held positions in different regions of the World Bank (Eastern Europe and Central Asia, Latin America and the Caribbean, Africa) working on infrastructure, urbanization and climate change. She is the author of a number of articles and books on these topics. Marianne Fay holds a PhD in Economics from Columbia University.

