The Future of Water Development in the Southwest

– The Development of the Desalination and Water Purification Roadmap

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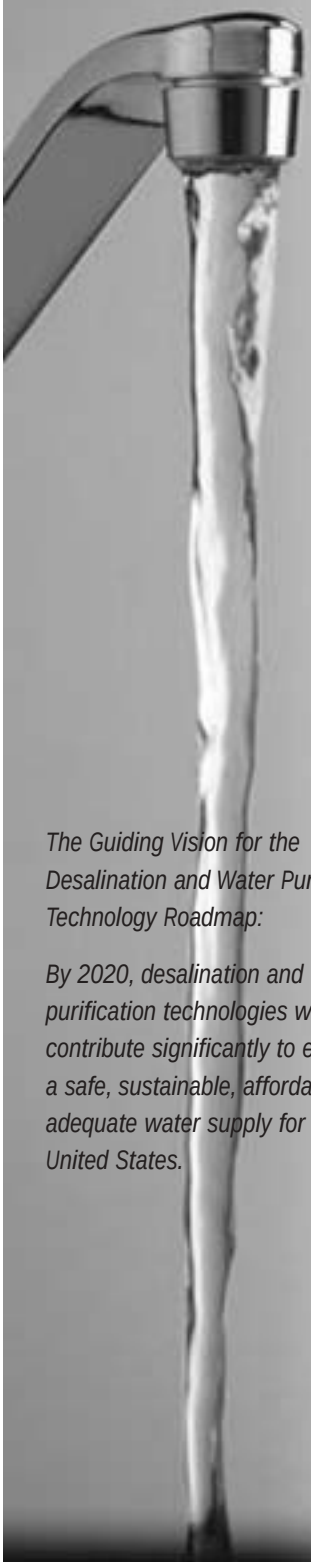
In 2002, Congress authorized the U.S. Bureau of Reclamation to work with Sandia National Laboratories to develop a plan for research and implementation of desalination technology. The goal in developing such a plan is more widespread use of desalination technology in water-scarce regions. An executive committee of 11 desalination experts from the public and private sectors was formed to develop a consensus on areas of desalination research and development that may lead to technological solutions to the water supply challenges facing the United States. The committee's conclusions are presented in a report titled "Desalination and Water Purification Technology Roadmap – A Report of the Executive Committee," published in January 2003 by the U.S. Bureau of Reclamation. The following article summarizes some of the non-technical points in the Roadmap.



The Guiding Vision for the Desalination and Water Purification Technology Roadmap:

By 2020, desalination and water purification technologies will contribute significantly to ensuring a safe, sustainable, affordable, and adequate water supply for the United States.

In recent years, much attention has become focused on desalination in the Southwest. Many states and municipalities are now considering desalination as the means to a supplemental water source for the future. As local water supplies diminish, drought continues in the region, and the cost of imported water rises, desalination begins to look like an attractive alternative. However, as the technology currently exists, desalination is not a magic solution to our water-supply challenges. While the technology soon may exist to make desalination feasible, other barriers may hinder its success. The degree of commitment to water supply research and development will strongly influence how soon it is economically viable. The next steps in research must be chosen with a coordinated, integrated strategy.

SHOWSTOPPERS: BARRIERS TO SUCCESS

No matter how good a technological solution is, its effectiveness may be limited by local, state, or federal policies and regulations. The following barriers were identified in the Roadmap process.

Jurisdictional and Organizational Issues. Despite revolutionary improvements, the widespread application of desalination technology can be blocked by:

- The divergence of water quality standards across jurisdictions.
- The separation of regulatory authority over concentrate disposal from authority for other aspects of water resource management.
- The inability of multiple communities to share costs of desalination and water supply purification facilities sited in one community or disposal facilities sited in another.

Public Perceptions of Purified Water. As bottled water labels colorfully illustrate, the public is drawn to the illusory image of their water having sprung in virgin purity from some mountain stream. The unromantic reality that all water on the planet is and must be reused is susceptible to manipulation and exploitation to foment public opposition to desalination and water supply purification technologies and facilities.

Controversies about Growth and Development and Facility Siting. In many communities, significant growth pressures have affected residents' perceived quality of life. Other communities are developing where people have fled to avoid growth and urbanization. In such communities as these, desalination and water supply purification technologies that enhance the availability and sustainability of usable water supplies may become enmeshed in local or regional controversies concerning land use, population, transportation, and environmental protection if water supply improvements are seen as promoting, or at least facilitating, more growth and development.

Creation of Industry-wide Standards. At present, there are no industry-wide performance standards for the desalination and water purification technologies discussed in the Roadmap. In addition, no single, unbiased source of information exists regarding the performance of these technologies. This lack of independent performance testing contributes to the slow adoption of these technologies. Without solid, unbiased performance data, fiscally conservative and often risk-averse public water agencies are hesitant to install desalination or water purification facilities.

FUTURE SCENARIOS

When setting a course for the future, it is helpful to evaluate alternative scenarios. In a Business-as-Usual scenario, the nation continues with limited public sector support of desalination technology research and development (R&D) and the current level of investment in private sector research programs. An alternative scenario, the Renewed-National-Commitment scenario, calls for an increased commitment to water supply R&D and the development of revolutionary water purification and desalination processes.

Both scenarios ultimately result in the widespread installation (with public sector cost-sharing) of desalination and water purification technologies that are able to upgrade a variety of impaired waters and thus ensure a safe, sustainable, and affordable water supply. The difference lies in the time until that point is reached, and what happens in the meantime.

The greatest disadvantage of the Business-as-Usual scenario is the cost of installing and using the currently available technologies. The cost of treating impaired water with these technologies is several times higher than that of conventionally treated fresh water. Communities with diminishing fresh-water supplies face either the high cost of importing water, or expensive desalination treatment (see "Desalination Coalition Formed"). With R&D supported only at its current low levels (see "R&D Investments"), efficient and economical next-generation desalination and water purification technologies will not become available for at least four decades, if ever.

Under the Renewed-National-Commitment scenario, wherein the research and development activities proposed in the Roadmap are completed, the timeline on which these revolutionary technologies become available will be accelerated by perhaps two decades. Concurrently, such public sector support will result in faster improvements to existing desalination and water purification technologies, resulting in cheaper and more effective technologies becoming available in perhaps as little as a

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Desalination Coalition Formed

Water supply agencies in Southern California, Texas, and Florida have formed a desalination coalition for the purpose of mutually pursuing federal funding to offset the construction and operation costs of desalination facilities. The coalition will promote a coordinated strategy with the goal to make seawater desalination cost competitive.

Southern California water agencies supply water to roughly half of the population of California. Even though California has the fifth largest economy in the world, Southern California is unable to afford water purification and desalination plants without public sector funding to offset some portion of the up-front capital cost. If the economic powerhouse that is Southern California can't afford current-generation technologies without assistance, then smaller communities across the nation have even less of an opportunity to employ needed desalination technologies.

R&D Investments as a Percentage of Sales

At present, it is estimated that the U.S. water purification industry invests an estimated $5 million to $10 million annually in desalination research and development – less than one percent of sales. When compared with other industries – such as the semiconductor industry, which invests nine percent of sales in R&D, it becomes obvious that U.S. firms that build desalination and water purification plants conduct very little basic or applied research and development.

R&D and its Impact on Federal Cost-Sharing

Federal cost-sharing of water infrastructure projects has been an historical fixture. Today's water planners continue this trend as they seek federal dollars to offset some of the installation costs for desalination and water purification plants. Projections suggest that one billion dollars will be spent domestically on these plants in the coming years. Assuming a conservative 10 percent federal cost share for these projects, the United States is facing a $100 million cost-share bill.

Dedicating even one-tenth of this amount to advance the state of the art in desalination and water purification technologies offers the nation the chance to reduce its cost-share bill; as these technologies become cheaper and more efficient, fewer cost-share dollars will need to be doled out.

decade. While the Renewed-National-Commitment scenario will not eliminate the need for public sector cost-sharing of desalination and purification plants, it will likely reduce the amount of cost-share money required over time as cheaper technologies become available more rapidly. (See "R&D and its Impact on Federal Cost-Sharing," previuos page)

NEXT STEPS

Water – where it is found, who owns it, how and for what it is used – presents a web of complex issues. Technological development must be conducted in context – technologists must consider where their technology will be used, under what conditions, with what constraints, and by whom. The context is defined by components of the roadmapping process (illustrated below), which consists of the following complementary activities:

From the Desalination and Water Purification Technology Roadmap, U.S. Bureau of Reclamation, 2003.

- **Create new technology**. Deciding which research proposals to fund when many are presented is a daunting task. Historically, much of the decision has been qualitative – a reviewer's opinion of the principal investigator or the "interestingness" of the proposal. Such qualitative analyses are inappropriate when judging focused, targeted research projects. Thus, a comprehensive framework must be developed so that research projects are selected based on their ability to meet, or contribute to meeting, the metrics of the Roadmap.
- **Characterize the resource**. Mapping and characterizing saline aquifers is an important part of the process to improve water availability for the nation. It is essential to know the size, delineation, and quality of our national water resources.
- **Address implementation issues**. Greater attention should be paid to issues found in areas where the need for desalination is acute. The complexity of these issues in terms of environmental, ecological, economic, regulatory, ownership, and other concerns demands a focused approach to identifying the core issues and developing a framework within which interested parties can work to resolve them.
- **Commercialize and implement**. Freeing the road of deployment and implementation issues will not alone cause the widespread adoption of desalination technologies. The barriers found within the industry itself and within the public will have to be mitigated or removed. Educating the public regarding the safety of desalinated water and the benefits that it provides will be important to smoothing the path for deployment. Working with the industry to develop incentives for early adoption of new technologies will speed their introduction to the marketplace. Developing independent testing facilities and creating comprehensive cost-modeling software

tools will also serve to mitigate barriers to commercialization.

- **Collaborate at the global scale**. The world-wide deployment of desalination technologies can be an important component in enhancing national as well as international security.

The complete Roadmap is available at www.usbr.gov/water/content/roadmapreport.pdf
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