

**IEEE POWER ENGINEERING SOCIETY
ENERGY DEVELOPMENT AND POWER GENERATION COMMITTEE**

**Panel Session
How the Power Industry is Adapting to Climate Change**

**2008 IEEE PES General Meeting, July 20-24, Pittsburgh, PA, USA
Monday, July 21, 2008, 2:00~5:00 p.m. (To be confirmed)**

Sponsored by: International Practices Subcommittee: Chair Tom Hammons

Working Group on Implementing Technology to Limit Climate Change (CCWG)

Panel Chairs

Jim McConnach, Chair of CCWG: jmconnach@ieee.org

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Track 3: New Technologies

Introduction and Overview

The Climate Change (CC) issue is receiving ever growing attention. Much of the attention is directed at mitigation measures for reducing greenhouse gas emissions, particularly CO₂. However equally important are measures for adapting to the CC that has and continues to occur (Ref 1.) In fact, because of the complexities and considerable uncertainties in CC science and predictions, investment in adaptation measures to manage climate risks may prove to be of better value and have more certain, tangible benefits than CC mitigation measures.

This Panel Session will discuss the impacts of CC on the power supply industry and some of the cost effective adaptation measures that can be taken to manage the associated risks. This will include research needs and measures for:-

- ‘hardening’ grid systems against extreme weather events such as hurricanes and floods;
- coping with changed load and plant output patterns; adapting equipment to operate under extreme conditions such as underwater and under higher average and night-time temperatures;
- extending and improving climate monitoring and recording;
- achieving earlier warning of extreme events;
- strengthening emergency response and restoration equipment and plans;
- addressing impacts on power system planning, operations and markets, and;

- providing the skilled resources to implement these adaptation measures.

Each Panelist will speak for approximately 20 minutes. Each presentation will be discussed immediately following the respective presentation. There will be a further opportunity for discussion of the presentations following the final presentation. The Panel Session has been organised by Jim McConnach and Ward Jewell.

Panelists and Presentation Titles.

1. Jim McConnach, Chair of CCWG “Introduction and Overview” (Paper 08GM0416 by Jim McConnach and Ward Jewell)
2. Ward Jewell, Director, Center for Energy Studies, Wichita State University, “The Electric Power Industry and Climate Change: US Research Needs” (Paper 08GM0827 by Judith Cardell, Ian Dobson, Ward Jewell, Mladen Kezunovic, Tom Overbye, P. K. Sen, Daniel Tylavsky, Lisa Beard, Floyd Galvan and David Hawkins)
3. Dr Richard Brown, Vice President, Quanta Technology, Consultant to Florida Power & Light “Hurricane Hardening Efforts in Florida”. (Paper 08GM1633)
4. Jim Price, Lead Engineering Specialist, Market and Product Development, California ISO, "Adapting California's Resources to Changing Regulations" (Paper 08GM0890 by Jim Price and Clyde Loutan)

5. Xun Zhou, University of Queensland, Australia, "Potential Impact of Emission Trading Schemes on the Australian National Electricity Market" (Paper 08GM1066 by Xun Zhou, Zhao Yang Dong, Ariel Liebman, Geoff James)
6. Invited discussers (tba)

Abstracts

Ward Jewell will give a presentation based on the PSERC publication on this topic (Ref 2.) Research needs for the US electric power industry to address global climate change are summarized. The research addresses both mitigation, how the industry contributes to climate change, and adaptation, how the industry itself is affected by climate change and its programs.

Richard Brown's presentation will cover "Hurricane Hardening Efforts in Florida". The 2004 and 2005 hurricane seasons wrecked havoc on power systems in Florida, destroying tens of thousands of structures and resulting in very costly and lengthy restoration efforts. Since weather experts are forecasting a cycle of increased hurricane activity, Florida utilities are starting to "harden" their infrastructure so that future hurricanes will cause less damage. Presently most transmission and substations are built to extreme wind criteria. This is not the case for distribution system, and most hardening efforts are focusing on damage to distribution facilities. This presentation will (1) give an overview of extreme wind hardening in terms of criteria and tactics; (2) discuss the progress of one utility's hardening initiative, and (3) discuss ongoing collaborative research efforts on cost/benefit models for hurricane hardening.

The presentation by Jim Price will explore how California utilities are adapting to Climate Change. Electric power generation is the second-largest category of greenhouse gas emissions (GHG) in California, next to transportation. California's legislature and energy regulators have adopted aggressive controls on the GHG emissions from electricity production, as well as aggressive targets for renewable energy due to heavy reliance on natural gas as a fuel for electric generation. These regulations will change the operational characteristics of California's resource mix. There is essentially no coal-fired generation within California, and readily identified coal-fired generation from out-of-state sources represents less than 5% of the energy procurement by the three large investor-owned utilities, although smaller municipal utilities have substantial imports from out-of state coal plants. However, California depends heavily on imports from other states, and the supporting generation is often difficult to identify. Increasing the amount of renewable in-state generation involves increasing reliance on intermittent, often remote resources. This requires new transmission and increases ancillary service requirements. Decreasing

the GHG emissions introduces uncertainty as to whether the adopted mechanisms will actually be effective if other states do not adopt similar enforcement mechanisms. If California's regulations result in changes to generation dispatch in other states, flows throughout the western region could change. Solving these issues can involve demand response resources (which California is actively developing) in addition to other supply resources.

The authors from Australia will provide a complementary view on the impact of a proposed National Emission Trading Scheme (NETS) on the Australian National Electricity Market (NEM). Many countries have started the implementation of emission trading schemes aimed at reducing GHG emissions by power stations. The Australian government aims to implement an emissions trading scheme from 2010/2011. This scheme will greatly change the market perspective of the Australian NEM. A thorough understanding of the potential impact of emission trading is essential for market participants as well as energy market policy makers. In this paper, a targeted study of the NEM is presented to illustrate the impact on generation companies of different design choices regarding the free allocation of permits aspect of the proposed emission trading scheme. A recommendation is proposed to best promote the reduction of emissions while minimizing the adverse impact on the electricity system, particularly on the generation companies.

Climate Change Impacts on Power Systems

The evidence of global climate changes that have already taken place and will continue to occur is now well documented (Refs 1 & 3). A summary of the major impacts of these climate changes on power and energy systems include:-

Rising average and peak air, ground and water temperatures

- Impact on equipment/plant ratings and power system security
- Changes to seasonal demand patterns and peaks
- Impact on reserve margins and reliability of supply

Extreme weather events (eg hurricanes)

- Increased risk to generation, delivery systems (T&D), telecommunications, and System Control Centre (SCC) reliability
- Emergency response and restoration plans, needs, equipment and costs increased

Forest Fires & Floods

- Increased risk to generation and delivery (T&D) infrastructure with impacts on supply reliability and costs

Rising sea levels

- Risk to coastal generation and delivery systems (T&D) infrastructure and populations with impacts on supply reliability and costs

There is a need for utilities to monitor and record these climate changes and impacts in order to establish sound databases on which to base the design and implementation of appropriate response and adaptation measures.

References

1. "Climate Change 2007 – Impacts, Adaptation and Vulnerability" Contribution of Working Group II to the Fourth Assessment Report of the IPCC www.ipcc.ch/ipccreports/ar4-wg2
2. T., J. Cardell, I. Dobson, W. Jewell, M. Kezunov, P. Sen, D. Tylavsky, "The Electric Power Industry and Climate Change: Power Systems Research Possibilities," Final Project Report, PSERC Publication 07-16, Jun. 2007, Available [Online]: www.pserc.org.
3. "Climate change and energy management. A scoping study on the impacts of climate change on the UK energy industry" Final report Prepared for: National Grid, EDF Energy and E.ON UK Date: 26 May 2006

James (Jim) S McConnach After graduating from St Andrews University, Scotland in 1964, Jim enjoyed a long career in the electricity supply industry in the UK and Canada. This included 23 years with Ontario Hydro where he had the opportunity to work on and manage a wide range of challenging projects in HVAC and HVDC transmission, hydro, fossil and nuclear generation, and energy efficiency. He retired from Ontario Hydro in 2000 and continues to practice as an independent consultant. He has been involved with the Climate Change Technology file for over 13 years and his main interests include mitigation and adaptation measures, greenhouse gas (GHG) market mechanisms and GHG standards development. Jim is a registered Professional Engineer in Ontario a Fellow of the IET, UK, and a Senior Member of the IEEE, USA. He is Chair of the IEEE-PES Policy Development Coordinating Committee and Chair of the IEEE Working Group on Implementing Technology to Limit Climate Change (CCWG).

Ward Jewell (M 1977, F 2003): Ward teaches electric power systems and electric machinery as a professor of Electrical Engineering at Wichita State University. He is Site Director for the Power System Engineering Research Center (PSerc). Dr. Jewell performs research in electric power quality and advanced energy technologies and has been with Wichita State University since 1987.