Desalination can boost US water supplies, but environmental research needed

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Recent advances in technology have made removing salt from seawater and groundwater a realistic option for increasing water supplies in some parts of the U.S., and desalination will likely have a niche in meeting the nation's future water needs, says a new report from the National Research Council. However, a coordinated research effort with steady funding is required to better understand and minimize desalination's environmental impacts -- and find ways to further lower its costs and energy use.

"Uncertainties about desalination's environmental impacts are currently a significant barrier to its wider use, and research on these effects -- and ways to lessen them -- should be the top priority," said Amy K. Zander, chair of the committee that wrote the report and professor at Clarkson University, Potsdam, N.Y. "Finding ways to lower costs should also be an objective. A coordinated research effort dedicated to these goals could make desalination a more practical option for some communities facing water shortages."

Over 97 percent of the Earth's water -- seawater and brackish groundwater -- is too salty to use for drinking water or agriculture. Interest in desalination has grown in the U.S. as some regions face water shortages and contention over existing freshwater supplies. Though desalination still generates less than 0.4 percent of the water used in the U.S., the nation's capacity to desalinate water grew by around 40 percent between 2000 and 2005, and plants now exist in every state. Most use a method called reverse osmosis, which pushes water through a membrane

to separate out most of the salts.

The report recommends that federal R&D on desalination be planned and coordinated by the White House Office of Science and Technology Policy and funded at the level of existing desalination R&D programs -- approximately $25 million a year. Currently there is no overall strategic direction to federal research on desalination, which is conducted by many agencies with varying goals. It also depends heavily on earmarks, which are unsteady sources of funding; from 2006 to 2007, federal funds declined by nearly 60 percent. Meanwhile, the private sector appears to fund the majority of the nation's desalination research. Both the public and private sectors can contribute to the proposed research agenda, the report says.

Substantial uncertainties remain about the environmental impacts of desalination, the report says. Limited studies suggest that desalination MAY be less environmentally harmful than many other ways to supplement water -- such as diverting freshwater from sensitive ecosystems -- but definitive conclusions cannot be made without further research.

Researchers should investigate the extent to which fish and other creatures get trapped in saltwater intake systems in various settings, and seek ways to mitigate this and other impacts. Studies also should examine the long-term ecological effects of disposing of the salt concentrate that remains after desalination in rivers or the sea, a common practice. In addition, environmental evaluations of new desalination plants should be conducted, including ecological monitoring before and after the plant starts operating. The results should be synthesized with existing data in a national assessment that can guide future decision making, the report says.

Desalination also has raised concerns about greenhouse gases because it

uses large amounts of energy. Seawater reverse osmosis uses about 10 times more energy than traditional treatment of surface water, for example, and in most cases uses more energy than other ways of augmenting water supplies. Researchers should investigate ways to integrate alternative energy sources -- such as the sun, wind, or tides -- in order to lower emissions from desalination, the report says.

Recent improvements in technology have lowered desalination's costs and energy requirements, which used to be prohibitively high. Meanwhile, other ways to augment water supplies have grown more expensive, making desalination more competitive. Finding ways to further lower costs should be another goal of the research effort, the report says.

Developing cost-effective, environmentally sustainable ways to dispose of salt concentrate should be a priority. The cost of disposing of this waste varies widely by site and has generally risen. Inland plants, in particular, have few or no cost-effective and environmentally sustainable disposal methods.

Making the membranes used in reverse osmosis more permeable could lower desalination's energy use and costs further, as can improving the pre-treatment of water to remove sediments that can hinder membranes' efficiency, the report says. Even with improved technologies, however, the energy used by reverse osmosis probably cannot be reduced more than 15 percent below current levels. Larger reductions in energy costs may be possible using other desalination methods that could be powered with low-grade heat left over from other industrial processes, which would otherwise go to waste. Thermal desalination is one such method, and it may be possible to develop other novel approaches.

Even if costs are lowered, the report notes, conserving water or transferring it from one use to another will in most cases remain a less

expensive option than adding water through desalination or other methods.

Source: The National Academies