Chapter 9

Future Prospects for Desalination in the United States

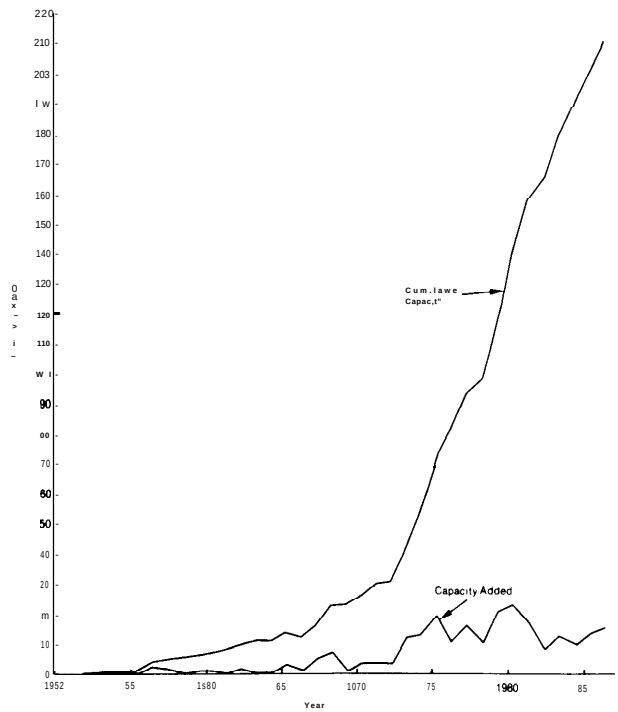
INCREASING USE OF DESALINATION TECHNOLOGIES

The use of desalination technologies for water treatment will probably continue to increase throughout the world. In the United States reverse osmosis (RO) will probably undergo the most expanded use, primarily for desalting brackish groundwater for potable purposes, and for treating municipal and industrial process water. How much desalination is used in the future will depend largely on the:

- decreasing viability of alternatives (other than desalination) for increasing freshwater supplies*;
- decreasing cost of membrane desalination processes;
- increasing demand for drinking water, especially in rapidly growing coastal and western communities;
- increasing need to treat and/or to remove potentially toxic contaminants from surface and ground water supplies;
- increasing stringency in regulatory programs covering drinking water, and wastewater discharges (i. e., the NPDES program);
- increased use of treated irrigation drainage water for drinking water in the West; and
- increased application of RO and other membrane processes to various industrial processes.

Trends associated with these factors indicate that the use of desalination technologies, and especially RO, will probably increase in the United States in the future (figure 13). Exactly how much this increase will be is unknown.

Figure 13.–Desalination Capacity in the U.S. and Territories Over the Last Two Decades



SOURCE: Office of Technology Assessment (data frOm K. Wangnick, "IDA Worldwide Plant Inventory," 19S7).

[1]There are several alternatives that could be used to increase or extend existing supplies of freshwater, but most have significant limitations. Conservation, especially in agricultural irrigation, has the greatest potential for extending present supplies of freshwater (82). However, conservation only occurs on a sustained basis if there are regulatory and/or financial incentives (e. g., higher water cost), and if existing institutional mechanisms are changed to encourage water conservation. Most easily accessible aquifers have already been tapped and many major aquifers, especially those in arid regions, are being depleted faster than they are being recharged from surface supplies. Most favorable dam sites on U.S. rivers have already been used. In addition, there are many major financial and institutional obstacles to large-scale transfers of water from water rich parts of the country. Further research into other options for increasing or extending water supplies (e. g., weather modification, towing icebergs, etc.) will allow an improved evaluation of their potential (63).

NON-TECHNICAL BIAS AGAINST DESALINATION TECHNOLOGIES

An institutional bias favoring "tried and true" conventional water treatment techniques has probably restrained to some extent the use of desalination technologies in this country, especially in the area of municipal water treatment. For example, EPA typically will not include innovative or "unproven' technologies in designating "best available technologies. Conventional technologies are also preferred by consulting engineers who design treatment plants, by water utilities that build plants, and by state agencies with responsibility for public health. Even equipment manufacturers are reluctant to invest their capital in new technologies that may not sell simply because they are new (85). Finally, it may take engineering schools many years to integrate new water treatment technologies into teaching curicula and text books.

This institutional bias against new technologies tends to be most significant when the technologies are first introduced. This was probably the case for RO in the 1970s. Although some institutional bias against desalination technologies undoubtedly still exists, its significance has probably decreased. For example, according to the latest inventory of desalination plants (33), desalination technologies are now used in 46 States and on the Marshall and Virgin Islands; RO is used by municipalities and/or industries in 44 States and on the Virgin Islands. Since only 20 percent of the desalination plants (with capacities of greater than 25,000 gpd) in the United States are used to treat municipal drinking water supplies, the bias against new technologies may be more of a problem for municipal water treatment than for industrial applications,

POTENTIAL AVENUES FOR FEDERAL SUPPORT OF DESALINATION

The desalination industry in most parts of the world is still adjusting to the moderating demand for desalination capacity that has occurred over the last 5 years. The U.S. industry seems to be consolidating into fewer companies, within an extremely competitive market. The low profit margins associated with the manufacture and sale of desalination equipment do not provide much capital for research, development, and marketing of new technological developments. Also, while Federal research support for desalination R&D has faded during the 1980s, many overseas firms are apparently receiving support from their respective governments.

When informally and randomly polled, industry representatives and desalination experts held widely divergent opinions about the appropriate level of Federal involvement in desalination. However, considering that the industry is presently unable to sponsor significant amounts of R&D (see ch. 6), most industry representatives believe that the Federal Government should increase its direct support of desalination R&D and/or demonstration projects, Sharing of R&D costs with the industry is an option that might be explored. Federally supported R&D would not only benefit all municipal and industrial users of desalination technology in the United States, but it would also improve the competitiveness of United States desalination firms overseas.

Some industry representatives and desalination experts do not favor direct Federal support for desalination R&D and/or demonstration projects. If R&D is left to the private sector, the level of R&D and its focus will be controlled largely by the market demand for desalination technologies. In this situation, R&D costs are indirectly paid for by domestic and foreign users of the technologies, particularly those who might be the first to apply new technological developments. Some industry representatives are particularly concerned that proprietary developments stemming from government-supported R&D would have to be widely shared.

Statistics can be developed to favor either position on Federal support. Opponents of increasing Federal support for desalination would point out that desalination now accounts for only 0.2 percent of **all** freshwater consumed in the United States for domestic, agricultural, and industrial uses. Supporters of increasing Federal involvement would

point out that the amount of desalinated water produced in this country is equivalent to about 1.3 percent of the 15 billion gallons of fresh water that is consumptively used each day for domestic and industrial uses. This percentage is likely to grow over time. A research program funded at $30 million per year would add only about $0.0004 to the cost of each gallon of desalinated water used in the United States every year. But, this amounts to about $0.40 per 1,000 gallons, or about 20 percent of the approximate cost of $2 per 1,000 gallons for desalinated brackish water. However, the primary issue is probably not how much research should be conducted, but who should pay for it—the Federal Government or the users of desalination?

If the Federal Government were to become more actively involved in the development of desalination technologies, demonstration projects could be supported through Section 106 of the Water Resources Research Act, which has had no funding since passage of the Act in 1984. Alternatively, demonstration projects could be considered for funding under Section 1444 of the Safe Drinking Water Act (see ch. 7). Such demonstration projects of desalination technologies would further highlight their economic viability for water treatment.[2] If demonstration projects are sponsored by the Federal Government, it might be most appropriate to build plants in small communities that have poor quality drinking water and limited financial resources. Seminars and workshops, structured around these demonstration plants, could reduce any resistance to employing desalination technologies by engineers, Federal and State regulators, and local government officials.

The government might also support desalination through other avenues. For example, the 1 million gallons per day test facility at the Federal Government's Yuma plant, which will be operated full-time for membrane testing, could be used both for Bureau of Reclamation and private testing of membranes. Alternatively, the government and industry could jointly develop a small test facility where individual companies could test new desalination equipment and membranes without having to share any proprietary equipment designs. The government could also accelerate the application of newly developed desalination (and other water treatment) technologies through low-level, long-term support of university educational programs and workshops concerned with desalination and other innovative water treatment technologies.

At present Federal involvement with desalination is split among three Federal agencies. A small amount of desalination R&D is sponsored through the water-related research grants program of the U.S. Geological Survey, Department of Interior (DOI). Overseas activities and construction/operation of the Yuma RO plant are managed by the Bureau of Reclamation (DOI). The Office of Drinking Water at Environmental Protection Agency follows developments in RO and other desalination technologies as they relate to drinking water. However, no agency is responsible for tracking and periodically reporting on the overall development status and costs associated with all desalination technologies, or for disseminating current and reliable information about desalination technologies. For example, considering the growing concern about the quality of drinking water, information on point-of-use water treatment alternatives might be extremely useful to consumers, especially those living in rural locations where water quality is poor.

Some desalination experts, citing the increasing size of the Federal budget deficits, believe that the primary avenue for Federal involvement will come through the regulation of potentially toxic pollutants. In other words, the market for membrane processes will be indirectly driven by the continuing development of increasingly stringent standards for drinking water, industrial wastewater discharges, hazardous waste disposal, and perhaps irrigation drainage water discharges. If additional Federal support for desalination research, development,

[2]There are three other possible sources of Federal funding for desalination-related projects:

1. The Federal Government now supports a few hundred thousand dollars worth of desalination research each year under Section 105 of the Water Resources Research Act (Public Law 98-242) administered by the U.S. Geological Survey.
2. Under Section 201 of the Clean Water Act EPA can support the construction of revenue-producing facilities that reclaim wastewater from sewage treatment plants. For example, the EPA contributed $7 million to support Denver's $30 million wastewater *treatment* test facility and research program.
3. The Department of Energy (DOE) and the Commerce Department's National Bureau of Standards (NBS), have a joint program, called the NBS/DOE Energy-Related Inventions Program. This program provides about $2.5 million in grants per year for the development of energy-saving inventions, which could include desalination technologies.

and/or demonstration was considered by Congress, it is likely that any proposed programs would have to compete with other national priorities. A drought in the West would tend to elevate the priorities associated with desalination and other water-related issues.