OPPORTUNITY 08
Independent Ideas For Our Next President

Diving in the Deep End

Help Water Agencies Address Climate Change

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Summary

Climate change poses the threat of dramatic changes in the supply and quality of water in the United States—as well as an increased burden on the infrastructure that supports water management. Early, bold action is needed to respond to the diverse challenges involved. *The next President must take a lead role in crafting, advancing, and implementing an effective response.*

Climate change affects water supplies primarily by affecting precipitation. In many areas, reservoirs will shrink. Floods will become more frequent and catastrophic, and coastal salt water intrusion will compromise groundwater. Water agencies attempt to cope with the consequences of climate change through assessment, preparation, and adaptation:

- *Assessment* refers to scientific studies of climate change and its likely effects. Disagreement among scientists' predictions slows down consensus about what actions to take. (The water industry tends to be dominated by forces that resist change and by experts who are uncomfortable dealing with imprecision.)
- *Preparation* refers to the development of local strategies and building support for implementation. Given scientific uncertainty, wholehearted public support for forceful measures is unlikely.
- *Adaptation* reflects the need for changing responses to a problem as more becomes known. Among water managers, adaptation is controversial, because it tacitly recognizes that climate change may be due in significant measure to human activities. This controversy obscures the overriding need to address the

critical issue of water shortages.

To date these approaches have led to unwarranted delays in action. Federal, regional, state, and local authorities should adopt a more flexible water strategy of "Adapt and Mitigate." This strategy has several components, specifically:

1. In the research realm, the federal government—through a Presidential initiative backed by Congress—should *combine research efforts*, now fractionated and diffused through multiple federal agencies, into a single, Los Alamos-type center. This will lead to greater uniformity in assessment results, more cooperation in technological development, and increased efficiency.

2. In the management realm, *regional approaches should be expanded* as the most effective and feasible way to meet the demands of climate change. The next administration should devise incentives for regionalization—and, when necessary, remind state officials that the alternative to regional cooperation is federal decision-making.

3. In the financing realm, because the demands of climate change and an aging infrastructure prevent many economically strapped localities from funding necessary improvements to their water supplies, the federal government must establish a mechanism to *provide utilities and other stakeholders access to capital*, with payments reasonably spread over time. In this way, the next President could ensure sufficient financing of improvements in water management.

4. In the planning realm, water agencies must use the best available data to *evaluate their vulnerability to climate change-induced problems* and to prioritize their responses. This includes analyzing alternative water resources, because access to several sources of supply is far superior to reliance on a single source. As agencies integrate their resource planning, the next administration should work cooperatively with them to improve data collection, analysis, and planning.

5. Finally, in the realm of partnerships, the next administration should actively *promote and support collaborations among water agencies*, and between water agencies and other groups. No water agency can meet the full array of climate change-induced water problems on its own.

Climate change also compels water agencies to recognize their own contribution to greenhouse gas emissions, mostly through the power plants operated to accommodate their needs. Agencies should regularly perform comprehensive emissions audits, reduce demand through innovative water efficiency programs, and consider the tradeoffs involved in contaminant reduction, reuse, desalination, and other activities. They also should promote use of renewable resources—solar panels, wind generation, small-scale hydro-turbine units—when feasible, with active federal support.

The challenges are daunting yet ill-defined. The key to overcoming these challenges is flexibility, as many people rethink water and utility management. What are most needed are information, the will to make a difference, and bold national leadership—and the next President can make sure all of these are in place.

Context

The Need for Action

Increasingly, planet climate change is believed to pose the greatest threat to civilization in the 21st century. It is expected to harm hundreds of millions of people throughout the world. Dramatic shifts in precipitation patterns and rising sea levels are only two of its likely consequences.

Although it sometimes evokes the dire scenarios of a science fiction screenplay, climate change—in the view of an overwhelming majority of climatologists—is almost certain. Some analysts and policy-makers, while accepting the likelihood of climate change, do still balk at the term “global warming,” which to them suggests human culpability. From the perspective of a water manager, though, this argument is largely academic. The reality is that the warming trend is expected to continue, and those of

us whose responsibilities include providing a reliable water supply for our country's citizens must deal with the potential consequences.

Elements of Water Agencies' Role

Water agencies' efforts to cope with the consequences of climate change comprise three critical elements: assessment, preparation, and adaptation.

Assessment

Assessment refers to scientific studies of climate change and its likely effects. There persists a lack of consistent data to support long-term models, and the models themselves vary wildly.

In order to be actionable, an issue has to be well-defined, and climate change is not. Even now, when an unprecedented amount of climatology research is being conducted, there is insufficient coordination among the various groups conducting the studies. Meanwhile, the water industry is dominated by technology experts renowned for their precision and adherence to empirical principles. If we are to achieve the level of predictability necessary to spur action by the conservative water industry, the research simply must improve.

Preparation

Preparation refers to the ability of water managers—urban and rural—to devise strategies to protect their constituencies. Scientists active in preparation take macro-scale information about climate change and apply it to a geographic zone, such as the Colorado River watershed. Managers and policy-makers then must leap the chasm that divides knowing what needs to be done from taking action. In many regions, notably the southwestern United States, change is not warmly greeted. For this reason, many recent advances—including a shortage management policy for the Colorado watershed region announced in December 2007 by Interior Secretary Dirk Kempthorne—are spectacular. Kempthorne's strategy of encouraging the states to craft solutions, while making it clear that one would be imposed upon them if they fail to reach an agreement, could be a blueprint for progress.

Adaptation

Finally, adaptation encompasses changing responses to a problem. Adaptation in water management is controversial, because it recognizes that climate change may be due in substantial measure to human activities that emit greenhouse gases (GHGs) that prevent the dispersal of solar radiation. By reducing water agencies' relatively minor contributions to GHG emissions, water agencies are producing a small degree of positive environmental change and demonstrating leadership that could have a cascading effect nationally and internationally. In addition, from a resource perspective, water agencies help residents and businesses adapt to changing conditions through improved water efficiency.

Evolution of the Controversy

Although some scientific work on climate change predated the Intergovernmental Panel on Climate Change (IPCC)'s first scientific assessment, that 1990 report is widely considered the "shot heard 'round the world" on this topic. British Prime Minister Margaret Thatcher characterized it at the time as "an agreed assessment of some 300 of the world's leading scientists of what is happening to the world's climate."

The ensuing debate about the link between this climatic phenomenon and industrial activities has been nothing if not well-publicized. But, today, few if any credible scientists attempt to refute the fact that the earth's mean temperature has increased by a statistically significant measure (1.1° F) during the past century. It appears likely a causal correlation exists between rising temperatures and global industrialization. Thus, we have an obligation, both philosophically and as a matter of survival, to do everything we can to reverse our contributions to this problem.

Arguments over causality have obscured the critical issue of water shortages. But, *irrespective of cause, climate change has the unprecedented potential to profoundly affect the world's water supplies.* The following discussion focuses on the impacts associated with reduced supplies of drinking water, although other significant repercussions—involving, for example, agriculture and food supply, ecology, and spread of disease—also require urgent attention.

Changes in Precipitation

The primary impacts of climate change on water supplies revolve around the quantity, form, and distribution of precipitation. In areas like the Colorado River Basin, where stream flows have been determined mostly by snowmelt, dramatic change will result as a greater share of precipitation occurs as rain rather than snow and as the winter snow-pack melts earlier and more rapidly. Reservoirs will receive less water and will lose more water to evaporation and sublimation due to rapid spring temperature increases.

Nationwide, drier conditions overall may result in greater frequency and severity of floods, causing water to become more turbid and reducing the quality of drinking water. This change—as well as warmer water temperatures—will require greater investments in water treatment technologies. Along the coasts, salt water intrusion caused by higher sea levels (from both glacial melting and expansion of water due to higher water temperatures) could devastate groundwater supplies.

At the same time, increased surface temperatures on land will increase evapo-transpiration rates, which drive the use of water for both agricultural uses—what most Colorado River water is used for—and for irrigation of urban landscapes—lawns, golf courses, and so on.

The Cultural Challenge to Water Management

The unpredictability associated with climate change is a bad fit with the conservative water management practices historically applied throughout the United States. Consider, for instance, the basis on which water rights were formulated in the Southwest. The vast majority of the Colorado River's water is allocated to agriculture, because the allocation process occurred during a period when the federal government was actively promoting westward migration. The water supplies that have transformed millions of acres of high desert into some of the country's most productive farmland are essentially free to the agricultural users, not because irrigation represents the most

beneficial potential use of the water, but because the federal government at one time had an active interest in cultivating the area's agriculture.

Fast forward 85 years. The Southwest has, for a variety of reasons entirely unrelated to agriculture, become the epicenter of U.S. population migration. Although water demands have changed dramatically, the management of water resources has not adapted to accommodate different uses. It appears that other U.S. regions (such as the Southeast) share a similar resistance to change.

All across the country, historical practices are colliding with new circumstances. Unless we in the water industry are willing to see water management as a more dynamic process, climate change is certain to exacerbate existing conflicts and create new ones. And, resources are only one factor in the water equation. Infrastructure—not just drinking water infrastructure, but that related to flood control—will be made obsolete by changes in precipitation patterns. The water management onion has many layers, and climate change goes completely to the core.

A Strategy of Adapt and Mitigate

Defining the Problem

Very few problems are so vexing as to utterly defy solution. Although daunting in scope and severity, the interactions of climate change and water can be solved, or at least managed, through appropriate planning. Across challenges ranging from assuring adequate water resources to flood control, the good news is that climate change's effects are incremental. Unfortunately, that is also the bad news.

One of humans' more encouraging traits is their willingness at times of crisis to rally around a common need, such as the rationing of food during World War II in the United States or the conservation of water now in southern Nevada. When government describes a well-defined challenge and articulates what the citizenry can do to overcome it, people will nearly always respond favorably, even if it involves some level of personal sacrifice.

Unfortunately, climate change is not well-defined. The predictive models used to extrapolate existing data into forthcoming decades vary substantially. In essence, we have dozens of crystal balls, each describing a unique future. The differences in these predictions have scientific, methodological, economic, and political roots. The farther forward in time the predictions go, the greater their divergence. Using data that span only about 100 years of Earth's climatic history, scientists are attempting to project impacts that will occur a century hence. The result is a range of possibilities, such as the 1.1°C-to-6.6°C increase by 2100, predicted by the IPCC. Meanwhile, an influx of research dollars is inducing numerous organizations, whose research objectives are not necessarily aligned, to move forward with discrete studies. Politically, the principal issue is the extent to which humans are responsible for these changes. Industries accused of causing much of the crisis balk at being singled out as key contributors to potentially the most environmentally devastating global phenomenon ever recorded, and they disparage the science or struggle to cite contrary findings.

The outcome is to create uncertainty, the greatest impediment to change. Before people will support the infrastructure investment needed for adaptation, they must be convinced there is a problem and have a reasonably clear picture of how they will be affected. At present, expecting the public's wholehearted support for strong measures, no matter how necessary, is unrealistic.

Consolidate Research Efforts

Right now, scientific research about climate change is being undertaken independently by a slew of organizations, and that number will only grow as interest and the potential funding pool increases. While more research is generally a good thing, its value is diminished when silo-based efforts provide little opportunity for collaboration in implementing the new ideas research should generate. Scientists need to be brought together and given an opportunity to explore each other's hypotheses. A Los Alamos-type center for climate change could dramatically accelerate scientific progress.

Far easier said than done, bringing all climate change research under one umbrella surely will spark conflicts over budget allocations and organizational territoriality. Nonetheless, if we are to decrease the uncertainty associated with climate change—which is a prerequisite for broad-based support—this simply must happen. Congress and the executive branch, which employs in various agencies the majority of scientists researching climate change, can maximize the value of the federal investment, minimize duplication, and reduce uncertainty by gathering the research programs in a multi-agency task force or a single agency, through legislation if necessary. The next President should lead the effort to unify these research programs.

Promote Regional Approaches

The ability to refine predictions is vital to building a solid foundation for more specific analysis. "Drilling down" into the data and defining the likely effects in a specific region are keys to preparation. Researchers at the Scripps Institution of Oceanography and the Lawrence Livermore National Laboratory are currently endeavoring to project specific regional effects, which will enable the necessary development of regional preparatory strategies. Regional approaches are the most sensible, effective, and feasible way to meet the demands of climate change.

For example, water managers in the Southwest must devise ways to manage system loss and increase storage capacity, based on the expectation of dramatic reductions in late summer flows due to smaller snow-packs and earlier snowmelts. These efforts will be facilitated by the agreement recently adopted by the Colorado River Basin states and hailed by Secretary Kempthorne as the most significant step taken in Colorado River management since 1922. The agreement—truly a gift to the region—calls for water levels in the river's two major reservoirs to be managed in tandem, in order to protect all users and create incentives for increased conservation. It will:

- help agricultural interests as they evaluate water management and crop selection in light of an extended growing season and greater per-acre irrigation needs
- help environmental interests as they evaluate the potential implications of vegetation changes and warmer source water on wildlife habitat and

- help municipal water agencies immensely as they adjust disinfection processes when water temperatures rise and water chemistry changes because of increased total organic load and pH fluctuations.

Elsewhere, water managers must prepare for very different circumstances. In the higher latitudes and wet tropics, for instance, higher temperatures will cause greater precipitation. This will require innovations in managing reservoirs, controlling floods, and maintaining water quality, especially in areas having combined flood/sewer systems. In coastal areas, these issues are joined by salt water intrusion into groundwater aquifers, a devastating prospect from a water resources perspective. Regional approaches would facilitate effective responses to these unprecedented challenges. The next President should publicly urge greater regional coordination and direct the Secretary of the Interior to devise incentives to encourage it. The Secretary should remind state officials that the federal government may step in with decisions made in Washington if states fail to agree among themselves.

Provide Financial Support

Any well-prepared water, wastewater, flood control, or environmental agency should be able to meet some of the challenges of climate change. But, water agencies also are facing the high costs of remediating an aging infrastructure. Having to tackle both problems together will disrupt water agencies' financial base.

The need for financial support varies. In regions like the rapidly growing Southwest, infrastructure investments are more economically feasible and pose a less onerous burden for ratepayers and/or taxpayers. In low- or negative-growth areas, however, agencies are already struggling with shrinking revenues. This is also the case for small- and mid-size utilities, which account for the vast majority of water and wastewater managers. Addressing climate change may represent a greater financial strain than some of these communities can bear. *Communities cannot operate without effective water and sanitary sewer systems; allowing them to founder is simply not an option.*

In these circumstances, flexibility is needed in maintaining the ideal of self-sustaining water and wastewater agencies. The federal government must establish a mechanism to provide utilities and other stakeholders access to capital, with payments reasonably spread over time. By doing so, the next President could ensure sufficient financing of improvements in water management.

Improve Data Collection, Analysis, and Planning

Affected agencies must use the best available data to evaluate their potential vulnerability to climate change-induced problems and to prioritize their responses, based on the likelihood of occurrence and the magnitude of the effect on critical services. In the water industry, it is important to assess not only the additional infrastructure or resources required to counter increased temperatures, but also to analyze the effects on existing facilities.

Alternative water resource options also should be analyzed. It is axiomatic that access to several sources of supply is far superior to reliance on a single resource. For example, Lake Mead, the country's largest manmade reservoir, was long considered virtually drought-proof, but today, after eight years of drought, its losses are measured in trillions of gallons. Fast-growing Las Vegas, whose two million residents rely on Lake Mead for 90 percent of their water, has had to work quickly to develop hydrologically independent, or multi-source, water supplies. Atlanta, dependent on Lake Lanier, is in similar straits. There is even concern about water level declines in the Great Lakes, which hold five-sixths of the nation's fresh water reserves.[*]

> Ultimately, the key to coping with the effects of climate change on water will be the ability of water, wastewater, and flood control agencies to prepare for changing conditions. This is best accomplished by maintaining a diverse array of options and proactively assessing the vulnerability of existing and planned facilities, as well as current and potential supplies.

[*] Access to diverse sources of water bailed out millions of residents of southern California, who still could use Colorado River water after an August 2007 court ruling—protecting an endangered aquatic species, the delta smelt—prohibited the pumping of water through the Sacramento-San Joaquin Bay Delta. Similarly, water from the California State Water Project has saved southern Californians from potentially dire effects of the Colorado River drought.

All utilities with water resource planning responsibilities should analyze their water source's vulnerability to shortages, given changing conditions. Because all of these changes are mid- to long-term in nature, this process—if started immediately—should afford water agencies sufficient time to conduct what is known as Integrated Resource Planning and take the steps necessary to ensure a reliable supply. The next administration should work cooperatively with water agencies to improve these agencies' data collection, analysis, and planning.

Encourage Local Partnerships

Many resource planning exercises filter options through the lens of precedent, closing off potentially fruitful partnerships. To cite one example, agricultural exchanges have long been a non-starter on the Colorado River, due to growers' concerns that, once initiated on even a temporary basis, they would become permanent. This resistance has impeded proposals to assure farmers sufficient water rights in return for ending the cultivation of non-food crops for export (a practice that effectively converts water into currency). The strain that climate change is placing on water supplies should serve as a catalyst for partnerships of many forms.

One potential type of partnership is collaboration between two municipal water agencies. For instance, a few years ago, the Metropolitan Water District of Southern California and the Southern Nevada Water Authority reached a water banking agreement, an entirely new mechanism of interagency cooperation. Southern Nevada had water it wanted to store as a drought reserve, while Metropolitan wanted additional Colorado River water to address a short-term water quality issue. The two agencies—in different states!—were able to meet their needs in a creative manner.

Similarly, Nevada, California, and Arizona each receive a specific quantity of water in exchange for a financial investment in development of the Drop 2 Reservoir by the Bureau of Reclamation. This reservoir will improve Colorado River storage below Parker Dam and will capture non-storable flows for domestic use, while helping to maintain water levels in Lake Mead.

Partnerships also can boost desalination, to create "new" water from the ocean or from highly saline inland sources. While environmental impacts associated with brine discharge and desalination's high energy requirements temper its value as a near-term option, desalination must be incorporated into water resource plans. Exchange agreements between water users in different areas, states, and even countries will increase the feasibility of this option. Federal support would be especially useful in this sphere. The next administration should actively promote and support partnerships among water agencies, and between water agencies and other groups.

Tackling the Emissions Problem

Recognize Water Agencies' Role in Emissions Reduction

Adaptation—changing responses to a problem—includes the ability and willingness of water managers to reduce their own GHG emissions. This commitment is highly controversial, for two major reasons, which can be presented as questions:

- Are we certain that GHGs, and not natural long-term weather patterns, are the primary cause of climate change?
- Is it reasonable to assert that the actions of a single, relatively minor GHG contributor would make a measurable difference in atmospheric warming?

Although the first question receives the lion's share of attention, the second question is more relevant. There are enough committed people and organizations in the United States and in the world to generate momentum for a "carbon footprint reduction" movement, but only if there is sufficient evidence that their efforts—individually and collectively—will make a difference.

Skeptics point to a major GHG emitter, such as the growing Chinese industrial sector, and suggest that local efforts are insignificant in comparison. This is a rationalization born of apathy. The United States' GHG emissions are far greater than China's on a *per-capita* basis, and it is unseemly for the world's wealthiest nation to chastise a developing country if it is not taking proactive measures itself. Indeed, action *must* be

taken at the local, not just the national, level. Most of the solution rests with individual organizations taking the initiative even when they are not compelled by law to do so.

> Water and wastewater agencies are a significant contributor to U.S. emissions, because of their demand for electricity.

Becoming More Environmentally Conscious

Assuming that water agencies seek to demonstrate leadership in halting climate change, what is their most appropriate course of action?

Emissions Audits

The logical sequence for any organization begins with a comprehensive assessment of energy use and other emissions to quantify its total environmental load. For water managers, this includes the energy used to treat water and pump it throughout the water transmission and distribution infrastructure. Additionally, the emissions audit should assess direct emissions from fleet vehicles and indirect emissions associated with energy use within various facilities. After these and other factors are identified, analysts can calculate the organization's total annual GHG contributions, subtracting any energy derived from renewable sources. This net figure is a baseline from which emission reductions can be measured and monitored.

Conservation

A critical external factor—over which utilities can exert considerable influence—is the demand for water. Reducing per-customer demand through innovative and comprehensive water efficiency programs is among the most effective ways to constrict the entity's carbon footprint.[*]

[*] When the Southern Nevada Water Authority spearheaded a community-wide water conservation initiative in 2003, in response to a worsening drought on the Colorado River, consumption of water from the river declined 18 percent (measured in terms of acre-feet) in one year. This obviated the need to draw more water from Lake Mead, treat it extensively, and then transport it long distances.

Opportunities for improving energy efficiency involve "green building" technologies and fleet equipment. Unfortunately, one of the greatest opportunities directly conflicts with an emerging trend in the water industry: the removal of trace contaminants that pose little risk to health. Within the last decade, the ability to detect trace concentrations of contaminants in drinking water has increased in sensitivity by an order of magnitude or more, and many water agencies have felt compelled to apply more sophisticated—and often more energy-intensive—treatment systems to remove them, regardless of whether they represent a health risk at their current concentrations. The "precautionary principle," which advocates reducing all contaminant concentrations as close to zero as feasible, is laudable in theory; however, the benefit calculus becomes more complex when the increased GHG emissions resulting from the application of the new treatment methods are considered. This is not to say water quality should be sacrificed at the altar of carbon footprint reduction, but rather that the efficacy of chasing the last part per trillion of a given contaminant should be carefully evaluated.

Tradeoffs also are involved in reuse and desalination. While these technologies offer significant benefits in maximizing resources and increasing source-water flexibility, they tend to be energy-intensive. Again, a thorough analysis of the available options must include both the costs and benefits of implementation.

Renewable Energy Sources

Utilities should explore opportunities to generate renewable energy for their own needs. Examples include use of solar panels and wind generation where feasible, as well as small-scale hydro-turbine units that capitalize on the inherent movement of water through the system. Federal energy-related legislation should include incentives for investing in these renewable resources.

Finally, as major consumers of electricity, water and wastewater agencies have an opportunity to influence the energy industry and support the development of renewable energy resources. In concert with state and federal efforts to spur investments in this area, utilities can send a clear message to electric producers that renewable sources are preferred. Although costs certainly are a consideration, only

greater adoption of renewable energy will spark the research investment necessary to make these sources more economically competitive in the long term.

Concluding Observations

Climate change is upon us, and it has tremendous ramifications for the water industry. Affected utilities must evaluate their vulnerability to the potential effects of rising temperatures and make appropriate preparations to reduce the likelihood of catastrophic impacts. This obliges the scientific community to produce more useful models and significantly refine their data so that deviations in modeling outcomes are less pronounced. The water industry also must reduce its contribution to the problem by enacting GHG reduction strategies.

The challenges ahead are both daunting and ill-defined. Overcoming those challenges will require many people to rethink how they view water and utility management. Certain actions can and should be pursued immediately. These include increased use of water-efficient landscaping and greater water reuse in urban settings. In some cases, where even developers and golf courses have embraced stringent water use restrictions, businesses and residents have been willing to accept conservation measures that are clearly needed and administered equitably. Water resource and asset management plans that maximize flexibility and system reliability must be developed and put in operation. Other actions may take longer to implement but are worth the time and effort.

Water agencies and their partners—federal and state agencies, private organizations, and local government (with broad public participation)—should be reevaluating existing practices in light of changing conditions. Likewise, farmers, energy suppliers, industries, and individual consumers should be encouraged to think broadly of the possibilities of change.

The next President is not going to "solve" the problem of climate change. Its onset was incremental, and so will be its resolution. But, to forestall the potential effects that loom so ominously over our future, we must act promptly. All we need are information, the will to make a difference, and the bold national leadership that a President can provide.

About the Authors and the Project

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Patricia Mulroy oversees the operations of the Las Vegas Valley Water District and the Southern Nevada Water Authority, a regional agency responsible for acquiring, treating, and delivering water for Southern Nevada. She was a principal architect of the water authority, which has served as a model for other Western agencies since its creation in 1991.

Opportunity 08 aims to help 2008 presidential candidates and the public focus on critical issues facing the nation, presenting policy ideas on a wide array of domestic and foreign policy questions. The project is committed to providing both independent policy solutions and background material on issues of concern to voters.

Additional Resources

Association of Metropolitan Water Agencies. (2007). Implications of Climate Change for Urban Water Utilities. Washington, D.C.: Author. Available at: http://www.amwa.net/galleries/climate-change/AMWA_Climate_Change_Paper_12.13.07.pdf.