

Water Research Foundation Current and Recent Research on Climate Change

August 2010

Climate Change and Water Resources: A Primer for Municipal Water Providers #2973

Summarizes the best available scientific evidence on climate change, including both natural changes and changes that may be caused by human activities. Focuses on what is known about the implications of climate change for the water cycle and the availability and quality of water resources. Also provides guidance on planning and adaptation strategies. Includes a CD-ROM. Research partner: NCAR. Published in 2006.

Funded: 2003 Funding Source: Partnership

Incorporating Climate Change Information in Water Utility Planning: A Collaborative, Decision Analytic Approach #3132

Identifies vulnerabilities of drinking water utilities to changing climate conditions and the adaptations drinking water utilities will need to make to manage risk, given unavoidable uncertainties regarding the specific nature of future changes in local hydrologic conditions. It also developed flexible and responsive short- and long-term management strategies to help utilities deal effectively with this new source of uncertainty when planning for and implementing changes in response to climate change. Research partner: NCAR.

Funded: 2005 Funding Source: Partnership

Mitigating Impacts of Changes in Watershed Vegetation on Source Water Quality and Quantity #4009

Investigates and reports impacts of short-term, catastrophic or longer-term natural and human-caused changes to vegetative cover on the quality and quantity of source waters. It describes and evaluates the prevention and mitigation response strategies undertaken by utilities. It also uses examination of the impacts of actual shorter term changes or differences in land cover to evaluate the potential impacts of longer term climate change induced effects. Collaborative Partner: USEPA.

Funded: 2006 Funding Source: RAC

A Buyers' Guide to climate risk information for water utilities #4204

Identifies, evaluates and organizes currently available information sources in the global knowledge base -- including public domain tools, guidance, and data sets that might usefully comprise a water utilities tool kit for a *Buyers' Guide*.

Funded: 2008 Funding Source: Partnership

Joint Front Range Climate Change Vulnerability Study #4205

Will assess changes in the timing and volume of hydrological runoff that might be expected from selected climate change scenarios for the years 2040 and 2070. Two hydrological models will be calibrated and implemented in the study including the WEAP Model and the linked Sacramento Soil Moisture model.

Funded: 2008 Funding Source: Tailored Collaboration

Evaluating Effects of Climate Change on Water Quality Planning Criteria and Design Standards #4154

Will evaluate current water utility planning criteria and design standards for their effectiveness in equipping utility facilities with the features needed to adapt effectively to future climate conditions, with the purpose of assisting water utilities in the engineering of new facilities. Will build on the previous AwwaRF study, Climate Change and Water Resources: A Primer for Municipal Water Providers (Order 91120), and will focus on the western U.S. coastal climate variations and how utilities can modify existing planning criteria and design standards to provide the flexibility to deal effectively with the wide range of climate uncertainty predicted. Tailored collaboration partners: Contra Costa Water District, Seattle Public Utilities Commission, Los Angeles Department of Water and Power, and San Diego County Water Authority.

Funded: 2007 Funding Source: Tailored Collaboration

Greenhouse Gas Emission Inventory Guidance, Specialty Protocol Development and Management Strategies for Water Utilities #4156

Will present a protocol and develop a guidance document for water utilities that will provide a common framework or platform for water utilities to inventory and report their greenhouse gas (GHG) emissions. It will assist users in understanding issues and terminologies and present a step-by-step approach to perform a water utility-specific GHG emissions inventory. The protocol and guidance will focus on Scope 1 (direct) and Scope 2 (indirect) emissions, and will not address Scope 3 (optional indirect) emissions of upstream or downstream operations.

The project will also identify GHG emission management strategies that can potentially assist water utilities in reducing their carbon footprint, and to lay out a general framework for benchmarking between utilities given differences in water conveyance distance and elevation and scope of operations within the utility boundaries. The task will identify any incidental benefits in the value chain (i.e., downstream or upstream “Scope 3” emission reductions at an entity serving or being served by the water utility) associated with each management strategy.

Funded: 2007 Funding Source: Tailored Collaboration

Potential Impacts of Underground Carbon Sequestration on the Quality of Groundwater Supplies #4203

Will assess potential impacts of underground carbon sequestration on the quality of groundwater supplies and identify related knowledge gaps and research needs.

Funded: 2009

Funding Source: Rapid Response Research Program

Identifying and Developing Climate Change Resources For Water Utilities: Content For A Central Knowledge Repository Website

Will identify and develop content for a central knowledge repository website, or clearinghouse, to assist water utilities in assessing and managing the impacts of climate change.

Funded: 2009

Funding Source: Climate Change Strategic Initiative

Energy Efficiency in the North American Water Supply Industry: A Compendium of Best Practices and Case Studies #4223

Will develop a compendium of best practices in the energy efficient design, construction, and operation of water industry assets in North America. The scope of work will cover the principal activities of water businesses including water transmission, treatment, storage, distribution, and water reuse.

Funded: 2009

Funding Source: Partnership

Toolbox for Water Utility Energy and Greenhouse Gas Emission Management: An International Review #4224

The project will

- evaluate, compare, and contrast process models, impact assessment methods, and performance indicators used by water utilities in North America, Europe, South Africa and Australasia to evaluate their energy use and greenhouse gas (GHG) emissions
- identify how these tools are/may be used to support management decisions at water utilities such as capital improvement planning, construction management, asset management, energy management, and operations
- discuss implications of differences and pinpoint gaps in currently used energy and GHG emission assessment methods and performance indicators
- investigate opportunities towards a harmonized assessment method and provide recommendations towards common definitions of performance indicators and good practices for energy and GHG emissions accounting for water utilities

Funded: 2009

Funding Source: Partnership

Water Utilities and Climate Change: A Research Workshop on Effective System Adaptation #4228

Will organize a workshop that will provide effective guidelines for water utility adaptation planning within the context of urban coastal Florida.

Funded: 2009

Funding Source: Tailored Collaboration

Climate Change Impacts on the Regulatory Landscape: Evaluating Opportunities for Regulatory Change #4239

The project will:

- Identify, in the major federal legislation and regulations governing water utilities, including the Safe Drinking Water Act (SDWA), the Clean Water Act (CWA), and other environmental legislation like the Clean Air Act and the Endangered Species Act, areas in which compliance with existing regulation reduces a water utility's ability to cost-effectively adapt to climate change and reduce their carbon footprint.
- Develop a better understanding of the energy use and carbon footprint impacts from advanced treatment technologies (UV, ozone, membranes, etc.) used by utilities for compliance with drinking water regulations.
- Identify opportunities for regulatory flexibility or change to allow water utilities to balance multiple, potentially conflicting goals and to better meet complex challenges for optimizing treatment and cost with reduced greenhouse gas emission.

Funded: 2009

Funding Source: Climate Change Strategic Initiative

Vulnerability Assessment and Risk Management Tools for Climate Change: Assessing Potential Impacts and Identifying Adaptation Options #4262

Will develop tools to assist water utilities in identifying and managing risks associated with potential impacts from climate change

Funded: 2009

Funding Source: Climate Change Strategic Initiative

Analysis of Changes in Water Use Under Regional Climate Change Scenarios #4263

Will study anticipated water demands and use patterns under a range of climate change scenarios, categorized by specific customer class and industry sector, so that water utilities may better plan for and respond to changing water use patterns as a result of climate change.

Funded: 2009

Funding Source: Climate Change Strategic Initiative

Changing Mindsets to Promote Design of "Sustainable Infrastructure" #4264

Will define a new planning approach and will set out a comprehensive sustainable planning framework to include a broad suite of considerations. With primary focus on drinking water systems, the project will take a system approach and look at impacts from or to other water (stormwater and wastewater) systems. Examples of sustainable systems and design concepts to be considered include low-impact development, de-centralized systems, integrated water systems, alternate delivery modes, point of use/point of entry (POU/POE) treatment, and use of

triple bottom line evaluation methods (e.g., ecological footprint, life cycle assessment, etc.), and embedded, operational and supply chain carbon accounting.

Funded: 2009 Funding Source: Climate Change Strategic Initiative

Impacts of Underground Carbon Geologic Sequestration on the Water Quality of Groundwater #4265

Will identify groundwater quality impacts to resulting from migration of CO₂ from geologic carbon sequestration projects. Groundwaters are anticipated to include existing and potential future drinking water sources. Impacts will consider physical and chemical changes associated with varying levels of contaminant migration or displacement associated with underground storage and sequestration of CO₂.

Funded: 2009 Funding Source: Climate Change Strategic Initiative

Analysis of Reservoir Operations under Climate Change #4306

Will identify how reservoir operations can be adjusted to adapt to hydrologic changes associated with climate change and the uncertainties associated with climate variability.

Funded: 2010 Funding Source: Climate Change Strategic Initiative

Drinking Water Pump Station Design and Operation for Maximum Life Cycle Energy Efficiency #4308

Will develop a guidance manual focused on drinking water pump station design and operation to minimize the energy consumption and associated greenhouse gas emissions of a water utility. This manual will allow pump station designers to:

1. Improve pump wire-to-water efficiency in the water industry
2. Design pump stations to ease periodic pump efficiency testing, and/or provide for continuous real time pump efficiency readings and understand the benefits thereof,
3. Address the appropriate design/application of variable speed drives, and
4. Estimate the potential annual energy, cost, and carbon savings from pump station efficiency improvements

Funded: 2010 Funding Source: Climate Change Strategic Initiative

Water Quality Impacts of Extreme Weather-Related Events #4324

Will identify and characterize water quality impacts of extreme weather-related events

Funded: 2010 Funding Source: Climate Change Strategic Initiative

Ground Water Sustainability Under Climate Change #4325

Will provide preliminary evaluation of potential impacts of climate change on groundwater resources, identification of potential impacts for groundwater systems and development of recommendations for further investigation into this topic

Funded: 2010

Funding Source: Climate Change Strategic Initiative