

Chapter 6

Desalination Industry

DEVELOPING INTERNATIONAL MARKETS UP TO 1980

The very limited desalination market of the 1950s was dominated by European manufacturers, who controlled about 70 to 80 percent of the market. The desalination industry in the United States began developing in the mid-1950s in concert with the federally funded desalination R&D program. By the mid-1960s U.S. manufacturers had built about 45 percent of the distillation plants then operating; the Europeans had about 50 percent of the market (86). With the ongoing desalination R&D program supported by the U.S. Government, the U.S. industry was generally considered to be at the forefront of desalination technology throughout the 1960s and into the 1970s.

U.S. Government funding for desalination R&D peaked in 1967 at over \$100 million (in 1985 dol-

lars), and steadily decreased about 40 percent over the next 6 years until 1973 when program funding was all but eliminated. The American desalination industry was adversely impacted by this sudden withdrawal of Federal support. Furthermore, American overseas sales during the early 1970s began to suffer from intense competition from many aggressive, service-conscious Japanese and European companies, some of which were and still are indirectly supported by their respective central governments. The U.S. Government desalination R&D program was partially revived in the late 1970s, and funded at a relatively low level (i.e., \$10 million to \$15 million per year) until the early 1980s when funding for desalination and other water resources research was largely eliminated.

CURRENT INTERNATIONAL MARKETS

Desalination plant sales worldwide continued to increase throughout the 1960s and 1970s, and peaked at an annual high of just over 460 million gallons per day (mgd) of plant capacity in 1980. From 1981 through 1985 plant sales averaged about 180 mgd (86). This moderating trend primarily reflects the declining sale of large distillation and reverse osmosis (RO) plants (i.e., greater than 3 mgd) in the Middle East and Libya in response to falling oil revenues. Also, the working environment for plant suppliers in some Middle Eastern countries has become less attractive over the last few years with the advent of increasingly stringent contractor performance requirements, delayed contract payments, and other bureaucratic irritations (88). Future markets will probably be stabilized by the need to replace aging plants. Rising tensions in the Middle East may also have a potentially large impact on plant construction.

Almost 60 percent of all desalination capacity¹ is now located in the Arabic peninsula. Saudi Ara-

bia accounts for about 30 percent of the world's capacity followed by Kuwait with just over 11 percent, and the United Arab Emirates with about 11 percent. The United States has almost 10 percent of the world's capacity. Although multi-stage flash (MSF) distillation accounts for about 65 percent of the world's desalination capacity (followed by RO at 23 percent), in terms of the number of plants, only 15 percent are MSF. (Of the remaining plants, 49 percent are RO, 16 percent ED, and 20 percent other.) In other words, most MSF plants are quite large (i. e., in excess of 1 mgd); RO plants tend to be of smaller capacity, but more numerous. Seawater is used to feed most MSF plants, whereas brackish water is used with most RO and electro dialysis (ED) plants. The median size of all desalination plants larger than 25,000 gallons per day is about 3.0 mgd (86).

Although MSF distillation plants have dominated the market since the early 1960s, RO plants are capturing an increasing share of the desalination market. For example, in 1986 about 48 percent of the *contracted* desalination capacity was for RO plants; about 35 percent was for MSF distillation.

¹Desalination plant inventories include all plants with capacities in excess of 26,000 gpd, or 100 cubic meters/day.

Multiple effect evaporation units and electrodiagnosis accounted for about 5 and 4 percent of the market, respectively. The largest percentage of the world's RO capacity—about 35 percent—is installed in the United States; Saudi Arabia has about 30 percent (86).

Over the last three decades over 166 different manufacturers have installed plants in 105 countries (33). In fact, the number of plant suppliers increased by 22 percent between 1984 and 1986 as the market shifted away from large MSF plants to smaller RO plants. Over the last decade the manufacture of desalination plants worldwide has been dominated by European, Japanese, and U.S. firms—each group accounting for about 30 percent of the plants in operation. Japanese and European plant manufacturers, who specialize in building larger distillation plants, have been most severely impacted by the declining desalination market in the Middle East since 1980.

CURRENT DOMESTIC MARKETS

Based on sales figures from 1981 to 1985, domestic sales of desalination plants and equipment by U.S. industry are probably worth about \$35 million per year.³ Even with an increased share of the world's desalination market in 1986, U.S. manufacturers have been hit hard by stiff competition and declining profits. Over the last 5 years the domestic desalination industry has experienced great change within an overall trend toward fewer, but generally larger companies. Some firms have been acquired by larger chemical corporations involved in water treatment and/or process separation. A few firms have been acquired by larger companies, and then later sold. Declining profits have forced other firms to file for bankruptcy, or to go out of business (88).

The U.S. desalination market continues to be dominated by sales of small, U.S.-manufactured RO, ED, and vapor compression (VC) units for commercial and military uses, and small to moder-

³Domestically the United States has about 10 percent of the world's desalination capacity. This means that about 18 mgd of desalination capacity is added to our inventory each year. Most of this is for brackish water RO. At \$2/gal of installed capacity, this amounts to about \$36 million/yr in domestic plant sales. The remaining \$194 million of the U.S. industry market would represent overseas sales.

Total domestic and overseas sales of desalination plants and equipment by U.S. industry from 1981 through 1985 were probably worth between \$200 million and \$250 million per year.² U.S. manufacturers supplied about 45 percent of the plant capacity in the very competitive, but considerably reduced, 1986 market (86).

²Annual sales of desalination plants worldwide over the last 5 years have been about 180 mgd in plant capacity per year. According to the 1987 plant inventory by the International Desalination Association, about three-fourths of these plants use seawater for feed; most of the remaining plants use brackish water. The capital cost for seawater plants is about \$5 per installed gallon of capacity; \$2 for brackish water:

- Seawater plants: 135 mgd/yr x \$5/gal. = \$675 million

- Brackish water plants: 45 mgd/yr x \$2/gal. = \$90 million

Worldwide desalination plant sales would then be about: \$765 million/yr. U.S. sales (about 30 percent of worldwide sales) are about: \$230 million/yr.

ate-sized RO plants to coastal communities. However, there are concerns about potential international competition in the U.S. market, especially from the Japanese. There have been some efforts to expand the use of membranes in various industries; however, major investments are often required to develop such markets in industries where other technologies have been long used. Many representatives from the desalination industry believe that demonstration projects are needed to break such reliance on traditional water treatment technologies.

With worldwide sales of between \$200 million and \$250 million per year the desalination industry in the United States may spend from \$5 million to \$10 million per year on research and development,⁴ compared to an average of \$30 million

⁴An informal survey of industry experts was taken to determine the level to which U.S. industry supports desalination research, applications, and engineering. These estimates ranged from \$2 million to \$20 million annually. The \$5 to \$10 million estimate used in the text above is based on the assumption that about 3 percent of worldwide sales of the U.S. industry (i. e., 3 percent of approximately \$230 million) is invested in R&D. (This assumed percentage is the approximate percentage of sales invested by the FilmTec Corp. a few years ago when it was still a publicly owned stock company.) This produces an estimate of about \$7 million per year for R&D expenditures. A

per year (in 1985 dollars) in R&D during the 30-year, federally funded desalination program. Due to the low or negative profit margins associated with the intensely competitive worldwide market, larger industry investments in R&D are unrealistic at this

range of \$5 million to \$10 million per year is used in the text to indicate the level of uncertainty associated with this estimate. Unfortunately, the information required to verify this estimate is not readily available.

time. Much of the present research effort is probably applied research—rather than basic research—directed toward the development of specific products (e. g., chlorine-resistant membranes, low-pressure membranes, etc.), or improving plant efficiencies (e. g., energy recovery systems, etc.). Most ongoing R&D takes place within the framework of individual companies; there are no industry-coordinated research efforts being conducted at this time.