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2012 Water Smart Innovations Conference

Climate Change Technical Panel

Understanding the Impact of Climate Change on Water Resources Sustainability



Maddaus Water Management - Danville, California

AGENDA

- 1. Climate Change is a Reality
- 2. Effects of Climate Change on the Utility
- 3. Climate Change & Water Resource Management
- 4. Current Research Activities
- 5. AWWA Climate Change Committee Panel

1. Climate Change is a Reality

- United Nations Intergovernmental Panel on Climate Change (IPCC), Climate Change 2007: The Physical Science Basis (Paris, February 2009)
 - Temperature is increasing
 - Sea level is rising
 - CO2 & green house gasses (GHGs) increasing
 - Weather patterns are changing



Observed Historical Climate Change



TEMPERATURE

Last 100 years Earth warmed 0.76 °C 11 warmest years occurred in last 12 years

SEA LEVEL RISE

Rates almost doubled in 50 years:

180 mm per century in 1961–2003 310 mm per century in 1993–2003

SNOW COVER

Northern Hemisphere snow cover is decreasing

Source: Climate Change and Water, IPCC Technical Paper IV, Intergovernmental Panel on Climate Change, June 2008

Loading the climate dice*

- Assume the period from 1951 1980 as a "base period"
 - Relatively stable global temperature
 - Within the Holocene range, which is a period of time that the natural world and civilization adapted to
- Fit the information to a standard bell curve

*From Hansen et al. 2012

Loading the climate dice



Climate Changes to the Hydrologic Cycle



Source: 2009 National Climate Assessment "Global Climate Change Impacts in the United States"

Effects of Climate Change on Water Utilities

Water Quantity Impacts

- Temperature and precipitation variability
 - Increased or decreased precipitation
 - Changes in snowmelt quantity and timing of runoff
 - Changes in aquifer recharge

Water Quality Impacts

- Increased precipitation intensity could causes change in:
 - Sediment, pathogen loading in urban runoff and increase in sewer flows
- Increased temperature can cause:
 - Algal blooms,
 - Watershed vegetation,
 - Species growth/changing migration patterns
- Salt water intrusion



Effects of Climate Change on Water Utilities

Operational Reliability Impacts

- Changes in quantity & quality can change operational reliability
- Offsetting surface water supplies with increased groundwater pumping could lower the groundwater table
- Possible expensive groundwater treatment and/or create hydrologic barriers to prevent salt water intrusion
- Invasive species may cause complex operation and maintenance issues

Financial and Institutional Impacts

- Impacts to water supply quantity, quality, and operational reliability will necessitate changes in utility operations
- Changes in operations may significantly increase costs

Climate Change & Water Resource Management

 Climate change impacts on water resources need to be managed through short & long term mitigation and adaptation strategies

 Adaptation = actions & responses to address potential impacts from climate change (adapt to new water resource conditions)

 Mitigation = actions to address possible <u>causes</u> of potential of climate change (e.g., reduce carbon footprint)

Water Resources Planning and Management Responses to Climate Change



The Bottom Line: What Does It All Mean?

- Need for more flexibility & creativity
- Need to incorporate Climate Change into planning efforts and work regionally
- Need to budget more for:
 - Reducing Carbon Footprint
 - Energy Management
 - Demand Management
 - Supplemental Supplies
 - Infrastructure
 - Research and Planning



Climate Change Research Available

AWWA: Climate Change Committee
Publish "Climate Change Committee Report" June 2011

 AMWA: Association of Metropolitan Water Agencies <u>http://www.amwa.net/cs/climatechange</u>

Publish "Climate Change Initiatives Plan" (updated annually)

NOAA Climate Service:

http://www.noaa.gov/climate.html

Working on creating "regional" climate change centers

US EPA:

http://www.usepa.gov

Published in 2009 "National Water Program Strategy: Response to Climate Change"

Climate Change Research Available

US Bureau of the Reclamation:

http://www.usbr.gov/research/docs/climatechangelitsynthesis.pdf

Published in 2009 "The Literature Synthesis on Climate Change Implications for Reclamation's Water Resources"

WUCA: Water Utility Climate Alliance (9 large metro utilities) <u>http://www.wucaonline.org</u>

Published in January 2010: "Climate Science and Modeling" "Decision Support Tools for Climate Change"

WRF: Water Research Foundation <u>http://www.waterresearchfoundation.org</u>

Focus on Research Projects and Workshops Project #4208 "Identifying and Developing Climate Change Resources for Water Utilities: Content for Central Knowledge Repository Website"

Climate Change Research Available

USGS: Unites States Geologic Survey

http://geochange.er.usgs.gov/

Published 2009 "Climate Change and Water Resources Management: A Federal Perspective"

NCAR: National Center for Atmospheric Research <u>http://www.ncar.ucar.edu/</u> Multiple scientific publications

Multiple scientific publications

- Western Urban Water Coalition <u>http://www.wuwc.org/html/wuwc_issues_climate.html</u> Sent Climate change positions to Congress
- USDA: United States Department of Agriculture <u>http://www.fs.fed.us/ccrc/files/CC%20and%20Water%20In%20Brief.pdf</u>
 Published in June 2008 "Climate Change and Water from the Forest Service" Sustaining Healthy Watersheds

These are just a few of the great organizations and references available!



2011 & 2012 IPCC Reports – http://www.ipcc.ch/publications_and_data/publications_and_data_repor ts.shtml#SRREN ¹⁶

Climate models project more frequent hot days throughout the 21st century



Source: Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) of the Intergovernmental Panel on Climate Change 17

Climate models project there will be more heavy rain events throughout the 21st century



Source: Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation (SREX) of the Intergovernmental Panel on Climate Change 18



Figure 1.11 | Share of primary energy sources in world electricity generation in 2008. Data for renewable energy sources from IEA (2010a); for fossil and nuclear from IEA (2010d).

Source: Renewable Energy Sources and Climate Change Mitigation Special Report of the Intergovernmental Panel on Climate Change

Example of GHG Reduction Strategies



http://www.fhwa.dot.gov/environment/climate_change/adaptation/wor kshops_and_peer_exchanges/albany_09_2008/gccalbany.cfm

Impacts of Global Warming



Source: Renewable Energy Sources and Climate Change Mitigation Special Report of the Intergovernmental Panel on Climate Change

Source: Climate Change and Water, IPCC Technical Paper VI, Intergovernmental Panel on Climate Change, June 2008



Panel Discussion

Future questions can be addressed to session moderator: Michelle Maddaus: michelle@maddauswater.com



Panel Members: Paul Miller: Keely Brooks: Bill Davis:

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Water Smart Innovations 2012 Las Vegas Nevada

Session Title:

"Climate Change and Water Efficiency – New and Exciting Tools and Efforts"

The session will consist of one 30-minute presentations and a 60-minute panel discussion. Attendees have a great opportunity to learn about the direct link between Water Efficiency and Climate Change as well as get a great overview of the current technical tools and information available.

Presentations will focus on the following topics:

- Reference Tools for Water Efficiency, Climate Change and Sustainability
- New technical projects in Climate Change
- New key studies released on Climate Change
- Overview of organizations across the nation and their current efforts in Climate Change

Panel Discussion: "Climate Change and Water Efficiency: Now and the Future"

A distinguished panel of AWWA Climate Change Committee members and industry experts in Water Efficiency will hold an open discussion on Water Efficiency, Climate Change, and Sustainability. Topics of discussion will include technical aspects of the field and the current challenges that need to be addressed to further advance the field. The intention of the panel will be a dynamic discussion that may address some of the following questions:

- What is the link between Climate Change and Water Efficiency?
- What specific items should a utility be doing for Climate Change adaptation and mitigation?
- How can I convince my utility board/council/commission that we should be addressing Climate Change?
- What are the possible steps that we can take for Climate Change to become more "mainstream" and part of standard water utility practice?
- Is Climate Change real? What evidence do we really have?
- Why do people not believe in Change Change and how can we help clarify the topic for the general public as well as technical consultants?
- What tools could be developed to help communicate Climate Change, Water Efficiency and Sustainability to the Public? Water utilities? Energy utilities? Consultants?
- How do utilities currently use climate information?
- How do the uncertainties associated with future climate change compare to the uncertainties decision-makers deal with on a day-to-day basis while managing resources? In the Long-term? For instance, how does variability in future populations compare to uncertain climate?
- It is easier to predict climate change than to predict technological change." What technologies might emerge that would assist utilities with climate change mitigation and adaptation?
- What are utilities looking at these days when thinking about adaptation and/or mitigation? What are they missing?

- How can utility managers assess the potential risks associated with climate change impacts?
- What should utilities be telling customers, and rate-payers, about climate change, if anything?
- What research is needed to make better planning and operational decisions regarding climate change impacts?

Submitted by: Michelle Maddaus AWWA Climate Change Committee Chair Ph: 935-831-0194 Danville, California Email: michelle@maddauswater.com

Panelist Biographies:

Michelle Maddaus:

Michelle Maddaus is a senior engineer and for Maddaus Water Management based in Danville, California. Her primary role is water conservation planning and evaluation and water demand forecasting. Michelle works nationally and internationally teaching benefit cost analysis for conservation programs. Ms. Maddaus has served from 2008 to 2011 as chair of the Climate Change Committee of the American Water Works Association. For the past three years she has grown the group to include over 80 top experts from across the United States, Canada, and Australia. In monthly meetings the committee focuses on the technical aspects of climate change adaptation and migration. Michelle received her B.S. in Civil and Environmental Engineering from the University of California at Davis and her M.B.A. in from the University of California Davis.

Paul Miller:

W. Paul Miller currently works for the U.S. Bureau of Reclamation, Lower Colorado Region in the Boulder Canyon Operations Office (Reclamation) located in Boulder City, NV. His primary responsibilities include working closely with Hoover, Davis, and Parker Dams to ensure the delivery of Colorado River Water to lower division states (California, Arizona, and Nevada) and Mexico, aiding in the development of Reclamation's 24-Month Study Model and Annual Operating Plan, and investigating the impacts of climate change to the Colorado River Basin. Paul received his B.S. in Environmental Hydrology and Water Resources from the University of Arizona in 2003, his M.S. in Environmental Engineering from the University of Notre Dame in 2005, and his Ph. D. in Civil and Environmental Engineering from the University of Nevada, Las Vegas in 2010. His dissertation was titled, "Assessment of Impacts to Hydroclimatology and River Operations due to Climate Change over the Colorado River Basin."

Keely Brooks:

Keely Brooks is the Climate Change Policy Analyst for the Southern Nevada Water Authority (SNWA). She is responsible for monitoring climate change research, advances in mitigation and adaptation strategies and legislative initiatives. She also evaluates climate change issues and their implications and impacts on short- and long-term water resources planning, treatment and operations for the SNWA and Las Vegas Valley Water District. She received her Bachelor's in Geology from Skidmore College, in Saratoga Springs, NY, where she graduated Magna Cum Laude. She holds a M.S. degree from Syracuse University in Geology. Her graduate work focused on reconstructing past climates of lowland tropical Africa.

Bill Davis:

Bill Davis is a senior economist, and principal with CDMSmith. Mr. Davis has more than 20 years experience in water resource planning. He specializes in water demand analysis, water conservation planning and evaluation, and incorporating these analytical components into Integrated Resource Planning. His most recent work includes the development of customized water demand models that incorporate uncertainty with respect to climate into water demand projections. Mr. Davis has served as chair of the Water Resources Planning and Management committee of the American Water Works Association, and now serves as a Trustee of the AWWA Water Resource Sustainability Division. Bill Davis has a Bachelor's Degree and from the University Kansas and a Master's Degree in Agribusiness Economics from Southern Illinois University.