Global Competitiveness of U.S. Environmental Technology Industries: Municipal and Industrial Water and Wastewater

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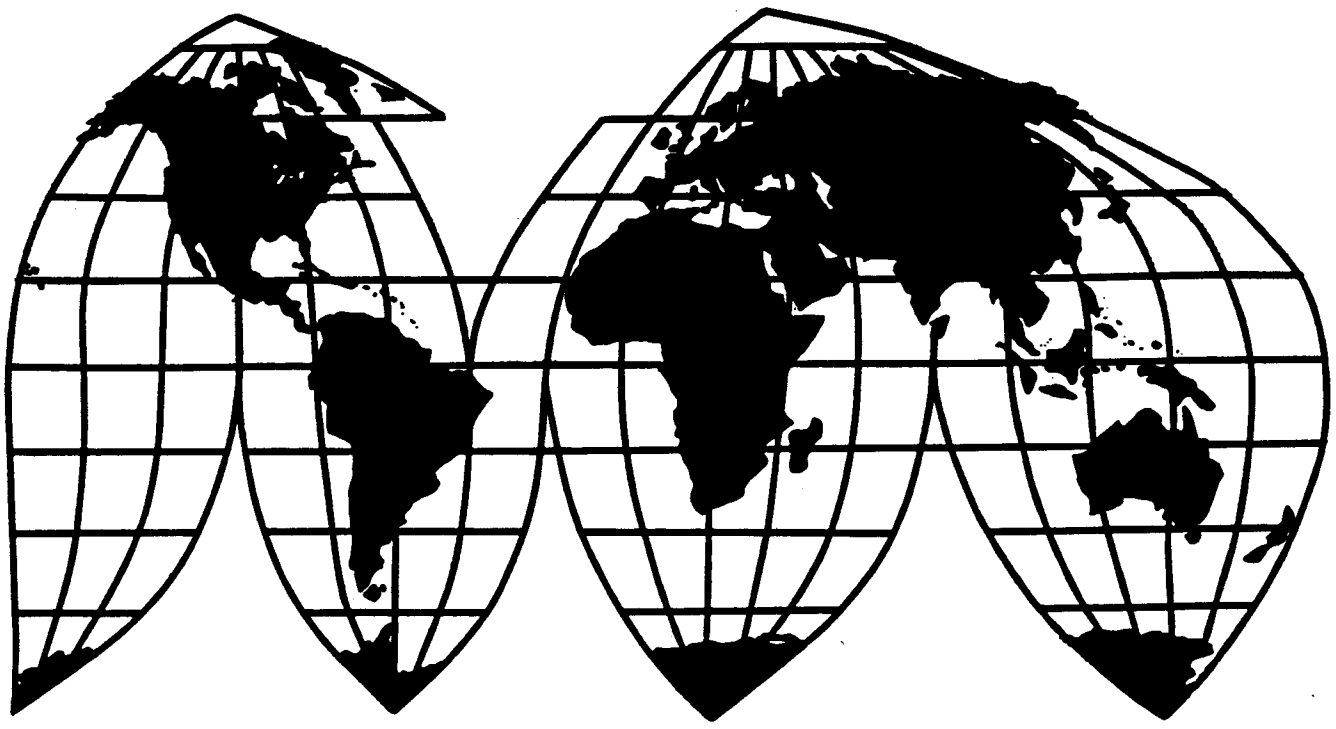

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NOTE

The information and analysis in this report are for the purpose of this report only. Nothing in this report should be construed to indicate how the Commission would find in an investigation conducted under statutory authority covering the same or similar matters.

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EXECUTIVE SUMMARY

Background

On October 14, 1993, the Senate Committee on Finance requested that the U.S. International Trade Commission (USITC) collect and analyze information on the competitiveness of U.S. industries producing environmental goods and services, in part by comparing the export promotion/technical assistance policies of the United States in the environmental technology field with those of its principal competitors. The Committee requested two reports: one focusing on the industries providing goods and services for municipal and industrial water and wastewater treatment and another focusing on the industries providing goods and services for air pollution prevention and abatement. The USITC instituted its investigation on water and wastewater treatment on November 21, 1993.

The Committee's request letter defined environmental technology as goods and services for pollution abatement, pollution prevention, or environmental remediation; or goods and services that have as a central component the reduction of energy or materials consumption or the reduction of environmental impact during use or upon disposal.

In this study, the goods used for water and wastewater treatment have been grouped into four categories: (1) process equipment; (2) delivery equipment; (3) instruments; and (4) chemicals. All these categories include goods used for end-of-pipe treatment, as well as goods that can be used to change production processes in order to reduce the amount or concentration of the liquid wastes produced. The services used for water and wastewater treatment can be grouped broadly into two categories: (1) engineering and construction; and (2) environmental testing. There is considerable overlap among the firms providing goods and services in each of these categories.

Findings

Overview of the Global Market

Though estimates vary because of definitional differences, both world markets and trade levels for environmental technologies are growing, with water-related goods and services making up a significant portion of the total.

- According to the Organisation for Economic Co-operation and Development (OECD), the world market for environmental technologies was $200 billion in 1990, and is forecast to reach $300 billion by 2000. Of this $200 billion, $60 billion was reportedly water-related. OECD's estimate has been widely quoted since its original publication in 1992.

- OECD estimated that the United States ran a trade surplus of $4 billion in 1990 for environmental goods and services, with exports of $8 billion and imports of $4 billion. However, the Environmental Protection Agency (EPA) estimated the U.S. trade surplus for 1990 for environmental equipment at only $800 million, with a trade surplus in water-related equipment of about $220 million. EPA did not include services in its estimate and included only selected water and wastewater equipment. The difference in estimates is an example of the complexities associated with defining environmental technology.

The Market and Industry in the United States

The United States is the world's largest producer and consumer of environmental goods and services. The U.S. industries providing services and equipment for water and wastewater treatment consist of thousands of firms ranging from large multinational enterprises, for which water and wastewater services and equipment are a relatively small part of total revenues, to small companies

serving niche water and wastewater markets. The U.S. municipal water and wastewater treatment market consists largely of publicly owned facilities, however these facilities are increasingly being privatized as municipalities find themselves with inadequate financial resources to modernize aging infrastructure.

- U.S. construction and engineering firms find it difficult to compete internationally against larger, more integrated foreign firms.

- Because the cost to establish laboratory services overseas is high, most U.S. laboratories have not ventured abroad.

- The U.S. industry producing instruments enjoys a strong competitive position in both the United States and overseas as a result of such factors as high R&D investments, technological sophistication, competitive prices, and after-sales service.

- Revenues of U.S. process and delivery equipment firms have steadily increased over the past several years. A significant portion of U.S. exports of delivery equipment consists of specialty equipment of novel design or high quality that is not readily available from foreign sources.

- The United States is one of the largest volume exporters of water treatment chemicals.

The Market and Industry in the Major Competitor Nations

The major foreign competitors for U.S. companies in providing services and equipment for water and wastewater treatment are companies in Great Britain, France, Germany, and Japan, particularly Great Britain and France in services. These countries are also among the major consumer nations.

- Capital spending in European Union countries on pollution control, mainly in the public sector, is now approaching $15 billion a year, with more than a third of the spending on water purification and sewerage systems.

- Great Britain and France have gained a competitive edge worldwide due in large part to the extensive privatization of their domestic water and wastewater services, giving the companies that provide these services a strong base from which to expand internationally. France has not gone as far in privatizing as has the United Kingdom. Although French waterworks and wastewater treatment facilities are often operated by private companies, ownership of the facilities generally remains in government hands.

- Although the primary firms providing France's water and wastewater treatment are well established and strong international competitors, France's treatment of domestic wastewater lags behind that of other developed countries.

- There has been almost no privatization of Germany's water and wastewater treatment services. Historically in Germany, water services have been organized and operated independently of wastewater services to a much greater extent than in other countries.

- While being well supplied with water services, Japan is significantly behind North America and Europe in the introduction of modern sewerage systems. Both of these services are provided by the public sector.

- Foreign engineering and construction firms, especially in France and the United Kingdom, are larger and more integrated than those in the United States and more likely to concentrate on water and wastewater.

- Environmental testing services in the EU are often performed by public-sector or university laboratories. Competition in the industry has been growing in recent years in response to increased environmental awareness and stricter government regulations.

U.S and Foreign Government Programs and Regulations

Government programs of the United States, France, Germany, Japan, and the United Kingdom to promote export sales include education, market information, and trade fairs; overseas presence and advocacy; feasibility studies; research and development, demonstration, and commercialization; technology training and cooperation; and finance and insurance. The export promotion programs of each country vary in terms of type and directness of support, emphasis, and approach; the magnitude of funding; and the degree to which they are tailored to specific industries. France and, to a lesser extent, the United Kingdom have an integrated approach with a national plan. The United States has increased its efforts to foster an integrated and coordinated program for total exports by establishing the Trade Promotion Coordinating Committee (TPCC). Germany provides low levels of national export promotion. Although it does not have a formal strategic plan, Japan has structured its foreign aid to foster exports.

- Environmental technology exports are identified and encouraged as part of overall export promotion programs. The basic objectives of the U.S. strategy are to strengthen cooperation between government and business, strengthen environmental technology development and commercialization, help U.S. businesses to succeed in the most promising markets, and coordinate and focus U.S. government export programs and resources.

- The TPCC has moved aggressively to coordinate promotion of all exports, including focusing on targeted markets, especially information on the desirability of exporting, how to export, and the availability of potential business partners. The nineteen federal agencies of the TPCC have formulated a National Export Strategy with 65 specific recommendations whose ultimate goal is to increase total exports to $1 trillion annually and create six million new jobs by the year 2000.

- While much of the increased U.S. effort is a redirection of funds, some agencies are allocating more resources to promotion of total exports. The U.S. Export Import Bank (Ex-Im Bank) has increased total authorizations significantly and the degree and speed of its responsiveness have been considerably enhanced.

- As recommended by the TPCC, an Advocacy Center has been set up in the U.S. Department of Commerce to coordinate the activities of the nineteen government agencies involved in export promotion. An on-line computer data base tracks the progress of pending foreign projects.

- An Office of Environmental Technology Exports also has been established in the U.S. Department of Commerce to provide environmental export programs to the business community and foster public-private partnerships. The office has a lead role in the Environmental Trade Working Group and is implementing the Environmental Technology Export strategy. This includes targeting specific markets and developing market plans for each country's environmental situation and priorities.

- Export credit agencies of the surveyed countries do not generally incorporate preferential treatment for environmental technology exports. Most agencies treat applications for export credit as a strictly commercial decision based on returns and risk. Environmental considerations address the potential environmental impact of the project. Ex-Im Bank has been one of the leaders in identifying the environmentally beneficial exports associated with its loans and guarantees.

- Development assistance is a very important source of financing for large infrastructure projects that are key opportunities for environmental technology exports. Member countries of the Development Assistance Committee of the OECD have begun to introduce indicators of environmental content for their projects based on three codes: specifically for environmental purposes; significantly influenced by environmental considerations; and none or unknown. The U.S. Trade and Development Agency is the key agency for funding feasibility studies that can lead to U.S. exports.

- Several ways for a country to promote exports are: outright tying of a country's exports to its provision of aid to a recipient country; use of a country's trust funds maintained at a multilateral development bank to finance feasibility studies; and supplementing multilateral assistance with bilateral assistance. Based on notifications of tied aid offers to the OECD, individual countries' tying of environmental exports to their bilateral aid programs have declined as a result of the 1992 OECD tied aid agreement. However, the possibility of effectively tying exports, while meeting the terms of the OECD tied aid agreement, does exist.

- Of the regulatory frameworks for the nations reviewed, the United States and Germany have the most detailed permit requirements and the most stringent treatment standards for industrial and municipal wastewater. The United States and Germany also have the largest percentage of population served by municipal wastewater treatment systems. Japan stringently regulates effluent from industrial facilities.

Competitive Position

The U.S. water and wastewater market is relatively mature and is facing excess capacity in many areas. In addition, U.S. environmental regulations are among the strictest in the world, and U.S. companies are among the most technologically sophisticated in the world. Thus, there is new focus on export markets as an outlet for equipment and services and as a means to assist environmental protection activities in other countries.

- Non-U.S. revenues are becoming an increasing share of total revenues for both services and equipment firms. From 1991 to 1993, foreign revenues from water and wastewater grew faster than domestic revenues.

- The largest firms, particularly for services, account for the vast majority of both U.S. and non-U.S. revenues.

- Competitive factors such as price, quality, company reputation, and availability of project finance were found to be significant in non-U.S. markets. Factors that were found to be less significant include technical standards, intellectual property protection, licensing, and lack of metrification in the United States.

- Competitive factors such as size, scale, overseas experience, degree of privatization of the home market, and the ability to offer full-service contracts instead of a single service or piece of equipment, or even turnkey operations may give non-U.S. firms an advantage in leading consortia to bid on large-scale infrastructure projects such as municipal water and wastewater facilities in developing countries.

- Environmental regulation and enforcement will continue to drive the market in both the developed countries and in the developing countries. However, environmental regulation in the home country may not be closely related to the competitiveness of the national industries pursuing business in the export markets.

- U.S. firms may or may not have less access to government support, including export financing, than their European and Japanese competitors. The limited availability of necessary data precludes the calculation of levels of support for such items as research and development, export promotion, export finance, and foreign aid that go to support water and wastewater industries.

CHAPTER 1

INTRODUCTION

Debates surrounding both the North American Free-Trade Agreement (NAFTA) and the recently ratified General Agreement on Tariffs and Trade (GATT) have focused attention on the seemingly inherent conflict between economic growth and environmental quality. As demonstrated by the 1992 Earth Summit in Rio de Janiero, there is growing governmental recognition that all the countries in the world face serious environmental problems. In turn this recognition has generated considerable interest in the development and application of environmental technology as one means of making economic growth more environmentally friendly.

This rising interest in environmental problems has coincided with several developments that have accelerated the attention given to environmental technology. First, recent economic conditions and concerns about foreign competition, as well as budget concerns, have created a keen interest in the creation of high-wage jobs in the U.S. economy; industries utilizing sophisticated technologies often create high-wage job opportunities. Second, the potential for increased foreign competition has renewed the emphasis on reducing the cost of environmental regulation in the United States for both industry and municipalities; innovative environmental technology may assist this effort. Third, the recent trade agreements (NAFTA, GATT) that have highlighted environmental problems around the world have also increased U.S. access to foreign markets and redirected attention towards export markets high-technology products. Fourth, there is a greater emphasis on pollution prevention than on traditional end-of-the-pipe treatment. This decline in demand for some traditional treatment and remediation activities has coincided with a decline in Government funding for such traditional environmental activities as municipal water and wastewater (W&WW). Fifth, the shift from defense- to civilian-oriented activities has both public and private entities seeking new outlets for scientific and engineering expertise.

These five conditions have combined to create excess capacity in many U.S. environmental technology industry sectors that serve a relatively mature domestic market. Therefore, industry is focused on increasing exports as an outlet for environmental goods and services (EGS)[1] and as a means to help foreign countries protect their own environments.[2] The twin themes of environmental technology and export markets have generated a demand for information to help policy makers design and evaluate policies and programs to deal with these conditions and with EGS firms.

Purpose of the Report

On October 15, 1993, the U.S. International Trade Commission (USITC) received a letter from the Senate Committee on Finance requesting that the USITC provide two reports on the competitiveness of U.S. industries producing EGS. The Office of Technology Assessment (OTA) of the U.S. Congress, at the request of the Senate Committee on Finance, conducted a series of studies examining emerging market opportunities for U.S. exporters of environmental goods and services. These reports identified a number of factors relevant to the global competitiveness of U.S. environmental technology in general.[3] The Committee requested that the USITC follow up the OTA

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[1]The acronym EGS was used by OTA, January 1994, and will be used here for consistency with that report when referring to overall environmental goods and services, as opposed to just municipal and industrial water and wastewater treatment.

[2]U.S. Department of Commerce, International Trade Administration, statement by Secretary Ronald H. Brown quoted in *The National Export Strategy, Second Annual Report* reprinted in *Business America*, vol. 115, No. 9, special issue, (Oct. 1994), p. 119.

[3]OTA, *Industry, Technology, and the Environment: Competitive Challenges and Business Opportunities*, OTA-ITE-586 (Washington, DC: GPO, Jan. 1994); *Trade and Environment: Conflicts and Opportunities*, OTA-BP-ITE-94 (Washington, DC: GPO, May 1992); and *Development*

work with an examination of two specific areas of environmental technology. This first USITC report, instituted on November 15, 1993, analyzes one of largest areas of the overall environmental technology field--the industries providing goods and services for municipal and industrial W&WW treatment. Specifically, the Finance Committee asked the USITC to compare U.S. programs and policies, such as export promotion and technical assistance, with those of nations whose industries are the primary competitors in the various areas of environmental technology. The second report requested by the committee, focusing on the industries that provide air pollution prevention and abatement equipment and services, is scheduled to be completed in early 1996.[4]

This report provides information on the production and trade of those EGS used in the provision of municipal and industrial water and in the treatment and disposal of municipal and industrial wastewater. OTA and other organizations have identified the need for better data, particularly production and trade data. Most experts agree that more detailed information is needed to define environmental technology more precisely and to develop export policies and strategies. Other efforts are underway in the United States and abroad, most notably by the Organisation for Economic Co-operation and Development (OECD),[5] to define environmental technology and to determine the structure and character of the market.

Scope of the Report

This report focuses on four major market segments for W&WW goods and services: (1) municipal water supply, (2) municipal wastewater treatment, (3) industrial water supply, and (4) industrial wastewater treatment. The U.S. industries that produce and export goods and services for these four market segments consist of thousands of firms ranging from small engineering and manufacturing operations to large multinational engineering and construction firms and some of the largest manufacturers in the country. Their products and services range from individual components, chemicals, or pieces of equipment and scientific instruments, to the design, construction, and operation of large-scale W&WW systems serving urban areas. The report focuses chiefly on 1993 data on production and trade by U.S. industry, but presents other data when helpful for descriptions and analyses.

Definition of the Environmental Technology Industry

The Finance Committee letter requesting this report defined environmental technology as goods and services for pollution abatement, pollution prevention, or environmental remediation; or goods and services that have as a central component the reduction of energy or materials consumption or the reduction of environmental impact during use or upon disposal.[6] Such an all-inclusive definition of environmental technology makes challenging any attempt to measure the value of the goods and services covered. Before the EGS industry can be measured, it must be defined; how the industry is defined may determine the value of the information gathered or any analysis that is based on such information. The discussion below reviews some of the difficulties encountered in precisely defining the industry.

Assistance, Export Promotion, and Environmental Technology--Background Paper, OTA-BP-ITE-107 (Washington, DC: GPO, Aug. 1993).

[4]The request from the Committee on Finance of the U.S. Senate for the two reports is included as appendix A.

[5]OECD, *Forum Discussion on the Environment Industry: Background Paper*, OCDE/DSTI/IND(94)20 (Paris: OECD, Nov. 1994).

[6]This definition appears in the letter of request for the investigation (see appendix A) and in S. 978, the National Environmental Technologies Act, which was introduced in 1993.

First, the distinction between the market (demand) and the industry (supply) is not always clear. This study does not measure the revenues generated by facilities that treat and deliver water and collect and treat wastewater per se, but the revenues of providing goods and services to these facilities. These facilities that treat water and wastewater constitute the market for the industries that provide the goods and services covered by the study. Some studies include water and wastewater facilities as suppliers, while others, including this study, would consider them to be part of the market. This can result in the double counting of the value of some goods and services. For example, as privatization of water and wastewater facilities becomes a more significant factor in the U.S. market, both the demand and supply could appear to grow significantly although the quantity of actual goods and services produced and consumed may actually decrease if privatization improves efficiency. Some definitions of the industry include only those goods and services produced by private-sector third parties but not captive production of goods and services by municipal and industrial consumers of environmental goods and services. Neglecting to count this captive production may result in an underestimation of the supply side.

Second, environmental goods and services include those used to change production processes to prevent water pollution, as well as those used for end-of-pipe pollution treatment or control. One difficulty is identifying the goods and services used to change production processes. A second, related, difficulty is differentiating between production process changes made solely for environmental purposes and those made for other reasons (such as increased efficiency) that may coincidentally have a beneficial environmental impact.

Third, many of the goods and services have uses other than for environmental protection. These products, such as pumps and valves, have multiple end uses, and it is difficult to separate production intended for environmental purposes from that intended for other purposes. In addition, statistics are usually kept for industries that produce similar products or for establishments that engage in the same type of activity.[7] Some industries, as defined for statistical reporting purposes by the Standard Industrial Classification (SIC) system, however, produce products for more than one purpose. For example, both Laboratory Analytical Instruments (SIC 3826) and Engineering Services (SIC 8711) include products or services for both environmental and nonenvironmental purposes. This study, through the questionnaire, has attempted to identify the proportion of the goods and services produced and exported by those companies specifically for environmental purposes.

In summary, this study has attempted to address these three definitional difficulties through the use of questionnaires to private sector service and equipment producers. However, the revenue totals for the services firms do include some revenues from the operation of utilities. Also, the survey of the industries producing goods and services for municipal and industrial consumers does not yield an estimate of the production of environmental goods and services by those consumers. The study has focused on the problem of multiple end uses, however, and has attempted to identify the proportion of the goods and services produced and exported by those companies specifically for environmental and W&WW purposes by asking the questionnaire recipients to make these allocations.

Approach of the Report

The approach of this report is to examine the competitive factors identified by OTA, as well as others that have been identified during the course of this investigation, and to determine whether these factors are as applicable to the industries supplying the W&WW market as OTA found them to be for the industries supplying environmental technology in general. These factors include those internal to the industries such as price, quality, and research and development, as well as those external to the industries such as government policies regarding environmental regulation, export

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[7]U.S. Technical Committee on Industrial Classification, *Standard Industrial Classification Manual, 1987* (Washington, DC, 1987), p. 3.

promotion and market development, technology transfer, technical and economic development assistance, and intellectual property protection.

The report also examines recent supply and demand conditions prevalent in the domestic and selected foreign markets. Given the definitional difficulties, the diversity of the goods and services covered, the lack of statistical information, and the number of firms involved, the analysis is largely qualitative.

Information in this report has been compiled from written submissions, responses to the USITC's questionnaires, review of existing literature, meetings with government and industry officials, telephone interviews, and other sources. The questionnaires represent one of the first attempts by the U.S. Government to ascertain the end use of much of the equipment and the purpose of the services used in the provision of municipal and industrial W&WW treatment.

The USITC developed two questionnaires for use in this investigation: one for equipment manufacturers and one for service providers. These questionnaires requested data and information about each firm's overall operations, operations in support of municipal and industrial W&WW, and revenues from U.S. and foreign markets. The response rate was 42 percent for equipment manufacturers and 44 percent for service providers. Appendix B contains a discussion of the questionnaire sample and response rate.

Organization of the Report

Chapter 2 provides an overview of the global market for W&WW goods and services. Chapter 3 describes the U.S. industries and market in terms of structure, production, consumption, trade, and other factors affecting production of these goods and services and the performance of the industries. Chapter 4 discusses similar issues for the industries and markets of the United States' major foreign competitors. The primary competitors for W&WW goods and services appear to be France, Germany, Japan, and Great Britain. Chapter 5 describes government policies and programs of the United States and the major foreign competitors that may affect trade in these goods and services. Chapter 6 analyzes the factors that affect the competitive position of the W&WW goods and services industries of the United States and its major rivals in the global market.

CHAPTER 2

THE GLOBAL MARKET

Earth is the water planet, with water covering 70 percent of the surface. However, over 97 percent of this water is saltwater, and another 2 percent is locked up in glaciers and icecaps. This means that less than 1 percent is readily available as fresh water in streams, rivers, lakes, and as groundwater. As the National Geographic noted in a special issue on water in 1993, if all the water in the world could fit in a gallon jar, the readily available fresh water would be represented by less than a tablespoonful.[1]

The combination of a growing population and increasing industrial development has created an intense demand for an essentially fixed supply of water. Many areas of the world face severe problems from pollution of both surface water and groundwater. The global market for water and wastewater goods and services reflects these needs and problems as many countries seek to provide essential services and to solve the environmental problems created by the pollution of the world's waters.

Worldwide, 1.7 billion people lack access to sanitation services; even in urban areas, the number of people without such services increased by more than 70 million in the 1980s. Approximately 170 million people in urban areas lack access to nearby potable water; in rural areas an estimated 855 million people lack safe water.[2] These people often must buy water from vendors, paying several times more per unit of water than do people connected to municipal water systems.[3]

Several studies estimate that the global market for environmental goods and services, of which water and wastewater is a major part, is $200-300 billion and they forecast it to grow steadily over the next decade (see table 2-1).[4] The Organisation for Economic Co-operation and Development's (OECD) estimate of $200 billion in 1990, with growth to $300 billion by 2000, has been widely quoted since its original publication in 1992 and has served as a rallying cry for promotion of U.S. environmental exports.[5] Other groups have fairly similar estimates for 1990 (1992 in the case of Environmental Business International (EBI) and ECOTEC), but differ significantly in their forecasts for future years. The ECOTEC estimate for 2000 of $320 billion is only slightly higher than that of OECD, but EBI at $426 billion for 1998 and Environmental Technologies Development Corporation (ETDC2) at $580 billion are much higher. In all four estimates (for 1990/92), the United States represents about 40 percent of the global environmental market. Differences in definition appear to account for much of the variation in the estimates.

Another survey, by Helmut Kaiser Consultancy, an international market research firm based in Germany, projects that the global market for environmental technology spending will reach $374 billion in 1995, up from a current figure of $330 billion. That study estimates that annual spending on water cleanup alone will rise by nearly 50 percent by 2000, to $162 billion.[6] These figures primarily account for pollution abatement and remediation, but generally do not fully account for pollution prevention through cleaner production.

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[1]Michael Parfit, "Sharing the Wealth of Water," *National Geographic* (Nov. 1993), p. 24.

[2]World Bank, *World Development Report 1992: Development and the Environment* (New York: Oxford University Press, 1992), p. 47.

[3]Ibid., p. 48.

[4]Interagency Environmental Technologies Exports Working Group, *Environmental Technologies Exports: Strategic Framework for U.S. Leadership* (Nov. 1993), p. 11

[5]OECD, *Forum Discussion on the Environment Industry*, p. 3.

[6]Debra Rubin, Don Shapiro, Peter Reina, and Armin Schmid, "Firms Gear Up to Think Globally, Link Locally," *Engineering News-Record: Focus on Environment* (Feb. 21, 1994), p. 42.

Table 2-1
Global environment market

(*Billion dollars*)

Market	OECD 1990	OECD 2000	ECOTEC 1992	ECOTEC 2000	ECOTEC 2010	EBI 1992	EBI 1998	ETDC2 1990	ETDC2 2000
North America:									
United States	78	113	85	125	200	134	180	115	185
Canada	7	12	14	18	30	10	17	7	14
Mexico	-	-	1	5	10	1	2	3	18
Subtotal	85	125	100	147	240	145	199	125	217
Other Latin America	-	-	2	4/5	15	6	10	-	-
Europe:									
United Kingdom	7	11	-	-	-	-	-	11	28
France	10	15	-	-	-	-	-	10	30
Germany	17	23	-	-	-	-	-	21	65
Rest of European Union	-	-	[1]60	[1]89	[1]144	[1]94	[1]132	15	48
Rest of Western Europe	19	28	-	-	-	-	-	6	17
Eastern Europe/NIS	15	21	5	9	23	14	27	15	25
Subtotal	68	99	65	98	167	108	159	78	213
Asia/Pacific:									
Japan	24	39	30	44	72	21	31	24	65
Australia/NZ	2	3	-	-	-	3	5	2	4
Taiwan	-	-	-	-	-	-	-	5	30
Hong Kong	-	-	-	-	-	-	-	-	3
South Korea	-	-	[2]5	[2]12	[2]50	-	-	1	8
China	-	-	2	5	20	-	-	-	-
India	-	-	1	2	7	-	-	-	-
Rest of Asia Pacific	-	-	-	-	-	6	13	14	28
Subtotal	26	42	38	63	149	30	49	46	138
Rest of World	21	34	-	-	-	6	9	6	12
Total World	200	300	210	320	570	295	426	255	580

[1] All Western Europe.
[2] East and South-East Asia.

Source: Compiled from: OECD, Meeting of Experts on the Environment Industry, *Background Paper*, Oct. 13-14, 1994, p. 6; OECD, *The OECD Environment Industry*, p. 15, not including "clean" technologies; ECOTEC, *The UK Environment Industry*, not including "clean" technologies; EBI (Environmental Business International), in OTA *Industry, Technology, and the Environment*, p. 98, including some "clean" technologies, such as alternative energy sources; ETDC2 (Environmental Technologies Development Corporation), James Higgins, "Global Environmental Industry," *Ecodecision* (Jan. 1994), p. 22, including replacement "clean" technologies only, excluding entirely new "clean" processes, "clean" and alternative energy generation, and "clean" products.

Note: Since figures are estimates, sums may not equal totals shown.

The OECD study divided the environmental goods and services market into five categories: (1) water and effluents treatment; (2) waste management; (3) air quality control; (4) land remediation and noise pollution abatement; and (5) general environmental services.[7] OECD estimates that $60 billion of the environmental market is represented by water and wastewater equipment, and that this will increase to $83 billion by 2000.[8]

The OECD estimate of the U.S. trade surplus in environmental goods and services was $4 billion in 1990, with exports of $8 billion and imports of $4 billion.[9] According to a recent report by the Environmental Protection Agency (EPA), in response to the OECD and other studies, the U.S. trade surplus for the same year for environmental equipment was $800 million, with a trade surplus in water-related equipment (not including services) of about $220 million. EPA, using a more restrictive definition, estimated U.S. exports of environmental equipment at $1.3 billion and imports at $500 million, and U.S. exports and imports of water-related equipment at $410 million and $190 million, respectively, in 1990. In 1991, exports of environmental protection equipment, as defined by EPA, rose to $1.7 billion while imports rose to $1.1 billion. For water-related equipment, exports rose to $450 million and imports to approximately $220 million.[10] EPA's definition of environmental equipment covers a small number of categories of equipment that are readily classifiable in international trade statistics as environmental equipment, thereby excluding many multiple-use items, chemicals, and pollution prevention equipment. For example, it included machinery for purifying water and other liquids, but not sewer pipes, because there is no separate classification for sewer pipes.

The global market for environmental technologies is a series of quite distinct national and sub-national markets. Even at comparable development levels, countries display widely varying degrees of environmental awareness, regulation, and enforcement. In particular, other countries' regulations have emphases and procedures that differ widely from those of the United States, even countries at similar levels of economic development.

Most of the current environmental technologies market, by dollar value, is in developed countries. These tend to be relatively mature markets, especially for W&WW where treatment systems are in place but often outdated and in need of modernizing and upgrading. These countries are expected to continue to account for the majority of the market into the next century. The OECD estimates that in 1990, 82 percent ($164 billion) of the market for environmental goods and services was in the 24 member countries of the OECD, with almost half of that ($78 billion) accounted for by the United States.[11] Of the rest, Eastern Europe and the former Soviet republics accounted for 7.5 percent, with the remaining 10.5 percent divided among other non-OECD countries.[12] The United States is estimated to account for 40 to 45 percent of the world's environmental technologies production. The OECD and ETDC2 estimate that the United States, Germany, and Japan produce about two-thirds of total output of environmental technologies.

Developing country environmental technology markets have vast potential for sales, but their markets differ in several ways from more established markets in developed countries. Developing country environmental problems are serious and wide ranging, and the economic and human costs of inadequate environmental infrastructure or management is immense. According to the World Bank,

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[7]OECD, *The OECD Environment Industry: Situation, Prospects and Government Policies*, OCDE/GS(92)1 (Paris: OECD, 1992), p. 5.

[8]OECD, *The OECD Environment Industry*, p. 13. The OECD breaks out environmental equipment into four different sectors, but combines services from all sectors in one estimate.

[9]OECD, *The OECD Environment Industry*, p. 21.

[10]EPA, Office of Policy, Planning, and Evaluation, *International Trade in Environmental Protection Equipment - An Assessment of Existing Data*, EPA 230-R-93-006 (Washington, DC, July 1993), p. 21.

[11]OECD, *The OECD Environment Industry*, p. 15.

[12]Ibid.

more than 3 million people, mostly children, die each year from diarrheal diseases spread by contaminated water.[13] Developing countries often lack the most rudimentary environmental infrastructure such as basic water delivery and waste collection systems. About 26 percent of developing countries reported that more than half of their population was without access to safe and adequate water supply in 1990 down from 45 percent in 1981. About 41 percent of these countries reported more than half of their population did not have access to appropriate sanitation in 1990, down from 47 percent in 1981.[14] The market is an immature one, with the focus on investing in such systems. A significant portion of the total outlay for these investments may be in local labor and low-technology components such as concrete and pipe. Developing countries are more reliant on outside financing to pay for many environmental investments. Much of this funding comes from official development assistance or multilateral development banks.

Where services do exist, the provision of water is generally less efficient in developing countries than in the developed world. There are 2-3 employees per 1,000 water connections in Western Europe, about 4 in a more advanced developing country, such as Chile, and 10-20 in most other Latin American countries.[15] The financial performance of water and sewage utilities is also poor, with costs seldom covered by user fees, resulting in the need for large payments of public money. A review of World Bank-financed projects showed that the price charged for water is only about 35 percent of the average cost of supplying it.[16] For example, in Caracas, Venezuela and Mexico City, some 30 percent of water and sewer connections are not registered, necessitating an annual Federal subsidy in the case of Mexico City of more than $1 billion a year, or 0.6 percent of GDP.[17]

In rural areas in developing countries, governments often employ low-cost technologies on the assumption that people in such areas are unwilling to pay for better services. However, studies have shown that people in such areas want, and will pay for, improved service. Since they are often unwilling to pay for the poor service they do get, however, resources to operate and maintain systems are not provided, leading to yet further deterioration in the quality of service and to a "low-level equilibrium trap."[18]

Table 2-2 shows, by region, the percentage of the developing world's population supplied with adequate drinking water and sanitation services. Coverage is much greater for urban areas than rural. Coverage is also greater for water supply than wastewater treatment. Fifteen percent of the urban population of the world's developing countries, approximately 205 million people, lacked access to an adequate and safe water supply at the end of 1990. Twenty-six percent, 345 million people, lacked access to appropriate means of waste disposal. For the rural population, 38 percent, or 1.1 billion people, lacked adequate safe water, and 58 percent, or 1.6 billion people, lacked waste disposal facilities.[19]

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[13]World Bank, *World Development Report 1992*, pp. 48-49.

[14]World Health Organization (WHO), *The International Drinking Water Supply and Sanitation Decade - End of Decade Review (as at December 1990)* (1992), p. 1.

[15]Ismail Serageldin, *Water Supply, Sanitation, and Environmental Sustainability: The Financing Challenge*, (Washington, DC: World Bank, 1994), pp. 7-8.

[16]World Bank Infrastructure and Urban Development Department, *FY90 Sector Review: Water Supply and Sanitation*, Report INU-OR6, (Washington: World Bank, 1991), as cited in John Briscoe, "When the Cup is Half Full: Improving Water and Sanitation Services in the Developing World," *Environment*, vol. 35, No. 4 (May 1993), p. 13.

[17]World Bank Operations Evaluation Department, *Water Supply and Sanitation Projects: The Bank Experience 1967-1989* (1992), as cited in Briscoe, "When the Cup is Half Full," p. 29.

[18]Briscoe, "When the Cup is Half Full," pp. 14-15.

[19]WHO, *The International Drinking Water Supply and Sanitation Decade*, p. 7.

Table 2-2
Water supply and sanitation coverage in the developing world, 1990

	Percentage of population					
	Water Supply			Sanitation		
Region	Urban	Rural	Total	Urban	Rural	Total
Africa	79	32	46	68	22	36
Latin America	90	52	79	82	36	69
South Asia	73	64	66	50	12	22
Eastern Mediterranean	91	51	69	79	20	46
Western Pacific	91	66	72	92	76	80
Total	85	62	NA	74	42	NA

Source: Compiled from WHO, *The International Drinking Water Supply and Sanitation Decade - End of Decade Review (as at December 1990)*, 1992.

The high rate of coverage in Latin America reflects the economic development that has been taking place there. The high rate of coverage in the Western Pacific region is a result of the inclusion of several more developed countries, such as Australia, Hong Kong, Korea, Japan, and New Zealand.

The following tabulation illustrates the percentage of the industrialized world's population supplied with adequate sanitation services:[20]

United States	74
France	68
United Kingdom	87
Japan	44
Canada	70
Germany	86
Italy	61
Total OECD	62

A direct comparison between the preceding table and tabulation is not possible because different definitions of "adequate" are likely used by WHO and OECD. For the most part, however, coverage is considerably better in the developed than in the developing world. Such exceptions as France and Japan are discussed in chapter 4.

Developing countries exhibit differing patterns of demand as their markets for environmental technologies evolve. Since many developing countries lack industrial or public infrastructure, there is an opportunity, particularly for industry, to encourage investment in pollution prevention technologies aimed at avoiding the generation of pollution in the first place, rather than focusing on end-of-pipe solutions. However, since older and less efficient technologies can generally be purchased at a lower initial cost, the availability of financing is crucial to encourage investment in environmentally sound industrial and infrastructure technologies.

One similarity between developed and developing country markets is the trend towards privatization of water and wastewater facilities. British facilities are by far the most privatized, with water and sewage facilities completely owned and operated by private companies. Other countries

[20]OECD, *Environmental Performance Reviews: Japan* (1994), p. 72.

have privatized their water and wastewater treatment facilities to a lesser degree. In France the majority of water supply facilities are operated by private companies, but owned by municipalities. In the United States some water supply facilities have been taken over by private companies, also generally under operation and maintenance contracts of varying duration. Many developing country Governments have also begun to privatize their water and wastewater treatment plants. The Government of Chile is looking for private investment for its sanitary and water companies; it is studying buy, operate, and transfer contracts for some of the larger projects.[21] In Peru, an auction to privatize the water and sewage utility for metropolitan Lima is scheduled for the first week of May 1995.[22] Several African countries have also turned to private-sector operation of water and sewage facilities.

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[21] "Government to Turn in Plan for Sanitation Companies in November," *El Diario* (Oct. 26, 1994), p. 13, as cited by Knight-Ridder Financial News.

[22] "Privatization of SEDAPAL coming in May," *Gestion* (Feb, 17, 1994), p. 40, as cited by Knight-Ridder Financial News.

CHAPTER 3

THE U.S INDUSTRY AND MARKET

Overview

As noted in chapter 1, the United States is the world's largest producer and consumer of environmental goods and services, consuming approximately 40 percent, or $80 billion, of world production. Following are a description of the U.S. municipal and industrial W&WW market and a discussion of several industries that supply goods and services to the W&WW treatment market.

Structure and Dynamics of the Market

Recent estimates of the size of the U.S. W&WW market range from $14.3 billion to $17 billion. Table 3-1 shows an estimate for 1993 W&WW treatment expenditures made by William T. Lorenz & Co. The EBJ estimate includes delivery equipment but not construction, whereas the Lorenz estimate includes construction but not delivery equipment.

Table 3-1
Water and wastewater treatment: Capital and chemical expenditures, 1993

(Million dollars)

	Municipal		Industrial		
	Water supply[1]	Wastewater treatment[2]	Water supply	Wastewater treatment	Total
Design & engineering	255	223	276	380	1,134
Equipment	391	327	815	835	2,368
Instruments	43	69	175	183	470
Construction	2,501	1,382	1,834	1,865	7,582
Materials		534			534
Subtotal	3,190	2,535	3,100	3,263	12,088
Chemicals	350	400	1,500		2,250
Total	3,540	2,935	7,863		14,338

[1] Excludes distribution systems.
[2] Excludes sewers.

Source: William T. Lorenz & Co., *1994 Update - Water Pollution Control Industry Outlook* (Dodgeville, WI, Nov. 1994).

The following tabulation presents the Environmental Business Journal's (EBJ) estimate, in billions of dollars, of the 1994 U.S. W&WW market:[1]

Instruments	0.4
Process equipment	2.8
Delivery equipment	7.6
Chemicals	3.1
Total goods	13.9
Contract operations	0.4
Consulting	1.1
Design engineering	1.2
Analytical services	0.4
Total services	3.1
Grand total	17.0

Municipal Water and Wastewater

Drinking water treatment and distribution and wastewater collection and treatment services in the United States are generally provided and funded by local governments and have been paid for through service fees and taxes. Lack of funds has led many cities and counties to postpone both the rehabilitation of old plants and the construction of new ones; now, these cities and counties are faced with costs that have risen considerably. New Federal standards and the phase-out of construction grants will increase costs, most of which will be passed on to users. In 1992, the EPA determined that $137 billion in capital investment will be needed nationwide over 20 years to build or upgrade municipal sewer systems in order to comply with existing clean water requirements.[2]

There are about 59,000 community water systems in the United States, serving approximately 90 percent of the population. More than 85 percent of these systems serve communities of less than 2,500 people, or less than 10 percent of the U.S. population. Another 10 percent of the systems provide water to communities between 2,500 and 10,000 people, representing another 10 percent of the population. Five percent of the systems provide water to communities with populations over 10,000, or about 70 percent of the population, with the remaining 10 percent of the population being served by noncommunity systems (serving less than 25 people) or individual systems (wells).[3]

The United States obtains its domestic water supply from a combination of publicly owned water systems, investor-owned water systems, and individual systems. Approximately 35,000 of the water systems are publicly-owned; these serve just under 80 percent of the population. Although about 24,000, or 40 percent, of water systems are investor-owned, they serve only some 10 percent of the population, or 33 million people. There are a few large investor-owned systems, but the vast majority serve communities of fewer than 500 people.[4]

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[1] "The Dawn of the Water Era," *EBJ*, vol. VII, No. 11/12, (Nov./Dec. 1994), p. 1. EBJ also includes revenues of $23.1 billion for water utilities and $23.4 billion for publicly owned treatment works for a total estimated market of $63.5 billion. As discussed in on page 1- , this number may be high due to double counting.

[2] EPA, *1992 Needs Survey Report to Congress*, EPA 832-R-93-002, (Washington, DC, Sept. 1993), p. 1.

[3] William T. Lorenz & Co., *1994 Update - Water Pollution Control Industry Outlook* (Dodgeville, WI, Nov. 1994), p. 6-10.

[4] Ibid.

Faced with fiscal problems and deteriorating infrastructure, many municipalities are attempting to cut costs by turning operations over to outside contractors. Privatization can range from awarding operation and maintenance (O&M) contracts for treatment facilities to private companies, with ownership remaining in government hands, to the outright sale of facilities to private companies. The former, under which a private contractor provides complete services to operate and maintain a facility so that it complies with all applicable State and Federal regulations, is the more common course of action. By taking responsibility for several facilities, contractors can take advantage of economies of scale; spreading costs for some services such as purchasing, computerization, training, preventative maintenance, and personnel over different facilities.

Billions of gallons of wastewater from domestic, commercial, and industrial sites pass through sewers to publicly owned treatment works (POTWs) each day. The POTWs remove pollutants before discharging the treated water to rivers, lakes, and other bodies of water. The residues from the treatment processes, such as sludges, are incinerated, landfilled, or composted. In 1992, there were approximately 15,500 POTWs in the United States, with about 3,000 classified as "majors" (plants serving 10,000 or more customers, processing 1 million gallons or more of wastewater per day) and 12,500 as "minors" (processing less than 1 million gallons of wastewater per day).[5]

The O&M market for wastewater treatment is growing at about 20 to 25 percent annually. An additional 300 to 400 "major" plants will likely be built by the year 2000, opening up an even larger market for O&M companies, since this is the plant size most O&M competitors consider the most attractive for privatization.[6] Only 2 percent of 27,000 wastewater treatment facilities are privately owned,[7] however, and many obstacles stand in the way of continued privatization, especially for wastewater treatment facilities.

One obstacle to privatization is the restrictive Federal subsidies program under the Clean Water Act, which precludes private ownership of wastewater facilities built with Federal grant money unless the full amount of the grant is repaid to the government. A 1992 Executive Order[8] removed this disincentive by liberalizing the disposition process for local infrastructure facilities that received Federal grants, but industry sources maintain that the government has failed to enforce its provisions.[9]

A second obstacle to private ownership of wastewater treatment plants arises from the fact that the Clean Water Act regulates privatized municipal facilities as industrial, not municipal, dischargers. Under EPA regulations, industrial wastewater dischargers are treated differently from municipal dischargers, with a much more stringent set of regulations. Legislation was introduced in November 1993 to amend the Clean Water Act so as to define wastewater treatment facilities and to include privatized wastewater facilities in that definition.[10]

An obstacle to privatization of water systems is the disincentive created by the U.S. tax code, according to which contracts between government-owned water systems and nongovernmental

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[5] Ibid., p. 5-2.

[6] William T. Lorenz & Co., *1992 Update - Water Pollution Control Industry Outlook* (Concord, NH, Apr. 1992), p. 498.

[7] "The Dawn of the Water Era," p. 2.

[8] Executive Order 12803 of Apr. 30, 1992, 3 CFR 296 (1993).

[9] National Association of Water Companies (NAWC) official, USITC staff telephone interview, Jan. 5, 1995.

[10] Municipal Wastewater Treatment Facility Private Investment Act of 1993, S. 1681/H.R. 3539. Neither bill was reported out of committee. For a discussion of the issue see testimony of the NAWC before the Subcommittee on Water Resources and Environment, concerning Reauthorization of the Federal Water Pollution Control Act, presented by J. James Barr, VP and CFO, American Water Works Company, Apr. 21, 1993.

managers that are funded with tax-exempt bonds are limited to 5 years.[11] Since cost-effective operation and maintenance of facilities require substantial up-front expenditures, longer contracts are necessary for contractors to realize an adequate return on their investments. The Internal Revenue Service and the Department of the Treasury are reportedly examining a revision of this term-limit guideline.[12]

Industrial Water and Wastewater

Many industrial establishments require substantial amounts of water for cooling, boiler feed, and process use. For industrial uses, the quality of the water required for specific applications is generally as important as the availability of sufficient quantities. It is often necessary for a manufacturing facility to treat its influent water as well as its effluent.

Data are not as readily available on the size of the market for goods and services used for industrial water supply as are available for industrial wastewater. However, as shown in table 3-1, one expert estimates that the capital and chemical expenditures in 1993 for industrial water supply were nearly equal to that for industrial wastewater treatment.

In 1993, capital spending for W&WW treatment facilities by industry totaled an estimated $6.4 billion: about $3.3 billion for wastewater treatment facilities and $3.1 billion for water treatment facilities.[13] Construction is the major component in capital expenditures for industry (58 percent), followed by equipment costs (26 percent), design and engineering (10 percent), and instrumentation (6 percent).

According to U.S. Department of Commerce (DOC) statistics, water pollution abatement capital expenditures for industry were $2.6 billion in 1990, $2.8 billion in 1991, and $2.5 billion in 1992 (table 3-2). The chemicals industry accounted for the largest share of water pollution abatement expenditures by industry, followed by the petroleum and paper industries.

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[11] See 26 U.S.C. 103, 141 et seq. and IRS revenue procedures and interpretive guidelines issued thereunder. For a discussion of the issues, see National Association of Water Companies memorandum, May 9, 1994.

[12] NAWC interview.

[13] See tabulation, p. 3-1.

Table 3-2
Pollution abatement capital expenditures for all manufacturing industries, by industry, 1990-92

(Million dollars)

SIC Code	Industry	1990 Total	1990 Water	1990 By abatement technique: End of line	1990 By abatement technique: Changes in production processes	1991 Total	1991 Water	1991 By abatement technique: End of line	1991 By abatement technique: Changes in production process	1992 Total	1992 Water	1992 By abatement technique: End of line	1992 By abatement technique: Changes in production process
20	Food	249.0	163.3	[1] 142.0	[1] 21.3	481.8	359.5	330.0	[2] 29.4	316.8	[1] 202.6	[1] 162.3	[2] 40.3
21	Tobacco	5.9	0.8	[1]	[1]	5.9	0.5	0.5		14.5			
22	Textile	45.9	24.8	22.4	2.4	56.8	21.4	18.0	3.4	34.3	18.7	15.3	3.4
24	Lumber	105.1	10.4	8.7	1.7	141.2	13.8	11.0	2.8	94.5	18.9	10.5	8.4
25	Furniture	23.6	2.3	1.9	0.4	23.7	2.8	2.0	0.9	17.9	0.8	0.3	0.5
26	Paper	1,075.2	509.6	294.8	214.7	1,232.6	552.7	241.7	311.0	1,004.6	373.4	169.3	204.1
27	Printing	67.8	4.4	2.8	1.6	37.2	6.2	5.0	1.2	41.8	4.5	3.0	1.5
28	Chemicals	1,852.1	995.0	826.3	168.8	2,066.1	942.3	762.2	180.0	2,120.9	1,017.3	845.4	171.9
29	Petroleum	916.8	400.8	291.8	109.0	1,462.5	373.3	282.8	90.5	2,685.0	492.6	391.6	101.0
30	Rubber	93.8	11.0	9.0	2.0	81.7	18.8	7.2	11.6	96.7	18.2	12.4	5.8
31	Leather	8.3	6.5	[1]	[1]	15.0	9.6	[1]	[1]	8.5	6.7	6.4	0.3
32	Stone	127.5	19.8	15.6	4.2	154.4	22.2	19.4	2.8	138.8	20.2	12.0	8.2
33	Primary metals	499.1	166.8	140.8	26.0	673.4	131.9	113.9	18.0	525.7	123.5	99.3	24.2
34	Fabricated metals	171.0	61.1	48.7	12.4	176.9	66.4	48.6	17.9	103.3	42.4	28.3	14.1
35	Machinery	107.8	41.3	36.9	4.4	128.4	27.6	18.3	9.2	150.3	31.7	16.9	14.8
36	Electronics	177.5	58.4	45.2	13.2	233.7	122.7	111.0	11.7	126.6	45.6	28.9	16.7
37	Transportation	395.3	142.6	133.3	9.3	301.4	94.7	74.6	20.2	281.0	69.2	53.0	16.2
38	Instruments	91.5	25.6	24.8	0.8	104.4	44.3	41.2	3.1	89.1	18.8	10.1	8.7
39	Miscellaneous	17.7	7.0	[1]	[1]	13.1	3.8	3.6	0.2	16.6	[1]	[1]	1.7
	Total	6,030.8	2,651.4	2,056.7	594.6	7,390.1	2,814.6	2,100.1	714.5	7,866.9	2,509.8	1,867.9	641.9

[1] Withheld to avoid disclosing the operations of individual companies.
[2] Less than $500,000.

Source: Derived from official statistics of the DOC.

Note: Because of rounding (and withheld data), figures may not add to the totals shown.

Structure of the Industry

The industries serving the municipal and industrial market described above comprised approximately 5000 firms that provide services, equipment, and chemicals. Of these, 3000-3500 are predominantly service firms that provide the design, engineering, construction, laboratory analysis, and operation and maintenance. Another 1500 are predominantly equipment firms that provide the filters, pumps, valves, pipes, instruments, and other hardware. There are also about 100 companies that provide chemical and biologic products. Most W&WW service and equipment firms are either large firms for which W&WW accounts for a relatively small proportion of their total production or small firms geared solely toward providing products to water treatment markets. For example, there are few, if any, publicly traded firms that derive more than 50 percent of their revenues from wastewater treatment.[14]

Services

W&WW services are grouped into two categories: (1) engineering and construction and (2) environmental testing services. Both categories are used in end-of-the-pipe treatment, as well as to change production processes in order to reduce the amount or concentration of the liquid wastes produced.

Engineering and Construction Services

Many large firms offer both engineering and construction services to the W&WW treatment market. Water supply and wastewater treatment-related services provided by design engineers include feasibility studies, ground water studies, water resource management, design of water supply and wastewater treatment systems and structures, and construction management.[15] Water supply and wastewater treatment-related services provided by construction firms include pre-erection work, construction of water supply and wastewater treatment systems and structures, and project management.

Producers

There are approximately 13,000 environmental construction establishments and 39,000 environmental engineering services establishments.[16] Not all of these firms provide services for W&WW.[17] There are a few large firms whose W&WW business accounts for a relatively small part of total revenue and many smaller firms that serve niche W&WW markets and derive a relatively larger percentage of revenue from W&WW. In terms of domestic W&WW, the U.S. consulting engineering industry is not concentrated; rather revenues are spread across a large number of firms. Internationally, the U.S. industry is much more concentrated, with a smaller number of firms

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[14] Joan Berkowitz, *The Environmental Pollution Industry: Outlook 2001* (Washington, DC: Farkas Berkowitz & Co., 1992), p. 13.

[15] Lorenz, *1992 Update*, p. 493.

[16] U.S. Department of Labor, Bureau of Labor Statistics, *Employment and Wages: Annual Averages, 1992* (Washington, DC, Oct. 1993), pp. 76-80 and 512.

[17] According to the American Consulting Engineers Council, which represents approximately 50 percent of the consulting engineering industry in the United States (including important W&WW engineering firms, such as Black and Veatch, CH2M Hill, and Metcalf and Eddy), half of the council's members consider themselves to be environmental engineering firms. Of this group, 327 report activity in the water treatment sector, and 496 report activity in the wastewater treatment sector.

participating in markets abroad.[18] Similarly, there is little concentration among construction firms participating in the domestic W&WW market.[19] Each of the 12 largest U.S. construction firms had between $5 billion and $25 billion in total new contracts in 1993, 4 percent of which was for water, sewer, and waste. The 12 largest engineering firms, with over $500 million in billings apiece in 1993, averaged 1 percent in water supply billings and 2 percent in sewer and waste billings, whereas nearly one-fourth of smaller engineering firms, with 1993 billings below $50 million each, report 25 percent or more of their billings in water supply, sewer, and solid waste services.[20]

An important trend emerging in W&WW services industries is the development of total package capabilities. A firm with these capabilities may offer consultation,[21] design, construction, laboratory, and operation and maintenance services, as well as supplying equipment. Industry observers indicate that environmental testing services was the first area into which most consulting engineering concerns integrated. Other sources report that consultants are entering the construction field or combining previously separate consulting and construction entities.

The saturation of the domestic market has encouraged a growing number of environmental service firms to adopt a global strategy. A survey of such firms showed that globalized companies realize both higher profit margins and increased market share, both domestically and overseas.[22] Large U.S.-based international environmental engineering and consulting firms maintain many overseas offices; for example, in 1993 the leading five, combined, maintained 168 worldwide offices.[23] Similarly, large construction firms operate with offices and affiliates in various overseas locations.[24] U.S. firms are also globalizing by acquiring foreign firms[25] or by seeking joint ventures.

Consolidation is evident in the environmental engineering and construction industries and is expected to continue; the recent appearance of new entrants is principally the result of companies created by mergers. However, small specialized firms are expected to continue to survive on niche market projects, as well as on subcontracting opportunities on large projects, partly because they offer contacts with local officials and knowledge of local regulations.[26]

In 1992, about 5 percent of the total number of construction workers were employed in water, sewer, and utility lines services.[27] The American Academy of Environmental Engineers

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[18] American Consulting Engineers Council official, telephone interview by USITC staff, Sept. 27, 1994.

[19] Associated General Contractors of America official, telephone interview by USITC staff, Sept. 27, 1994.

[20] "The Top 500 Design Firms," *Engineering News-Record*, (Apr. 4, 1994), p. 42.

[21] Environmental consultants perform "diagnostic work and conceptual planning including sampling, monitoring, analysis, feasibility studies, and other such services." Lorenz, 1992, p. 486.

[22] Raymond H. Hill, "Globalization: The Next Frontier for Environmental Service Firms," *EI Digest* (Sept. 1993), p. 4.

[23] The leading 25 U.S.-based international environmental engineering and consulting firms maintain a total of 490 overseas offices, with 40 percent of these overseas offices in Western Europe. "Environment Today" (July 1993), as cited in Richard K. Miller and Associates, Inc., *International Environmental Markets - 1994 Edition*, pp. 24-26.

[24] Black and Veatch *1992 Annual Report* and The Parsons Corporation *1993 Annual Report*.

[25] Richard K. Miller and Associates, Inc., *International Environmental Markets - 1994 Edition*, p. 26.

[26] Jean Parvin, "Gearing up for Long-term Growth," *Engineering News-Record: Special Advertising Section - Environmental Market* (Feb. 15, 1993), p. E-3.

[27] U.S. Department of Labor, *Employment and Wages: Annual Averages, 1992*.

estimates that there are between 30,000 and 70,000 environmental engineers practicing in the United States, which they claim is between 1.5 and 3.5 percent of the total engineering profession.[28]

Revenues

Revenues for U.S. engineering and construction firms in W&WW services are shown in table 3-3. In 1993, U.S. engineering firms' revenues in sewer and waste were 6 percent of worldwide revenues and 8 percent of domestic revenues. Water supply accounted for 3 percent of worldwide and domestic revenues. Sewer and waste accounted for 3 percent of the total 1993 value of U.S. construction firms' new worldwide contracts and for 4 percent of total domestic contracts. Water supply accounted for 1 percent of both new worldwide and domestic contracts.[29]

Approximately 55 to 60 percent of environmental consulting engineering revenues are derived from private industry, with the remainder accounted for by government contracts.[30] Government entities account for a larger percentage of construction contracts in W&WW since many of the projects are for municipal W&WW, but exact data are not available.[31] For design and construction firms, operating in the industrial W&WW market is quite different from operating in the municipal market. Industrial projects are smaller and more specialized. Because fewer people are involved, the decision-making process is quicker. The contractual relationship is generally easier, and financing is more readily available.[32]

Table 3-3
Engineering and construction services: U.S. revenues, 1992 and 1993

	(Billion dollars)	
	1992	1993
Engineering:		
Total billings	33.9	31.7
Domestic	27.3	26.0
Total sewer and waste[1]	1.9	2.0
Total water supply	1.1	1.1
Construction:		
Total value of new contracts	230.4	217.8
Domestic	155.7	152.4
Total sewer and waste[1]	5.5	5.7
Total water	2.5	2.6

[1] Includes solid waste.

Source: *Engineering News-Record*, Apr. 5, 1993, pp. 34-73; May 24, 1993, pp. 36-79; Apr. 4, 1994, pp. 34-81; and May 23, 1994, pp. 40-84.

[28] John M. Buterbaugh, "Outlook for Careers in Environmental Engineering Promising Despite Slower Market Growth," *Engineering News-Record: Special Advertising Section - Environmental Engineering*, (June 6, 1994), p. E-26.

[29] Revenues for design engineers are based on total billings for the top 500 U.S. firms; revenues for construction firms are based on the value of total new contracts for the top 400 U.S. firms.

[30] "Foundation for the Future," *Environmental Business Journal*, vol. III, No. 4 (Apr. 1994), p. 9.

[31] Associated General Contractors of America official, telephone interview by USITC staff, Sept. 27, 1994.

[32] Industry officials, interview by USITC staff, Washington, DC, June 29, 1994.

Exports

Because overseas markets are viewed as risky by U.S. firms, a higher rate of return is sought. Since relatively low rates of return are realized for municipal W&WW projects the foreign market is not very attractive.[33] In terms of industrial wastewater projects, U.S. design and construction firms have a competitive advantage over British, French, and German firms, and U.S. firms reportedly have notable opportunities in this market in Europe.[34] The majority of large W&WW projects, however, are for municipal systems rather than industrial projects.

Design services and construction management reportedly constitute a significant portion of export revenues related to water projects.[35] Asia and Latin America are the principal markets for U.S. engineering services in the W&WW field. The European Union (EU) is an increasingly important market for U.S. environmental engineering and construction firms.[36] Other important markets are Eastern Europe, the Commonwealth of Independent States, and the Pacific Rim.[37]

Three U.S. firms ranked among the top 10 international construction firms in water services. In sewer and waste[38] services, 6 of the top 10 construction firms were U.S. firms.[39] There was just one U.S. firm in the top 10 international design firms in water services. In sewer and waste services, 3 of the top 10 design firms were U.S. firms and appear in the top 4 of this list.[40]

In 1993, in comparison with exports of other U.S. construction services,[41] water, sewer/waste, and hazardous waste were the least exported, with less than 3 percent, combined, of total U.S. construction exports.[42] With total U.S. construction exports in 1993 equaling $61.1 billion,[43] exports of water supply and sewer/waste construction services would have been less than $2 billion.

Of the same services, manufacturing plants, water supply, and sewer/waste were the least exported in terms of U.S. design services in 1993, at less than 5 percent of total U.S. design firm exports.[44] With total U.S. design firm exports in 1993 reaching $5 billion,[45] exports of water supply and sewer/waste design services would have been less than $250 million.

Marketing practices

Whereas engineering contracts are generally won on the basis of technical proposals, price is an important factor for U.S. construction firms bidding on domestic projects. Engineering firms are evaluated on the basis of qualifications, with price negotiated only after a firm is selected.[46] According to questionnaire responses, firms competing for public works W&WW construction projects are generally prequalified to determine their ability to perform the task. Then, the qualified

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[33] Ibid.
[34] Ibid.
[35] OTA, *Industry, Technology and the Environment: Competitive Challenges and Business Opportunities*, OTA-ITE-586 (Washington, DC: GPO, Jan. 1994), p. 135.
[36] Richard K. Miller and Associates, Inc., *International Environmental Markets - 1994 Edition*, p. 134.
[37] Ibid., pp. 207 and 302.
[38] Includes solid waste.
[39] "The Top International Contractors," *Engineering News-Record* (Aug. 29, 1994, pp. 26-42.
[40] "The Top 200 International Design Firms," *Engineering News-Record* (July 25, 1994), p. 24.
[41] General building, industrial/petroleum, transportation, power, and manufacturing plants.
[42] "The Top 400 Contractors," *Engineering News-Record* (May 23, 1994), p. 84.
[43] "The Top International Contractors," pp. 26-42.
[44] "The Top 500 Design Firms," p. 81.
[45] "The Top 200 International Design Firms," p. 22.
[46] If a price cannot be agreed upon, the client can then choose another firm.

firms bid for the project, competing primarily on price. Little marketing is required, except perhaps in the prequalification stage, as municipal contracts are all publicly bid.

According to questionnaire responses, construction firms identify prospective industrial W&WW projects through such methods as reporting services, industry contacts, and advertising. A construction firm typically submits a detailed proposal to the prospective client. The proposal generally would contain information concerning the qualifications of personnel that would be assigned to the project and information relating to the firm's past record in timely completion of projects and ability to complete work within budget. Marketing plays a more important role in the industrial market, as price is not necessarily the primary consideration.

Construction and engineering firms indicated in the USITC questionnaires that they accomplish domestic marketing by visiting potential clients to keep abreast of upcoming projects, maintaining a marketing or sales representative in each office, sending mailers periodically to municipalities, and relying on established relationships of senior management with client counterparts.

Internationally, a number of services to which engineering and construction firms can subscribe publish notices of calls for tenders on municipal projects. Work is also secured through such funding organizations as the U.S. Agency for International Development (USAID) and the World Bank.[47] Industry sources report that price is a major factor in bidding for overseas projects, with quality and reputation being less important.[48] Marketing is often accomplished through foreign offices of the parent.

U.S. engineering and construction firms reportedly are not competitive in the international market on the basis of price alone but often are when other factors are taken into consideration.[49] The cost of U.S. expatriate labor and travel expenses are the two biggest factors affecting U.S. price competitiveness. One source reports that U.S. engineers can be price competitive with engineers from other developed nations, but not with local engineers in developing nations or in former Eastern Bloc countries, where professional salaries range between 10 percent and 50 percent of their U.S. counterparts. However, U.S. engineering and construction firms do enjoy certain other advantages over their foreign competitors, including project management, quality, technology, reputation, and experience.

Other countries' design and construction industries generally offer turnkey services, including engineering, construction, equipment, and operation and maintenance services, whereas the U.S. industry traditionally approaches each of these aspects separately. This often works to the disadvantage of U.S. firms when competing with foreign firms in overseas markets, as foreign clients generally prefer to obtain these services from as few firms as possible. According to industry sources, U.S. firms find it difficult to compete with French companies like Compagnie Générale des Eaux (CGE) and Lyonnaise des Eaux-Dumez (Lyonnaise) (see chapter 4 for more information on these companies), because the nature of the U.S. market, particularly the municipal market, has kept them from becoming fully integrated. Because of this lack of integration, they do not have the capital available to these foreign conglomerates.[50] Some of the larger U.S. firms are beginning to offer turnkey services as they obtain the capital to do so.[51]

For the general U.S. engineering and construction industry, R&D investments lag behind those of major competitors. One source reports that Japanese firms' R&D expenditures are 20 times

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[47] Questionnaire responses.
[48] Ibid.
[49] The information in this paragraph is obtained from questionnaire responses.
[50] Industry officials, interview by USITC staff, Washington, DC, June 29, 1994.
[51] Ibid.

those of U.S. firms.[52] Moreover, sources report that U.S. companies rarely employ foreign developments in their applied research.[53] Foreign industry observers report that there is more innovation in wastewater treatment in terms of application of technology than in the equipment and technology itself. This may tend to favor some U.S. competitors, such as the United Kingdom, who claim to be stronger in the application of technology than in the development of new technology.[54]

Environmental Testing Services

There are about 1,500 commercial environmental testing services firms in the United States performing bioassays, field testing, and other toxicological and analytical tests.[55] Virtually all the environmental testing laboratories engage in testing for the W&WW market.[56] During the 1980s, demand for environmental testing services grew significantly, making the provision of such services quite profitable. This encouraged an increase in capacity, with capacity eventually exceeding demand, causing depressed prices at a time when operating costs were continuing to rise.[57] At the same time, many optional environmental compliance projects were cancelled or scaled down, exacerbating the situation. By late 1989, the industry began to consolidate as larger environmental testing firms acquired smaller laboratories.[58]

Environmental testing laboratories analyze water and wastewater to determine contamination levels from chemicals, microbiologicals, and particulates. W&WW testing reportedly is the largest, but slowest growing market for environmental testing laboratories.[59] According to the Environmental Business Journal, environmental laboratories derive 24 percent of their revenues from water-related testing.[60] One consultant put the total market for analytical services at about $1.5 billion in 1994.[61]

Producers

In the United States, environmental testing laboratories are run either by independent companies or by government, with each accounting for half of the U.S. commercial testing laboratory industry. However, the balance is shifting toward independent laboratories. Another recent change is from the once traditional fixed-site laboratory to onsite or field testing laboratories, which reduce cost and response time.

Environmental testing services can be part of vertically integrated firms, such as consulting engineering firms. Many consulting, engineering, and remediation firms that had acquired environmental testing capabilities to further their vertical integration in environmental services have been divesting themselves of these capabilities because of low profitability levels.[62]

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[52] Henry Michel, "Can the United States Compete?" *Worldwide Projects* (spring 1993), p. 37.
[53] Some examples are tunnel liners and the use of underground space for noxious industries, e.g., sewage treatment plants. Michel, "Can the United States Compete?" p. 37.
[54] ECOTEC Research and Consulting Ltd. and The Joint Environmental Markets Unit, (Department of Trade and Industry and Department of the Environment), *The U.K. Environmental Industry: Succeeding in the Changing Global Market* (London, 1994), p. 63.
[55] Ibid., and Lorenz, 1992, p. 440.
[56] Industry official, interview by USITC staff, Washington, DC, June 30, 1994.
[57] Lorenz, 1992, p. 434.
[58] Ibid., p. 435.
[59] Advanced Sciences, Inc., *Environmental Industry Infrastructure Phase II Report*, predecisional draft (Oct. 15, 1993), p. 28.
[60] "The Dawn of the Water Era," p. 3.
[61] *The Sixth Annual State-of-the-Industry Report* (Washington, DC: Farkas Berkowitz and Co., Mar. 1994), p. 20.
[62] Joan B. Berkowitz, *The Environmental Protection Industry: Outlook 2001* (Washington, DC: Farkas Berkowitz and Co.), p. 16; and industry official, interview by USITC staff, June 30, 1994.

Industry sources indicate that, because the cost to establish laboratory services overseas is high, most U.S. laboratories have not ventured abroad.[63] Revenues earned in foreign markets by U.S. laboratories are generally from U.S. multinational corporation clients, with the actual testing being performed in the United States. Industry sources report that there is a small incidence of foreign ownership in the U.S. commercial lab industry; countries represented include Britain and Denmark.[64]

Revenues

North America, primarily the United States, is the largest world market for environmental testing services. Revenues from W&WW sampling, monitoring, and analysis services offered by environmental consultants to the various U.S. industrial clients were estimated at about $30 million in 1981, increasing to $100 million in 1991.[65]

The leading four U.S. environmental testing firms, with annual revenues of $40 million to $80 million each, account for 16 percent of the overall environmental testing market. The next 25 firms account for 33 percent of the market, with annual revenues of $11 million to $25 million each. The remaining approximately 1300 firms, with annual revenues of less than $10 million apiece, account for the remaining 51 percent. Most of these firms have revenues under $3 million.[66] The overall independent analytical testing laboratory industry has an estimated 2,900 laboratories employing 65,000 people.[67] Information on testing services specifically for W&WW is unavailable.

Exports

U.S. laboratories have avoided foreign markets because of the risk of non-payment, political instability, inadequate intellectual property protection and lack of available credit.[68] Only about 2 to 3 percent of total U.S. environmental testing lab revenues are derived from exports.[69] Export earnings by the U.S. environmental testing industry are estimated at $40 million, with over half of these earnings from U.S. multinational corporations in the Western Hemisphere.[70] They are beginning to use foreign offices and foreign sales representatives, but participation in joint ventures and technology licensing is virtually nonexistent.[71] The primary obstacle U.S. laboratories face in foreign markets appears to be a lack of capital to build onsite laboratories.[72]

Mexico is the largest foreign market for U.S. environmental testing services, followed by Canada, Germany, the United Kingdom, and Japan.[73] Foreign markets regarded as having potential for growth in demand for U.S. services include Mexico, Canada, Western Europe, the Caribbean, Central and South America, the Pacific Rim, and the Commonwealth of Independent States.[74]

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[63] Questionnaire responses.
[64] Industry official, interview by USITC staff, June 30, 1994.
[65] Ibid., p. 436.
[66] *The Sixth Annual State-of-the-Industry Report*, p. 21.
[67] Lorenz, 1992, p. 440.
[68] Ibid., p. 25.
[69] Environmental Business Research, *Assessment of U.S. Environmental Technology Strengths and Applications: A Report for the Office of Energy and Infrastructure*, report no. 94-01 (Jan. 1994), p. 23.
[70] Ibid., pp. 23 and 26.
[71] Ibid., p. 25.
[72] Questionnaire responses.
[73] *Assessment of U.S. Environmental Technology Strengths and Applications*, p. 24.
[74] Questionnaire responses.

Marketing practices

U.S. laboratory services firms consider themselves to be very competitive, and have such advantages as reputation for quality, experience, volume capabilities, and state-of-the-art technology.[75] Principal competitive factors for laboratories include electronic data reporting capabilities, the quality and format of reports, technical skills, special capabilities and certifications, personal relationships, geographic location, customer service combined with price, and turnaround time or responsiveness.[76] Some laboratories attempt to improve their competitive positions by establishing regional facilities in order to gain specialized knowledge of regional regulatory mandates and to locate nearer to customers.[77]

Goods

W&WW goods have been grouped into four categories: (1) instruments, (2) process equipment, (3) delivery equipment, and (4) chemicals. All these categories include end-of-pipe treatment equipment, as well as equipment that can be used to change production processes in order to reduce the amount or concentration of the liquid wastes produced.

Instruments

The United States is the world's largest producer of instruments, including those for water and waste water treatment, and is the leading producer of many advanced-technology instruments and systems. The U.S. instrument industry is believed to manufacture about 45 percent of the world's production of process control instruments, analytical instruments, and on-line analyzers, and produce approximately 80 percent of the instruments used for water treatment in the United States. According to the Environmental Business Journal, environmental instrument manufacturers obtain 37 percent of their revenues from W&WW applications.[78] The U.S. instrument industry supplies approximately 60 percent of world's analytical instruments.

The strong competitive position of the U.S. instrument industry in domestic and foreign markets is due to a number of factors, including high investment in research and development, technological sophistication, competitive prices, and aftersales service. In addition, many of the leading U.S. instrument manufacturers have production and distribution capabilities in many industrialized countries, including Germany, Britain, Japan, and Canada.

Producers

There are approximately 3,200 U.S. establishments primarily engaged in the manufacture of all types of measuring, testing, controlling, and analyzing instruments and systems. Most of these manufacturers can produce instruments for W&WW treatment.[79] However, most of the instruments and systems purchased for water treatment are supplied by about 150 to 200 U.S. producers.

The U.S. instrument industry is highly fragmented, with most of the instruments produced by a large number of medium and large enterprises, but with none of these firms accounting for a high proportion of total U.S. shipments. However, a major part of the sophisticated analytical

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[75] Ibid.
[76] International Association of Environmental Testing Laboratories, *Environmental Testing Laboratory Survey - An Analysis of Key Industry Statistics*, exhibit VII-4 (Dec. 1993).
[77] *The Sixth Annual State-of-the-Industry Report*, p. 23.
[78] *The Dawn of the Water Era*, p. 3.
[79] Based on information obtained from "Control for the Process Industries," (Sept. 1993), pp. 48-65.

instruments, on-line analyzers, and water meters used for water treatment are produced by a relatively small number of the leading instrument manufacturers. No producer dominates the market. Virtually all of the firms producing instruments for water treatment also produce instruments for other markets, and sales for water treatment generally account for a relatively small portion of total sales. Most of these firms are relatively small enterprises and generally produce only a select number of specialty instruments.

During 1990-93, the estimated number of employees of the U.S. industry engaged in the manufacture of instruments for water treatment declined slightly because of improved production efficiencies and the growing practice of assembling highly labor-intensive parts and components, especially electronic types, in low labor cost countries. Because most of the products made by the industry are technology-intensive, skilled workers and professionals account for a large share of the work force. In contrast to other instruments, most water meters are relatively low-technology products, and, as a result, most of the work force manufacturing them is composed of low-skilled workers.

In recent years the U.S. instrument industry has experienced increased foreign competition as other countries' instrument industries have matured and grown in scope and capabilities. Direct foreign investment in the U.S. instrument industry has increased measurably,[80] and a number of the leading U.S. instrument manufacturers have been acquired by or entered into partnership with foreign firms. In addition, a number of foreign instrument manufacturers have established manufacturing and distribution facilities in the United States catering to the water treatment market and to other end users.

Revenues

The growth in U.S. shipments of instruments for water treatment (table 3-4) was primarily generated by the increase in the number of environmental laws and regulations in recent years; these laws and regulations have induced W&WW treatment facilities to invest more in instrumentation, especially in sophisticated instruments. For example, authorities increasingly require written documentation to assure that potable water and plant effluent meet standards and that measurements have been made for appropriate quality control assurance. The most accurate and economical way to produce these records is with computerized process control instruments, continuous on-line analyzers, and laboratory analytical instruments, combined with laboratory information management systems. As a result, computer-based systems are increasingly used in water treatment.[81]

The relatively small increase in U.S. shipments of analytical instruments in 1993 when compared with 1992 was mostly due to a lower demand for instruments by commercial laboratories, which was brought about by an oversupply of analytical testing capacity and decreased profitability[82] and by the weak financial condition of many local governments.[83]

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[80] Based on information obtained from the DOC, Bureau of Economic Analysis, *Survey of Current Business* (Washington, DC, Aug. 1991), pp. 77 and 106.

[81] Based on information obtained from "Computer Graphics Hierarchy for Wastewater Plant Operations," *WATER/Engineering & Management* (June 1994), p. 26.

[82] International Association of Environmental Testing Laboratories, *Environmental Testing Laboratory Survey - An Analysis of Key Industry Statistics* (Dec. 1993), p. 3.

[83] Industry official, telephone interview by USITC staff, June 14, 1994. However, based on opinions expressed in response to questionnaires of the U.S. International Trade Commission, virtually all respondents stated that they expect revenue to increase in 1994 and 1995.

Table 3-4
Process control instruments, analytical instruments, on-line analyzers, and water meters, U.S. producers' shipments, 1991-93

	(Million dollars)		
	1991	1992	1993
Process control instruments	345	355	360
Analytical instruments	440	475	480
On-line analyzers	40	45	45
Water meters	320	325	330
Total	1,145	1,200	1,215

Source: Estimated by USITC staff, based on data submitted in response to questionnaires and on other sources.

Exports

Estimated U.S. exports of instruments for use in water treatment are shown in table 3-5.[1] Approximately 60 percent of total U.S. exports of these instruments were to developed countries. The primary export markets were Canada, Mexico, Japan, Germany, France, and the United Kingdom. Most of the exports were advanced-technology instruments. In recent years, however, U.S. exports of instruments to developing countries have grown at twice the rate as those to developed countries. The fastest growing markets were Mexico, South Korea, and Taiwan.

Table 3-5
Process control instruments, analytical instruments, on-line analyzers, and water meters, U.S. exports, 1991-93

	(Million dollars)		
	1991	1992	1993
Process control instruments	73	75	76
Analytical instruments	136	147	149
On-line analyzers	12	13	13
Water meters	25	26	27
Total	246	261	265

Source: Estimated by USITC staff, based on data submitted in response to questionnaires and on other sources.

[1] Statistics relating to the value of U.S. exports of instruments used by the water treatment industry are not maintained by the U.S. Government or by the private sector. The estimated U.S. export data cited in this study are based on data submitted in response to questionnaires of the USITC, discussions with officials in the private sector, review of annual reports, 10 K reports, and other sources. During 1990-93, total U.S. exports of process control instruments, analytical instruments, and on-line analyzers grew from $3.1 billion to $4.5 billion, and total U.S. exports of water meters increased form $54 million to $79 million.

Marketing practices

U.S. instrument manufacturers, especially those producing advanced-technology products, devote a considerable effort to sales and aftersales services. Most of the medium and large U.S. instrument producers market the bulk of their products in the United States directly to end users and provide engineering and aftersales service through their own facilities. Small companies generally market a large portion of their products through independent distributors, and the remaining companies market theirs either directly to end users or through factory representatives. U.S. firms with production facilities overseas generally market and service their U.S.-made products through these subsidiaries. However, many of the large U.S. producers with significant foreign markets have wholly-owned sales, engineering, and aftersales service facilities overseas. U.S. producers with small overseas markets generally have their sales, engineering, and aftersales service handled by independent local firms.

U.S. instrument producers are subject to considerable domestic and, to a lesser extent, foreign competition in the U.S. market. Generally, manufacturers give discounts for large quantity and repeat purchases. Although price and quality are important, other purchasing considerations include conformance to technical specifications, operating cost, ability to meet desired delivery date, the level of aftersales service assistance, and compatibility with the existing system.[85] Another factor that has an impact on pricing and purchasing decisions is the growth of cooperative relationships between producers and purchasers of instruments, with manufacturers and purchasers collaborating in such areas as preliminary engineering, detailed system design, installation, startup, training, and maintenance.

Process Equipment

The process equipment components chosen by designers and users of W&WW facilities depend on the specific procedures employed by the firm or municipality to treat their water or wastewater.

Producers

There were approximately 140 firms identified as domestic producers of process equipment for purposes of the USITC questionnaire. These firms are believed to account for at least 90 percent of the domestic shipments of these products. The size of these firms ranges from firms with fewer than 10 employees in small firms with a very specific and limited product mix to firms with several thousand employees in major multinational companies.

Most U.S. firms do not produce equipment specifically for W&WW treatment but manufacture products, such as valves or filters, that are used for this and other purposes. Other manufacturers produce specialized equipment and systems, requiring that they establish a cooperative relationship with the purchaser, since development of such equipment can often be costly and involve a significant time commitment.

Exports

There is no classification of process equipment for W&WW treatment for purposes of collecting data on exports. An approximation of these data based on certain primary process equipment components is provided in table 3-6.

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[85] Based on information submitted in response to questionnaires, virtually all respondents cited price and quality as the most important factors for U.S. firms to successfully compete in U.S. and foreign markets.

Table 3-6
Process equipment for W&WW treatment: U.S. exports of domestic merchandise, 1991-93

Country	1991	1992	1993	Share of export market, 1993
	(Million dollars)			
Canada	56	72	76	15
Japan	54	45	44	9
Mexico	33	41	40	8
Korea, South	53	47	37	8
United Kingdom	34	26	28	6
Germany	18	15	15	3
France	9	10	13	3
Singapore	9	9	13	3
All other	188	192	227	46
Total	455	458	493	100

Source: Compiled from official statistics of the DOC.

Canada remains the single largest market for U.S. exports of process equipment primarily because of its proximity and the strong relationships between U.S. firms and the Canadian firms that purchase these items. The majority of these exports to Canada are reported to be for municipal water markets.[3]

Primary producers of process equipment responding to the USITC questionnaire reported that their major market for export was Western Europe, which accounted for nearly 33 percent of these firms' exports. The major market segment in Western Europe for these exports was reported to be the treatment of municipal water.

Marketing practices

Producers of process equipment market their product to all potential purchasers throughout the industrial and municipal W&WW treatment market. The largest industrial purchasers of process equipment are the chemical, food processing, paper, and petroleum industries.

Of the firms responding to the USITC questionnaire, nearly 40 percent of the revenues of firms producing primarily process equipment are derived from local industry end-users. The second largest market segment served by these firms is local and municipal government. The two factors these firms cite most often as determining their ability to compete in the domestic market are price and quality.[4] Other competitive factors are company name recognition and reputation, and the ability of the firm to meet specific needs of the purchaser. Decisions concerning the type of system needed to meet environmental requirements determined by whether environmental regulations are based on technology or on performance. If requirements are based on the performance of a system, as measured by the quality of the effluent, the availability of the purchaser to obtain or the seller to provide project financing to cover costs of more expensive systems enters into purchase decisions.

[3] Questionnaire responses.
[4] Ibid.

Delivery Equipment

To treat and purify water, municipal and industrial W&WW treatment facilities use delivery equipment components such as pumps, pumping equipment, industrial valves, pipes, and storage tanks. These multiple-use products are used in all phases of W&WW treatment and in distribution and collection systems.

Producers

The United States is the world's largest producer and consumer of delivery equipment for W&WW, with the exception of pumps and pumping equipment. In 1993, an estimated 616 U.S. establishments produced pumps, pipes, valves, and storage tanks and employed approximately 42,000 production workers. The workers producing these products ranged from low-skilled, assembly-line workers to highly skilled engineers. Nearly all delivery equipment producers can manufacture equipment and components for other industrial uses and applications.

The industry producing the majority of delivery equipment covered in this report is a capital-intensive, mature industry. Several of the largest firms in this industry are multinational firms that distribute their products globally through direct export, foreign subsidiaries, or various licensing arrangements.

Exports

Total U.S. exports of delivery equipment typically represent between 13 and 17 percent of U.S. factory shipments.[88] Principal export markets for delivery equipment were Canada, the EU (in particular Germany, the United Kingdom, and France), and Mexico. According to industry sources, a significant portion of U.S. exports of delivery equipment consists of specialty equipment of novel design or high quality that is not readily available from foreign sources. The majority of world trade for these products is accounted for by multinational corporations and their subsidiary firms.

Marketing practices

W&WW delivery equipment is typically sold directly to end users or through distributors. The primary competitive factors are price and the ability to meet advanced technology requirements in select market niche areas. Additional marketing factors include operating efficiency, customer service and equipment maintenance, and compliance with industrial, environmental, and safety standards.

The foreign market for delivery equipment can be separated into the new equipment market and the replacement market. New equipment is sold principally to general contractors for incorporation into utility systems being constructed for municipalities, industries, government agencies, and private utilities. The market demand for delivery equipment is cyclical, fluctuating with new construction activity and government expenditures.

According to industry sources, the replacement market accounted for as much as 50 percent of the delivery equipment market in 1993.[89] The replacement market is affected by the age and failure rate of delivery equipment and the desire to reduce operating costs through the use of more efficient products. Reliability, and aftersale service frequently figure as the major reasons in the replacement market for repeat purchases of the same brand.

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[88] Officials of The Water Systems Council, telephone interview by USITC staff, Aug. 1, 1994.
[89] Officials of the American Water Works Association, telephone interview by USITC staff, Apr. 29, 1994.

Chemicals

Chemicals[90] are used primarily in the treatment of water and secondarily in the treatment of wastewater, especially for sludge separation, to facilitate specific treatment processes or systems. These processes or systems primarily involve the addition of chemicals to water to help remove contaminants.

Producers

Producers of the chemicals used in W&WW treatment include large chemical companies as well as specialty chemicals producers. Of the chemical firms that produce water treatment chemicals, several firms specialize in a specific product types (for example, filter media or ion exchange resins) and produce a very limited number of products.

Companies that produce chemicals used in significant quantities for water treatment consist of both small regional suppliers and major multinational firms. Of the major domestic producers, the majority are multinational, either through ownership of subsidiaries in other nations or through affiliation with, or ownership by, foreign producers. Also, domestic firms seek to expand their markets by purchasing existing foreign firms.

There are 16 firms that make about 78 percent of the chemicals produced domestically for W&WW treatment. The largest domestic producer, a major producer of specialty chemicals, accounted for an estimated 19 percent of sales in 1993. There are a large number of regional producers that make up the remaining 22 percent of production.[91]

Employment in the U.S. chemical industry has remained fairly constant during the past several years. However, as demand for W&WW treatment chemicals has increased steadily (as opposed to a more stable level of chemical production for most industrial chemicals), it is believed that employment engaged in the production of these items has increased.

Revenues

The U.S. market for W&WW treatment chemicals, which is estimated to be $2-2.6 billion is satisfied primarily from domestic production. U.S. demand for these chemicals represents more than 50 percent of the world's demand. However, as with other areas of the water treatment market, those chemicals used in W&WW treatment are rarely produced specifically for this purpose. Water treatment may sometimes be a secondary or tertiary use for these chemicals.

Domestic consumption of such traditional water treatment chemicals as chlorine, lime, sodium chloride, and aluminum salts is anticipated to remain stable or even decrease in the coming 5-year period as new products enter the market.[92] Also, a new generation of prepackaged plants are being marketed for onsite production of the chemicals needed to treat water or wastewater. Such plants have been designed to produce large quantities of the necessary chemicals on an as-needed

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[90] Examples of the types of chemicals used in water and wastewater treatment, according to function, are as follows: coagulants and flocculants, ion exchange resins, filter media and adsorbents, oxidizers and biocides, Ph adjusters and softeners, corrosion and scale inhibitors, chelating agents, defoamers, and fluoridation chemicals. The specific chemicals most often used in these roles are bromine and its derivatives, carbon, chlorine, copper sulfate, cyclohexlamine, dimethylamine, ferric chloride, hypochlorite bleaches, hydrofluosilicic acid, hydrogen peroxide, ozone, polyacrylamides, polyacrylics, polyamines, sodium carbonate, sodium hydroxide, and sodium silicates.

[91] *Chemicalweek* (May 11, 1994), pp. 35-41.

[92] "Demystifying Water Treatment," *Chemical Engineering* (Sept. 1994), pp. 71-73.

basis, allowing users to avoid large front-end purchases that involve significant outlays of capital resources.

Exports

The United States is believed to be one of the largest volume exporters of water treatment chemicals, exporting some $210 million of W&WW treatment chemicals in 1993 (table 3-7).[10] The primary markets are Canada, which accounted for approximately 27 percent of U.S. exports, Japan, and Mexico. The remainder of exports enter a large number of different world markets, primarily in Western Europe, Latin America, and Asia.

Table 3-7
Water and wastewater treatment chemicals: Estimated U.S. exports by country, 1991-93

Country	1991	1992	1993	Share of total exports, 1993
	(1,000 dollars)			(Percent)
Canada	52,445	54,476	56,366	26.88
Japan	16,564	13,680	19,098	9.11
Mexico	18,865	20,276	18,507	8.83
Australia	5,933	22,327	10,292	4.91
Netherlands	6,321	7,690	9,326	4.45
United Kingdom	8,277	6,064	8,880	4.24
Belgium	6,026	7,039	8,187	3.90
Colombia	3,705	4,494	4,807	2.29
Venezuela	4,286	3,487	4,432	2.11
Brazil	1,639	2,497	4,048	1.93
South Korea	7,377	5,046	4,023	1.92
Israel	2,341	2,896	3,929	1.87
Hong Kong	2,009	2,185	3,614	1.72
France	2,296	4,065	3,534	1.69
Germany	3,964	4,887	3,292	1.57
All other	60,928	54,032	47,333	22.58
Total	202,976	215,141	209,668	100.00

Source: Compiled from official statistics of the DOC.

The major U.S. exports of W&WW treatment chemicals are activated carbon and ion exchangers (table 3-8). These two items together are estimated to account for nearly 45 percent of total U.S. exports of W&WW treatment chemicals.

[10] As there are no specific subheadings in the Harmonized Tariff System addressing chemicals for water and wastewater treatment, an estimate is based on statistics for several prominent water and wastewater treatment chemicals, including activated carbon, bromine products, caustic soda, chlorine, hydrogen peroxide, hypochlorite bleaches, ion exchangers, and sodium silicate.

Marketing practices

The primary consideration in marketing and purchasing decisions concerning W&WW treatment chemicals involves whether the product will accomplish the prescribed goals for a specific treatment process. Price is generally a secondary consideration since the fines and other costs that may result from a failure to meet Federal or municipal standards for water quality would likely far exceed the cost of chemicals.

The price and the associated cost of the materials do enter into the marketing process when two or more vendors offer similar products. However, it is more often the case that the accompanying guarantees on the product and associated services are the determining factors. In foreign markets, additional related factors become important, particularly familiarity and responsiveness to a foreign firm's standards and requirements.

Table 3-8
Activated carbon and ion exchangers: Estimated U.S. exports by country, 1991-93

Commodity and market	(1,000 dollars) 1991	1992	1993
Activated carbon:			
Canada	9,862	9,297	11,266
Belgium	5,901	6,624	6,576
Japan	4,939	4,730	6,076
United Kingdom	1,809	1,624	5,345
Netherlands	3,314	2,900	5,041
Mexico	1,862	2,208	2,021
Australia	692	1,159	1,966
Israel	611	234	1,954
South Korea	2,730	1,446	1,716
Singapore	492	2,167	1,672
Hong Kong	239	430	1,560
Italy	1,101	1,058	1,327
Germany	831	1,911	1,272
Ecuador	1,556	1,186	1,205
Ireland	64	69	1,140
France	842	1,782	1,090
All other	9,134	9,039	9,097
Total	45,979	47,864	60,324
Ion exchangers:			
Canada	8,361	9,207	10,074
Japan	8,905	6,372	7,244
Mexico	4,560	7,340	3,063
France	1,018	1,614	1,971
Germany	2,687	2,153	1,170
Belgium	18	0	1,040
Taiwan	624	1,502	1,035
United Kingdom	1,395	864	819
China	867	68	710
Italy	1,469	1,003	697
South Korea	532	852	611
Singapore	290	650	479
Argentina	260	115	450
Brazil	333	63	389
Hong Kong	276	121	329
Thailand	99	268	313
All other	3,508	2,990	2,595
Total	35,200	35,184	32,987

Source: Compiled from official statistics of the DOC.

CHAPTER 4

MAJOR FOREIGN PRODUCERS

Overview

The United States' major competitors in providing services to and producing equipment for the municipal and industrial W&WW markets are the United Kingdom, France, Germany, and Japan, particularly the United Kingdom and France in services. The United Kingdom and France have gained a competitive edge worldwide largely because of the extensive privatization of their domestic W&WW services, giving the companies that provide these services a strong base from which to expand internationally. A description of the market in the European Union and in each of these countries follows, indicating the extent to which privatization has occurred and how it affects these companies and their success in competing abroad. This chapter also provides a discussion of several sectors of the foreign industries that supply goods and services for W&WW treatment.

Structure and Dynamics of the Market

European Union

An average of 95 percent of the population of Western Europe has access to piped water, with a low of 80 percent in rural Portugal. The wastewater infrastructure is not nearly as widespread. According to consultants Beddows & Co, only 54 percent of the EU population was connected to adequate wastewater treatment plants by 1990, ranging from over 80 percent in the United Kingdom and Germany to less than 24 percent in Spain and Italy. Even major European cities such as Brussels and Milan have inadequate sewage treatment facilities.[1] This is consistent with World Health Organization data, which show that, in 1990, EU countries served the following percentage of their populations with wastewater treatment:[2]

	Primary	Secondary	Tertiary	Total
Belgium	45	0	0	45
Denmark	25	65	5	95
France	40	0	0	40
Western Germany	11	81	8	100
Greece	18	0	0	18
Ireland	15	54	1	70
Italy	NA	NA	NA	NA
Luxembourg	8	84	0	92
Netherlands	7	75	3	85
Portugal	20	23	2	45
Spain	17	9	0	26
United Kingdom	10	80	10	100

By comparison, 11 percent of the U.S. population was served with primary treatment, 31 percent with secondary treatment, and 27 percent with tertiary treatment.[3]

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[1] John Bruce-Jones, "The European Water Market: Why Americans Should Take the Plunge," *Environmental Business Journal (EBJ)*, vol. IV, No. 2 (Feb. 1991), p. 3.

[2] Water Services Association, *Waterfacts '93*, p. 42.

[3] NatWest Securities Ltd., *U.S. Wastewater Privatisation* (London, Jan. 1993), p. 6.

Capital spending in EU countries on pollution control, mainly in the public sector, is approaching $15 billion a year; more than a third of such spending is on water purification and wastewater treatment systems.[4] For combined capital and operating costs, ECOTEC estimates the pollution control market for W&WW treatment in the EU to be $13 to 15 billion, not including delivery equipment.[5] Table 4-1 sets out estimates for expenditures on water purification and wastewater treatment in various European markets.

Table 4-1
Water and wastewater treatment expenditures in the European Union, 1990 and 1991

(Million dollars)

Country	1990 Water treatment (capital and operating costs)[1]	1990 Wastewater treatment (capital and operating costs)[1]	1991 Water and wastewater treatment (capital expenditure)[2]
Belgium	117	85	NA
Denmark	9	140	88
France	1,103	922	1,062
Germany	1,705	1,611	1,769
Greece	81	36	11
Ireland	53	31	106
Italy	765	580	354
Luxembourg	9	23	3
Netherlands	397	391	NA
Portugal	122	126	265
Spain	412	125	NA
United Kingdom	1,464	1,518	1,769
Total EU	6,237	5,588	5,428

[1] Water Services Association, *Waterfacts '93*, p. 44.
[2] Euromonitor Plc, *The World Environmental Business Handbook: Global Industry Strategies for the 1990s* (London, 1993), p. 49.

United Kingdom

The Water Act of 1989 privatized the W&WW systems of England and Wales, set strict standards for drinking water quality, and created several new regulatory agencies, separating regulation from management and provision of services. It created 10 W&WW businesses that provide wastewater services for 99 percent of the population and drinking water for 75 percent. Unlike in most other countries, in the United Kingdom the public sewers also accept large quantities of industrial wastewater (50 percent of the industrial load) for treatment and disposal.[6] Twenty-two smaller water companies supply drinking water to most of the rest of the population. In recent years, over half the statutory water companies have been acquired by one of the three major French

[4] Euromonitor Plc, *The World Environmental Business Handbook: Global Industry Strategies for the 1990s* (London, 1993), pp. 49-50.
[5] ECOTEC, *The UK Environmental Industry*, p. 35.
[6] Global Environment & Technology Foundation, *International Environment and Trade Project--A Strategic Approach*, vol. II (May 5, 1994), p. A.44.

companies--CGE, Lyonnaise, or Société d'Aménagement Urbain et Rural (SAUR)--or by Biwater, a British company.[7] (See box on pages 4-4 and 4-5 for information on the British water companies.)

Economic regulation of these companies takes the form of a price cap formula that currently allows water charges to rise at a level above the rate of inflation in order to fund new investment. This formula is common to all privatized utilities in the United Kingdom.[8]

As part of privatization, the companies were offered what has been called a "green dowry": the Government wrote off the companies' $8 billion debt and provided an additional cash infusion of $2.8 billion. As a condition of the terms, the companies agreed to a 10-year $40 billion capital expenditure program.[9] Additional funds were raised through the public sale of shares in the new water holding companies. The holding companies owned the W&WW companies and were also allowed to diversify into other related businesses, such as W&WW process engineering, consulting, industrial W&WW treatment, and other environmental services. Privatization and the subsequent investment by the public have provided several of the British water companies with the base to expand internationally. By comparison, most U.S. competitors are small and limited in territorial coverage, because, unlike in the United Kingdom and France, most U.S. municipalities have provided W&WW services themselves. There are plans to invest $45 billion by 2000, including $13.7 billion to improve the quality of drinking water, rivers, canals, estuaries, and coastal waters; this includes $3 billion to bring drinking water up to EU standards.[10]

Several of the British water companies are active in the U.S. market. Anglian Water formed a joint venture with American Water Works Company in 1993 to concentrate on the privatization of municipal wastewater services. Anglian is also searching for operation and maintenance contracts, public and private partnerships, and ownership opportunities throughout the United States, mainly in smaller municipalities.[11] Thames Water's PWT subsidiary is active in the U.S. market. In 1994, Yorkshire Water formed a joint venture, Ogden Yorkshire, with Ogden Projects to provide contract operations for municipal and industrial W&WW facilities.[12] North West Water Group owns U.S. Water as well as a number of U.S. equipment firms. Severn Trent owns several equipment and services firms, including PSC Environmental Services.[13]

In 1990-91, direct environmental expenditure in the United Kingdom is estimated to have been $21 billion, or 2.5 percent of gross domestic product (GDP), with spending on water accounting for almost half. Of this $21 billion, capital expenditure is estimated to account for $7.3 billion, and current operating costs, $13.7 billion. Thirteen billion dollars relates to pollution abatement, with $4.7 billion (36 percent) spent on water pollution abatement.[14] The market for water pollution control equipment was approximately $200 million in 1993.[15]

In 1993 imports of water pollution control equipment were worth $75 million and accounted for 38 percent of the total market. Imports from the United States were approximately $20 million and accounted for 27 percent of total imports.[16]

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[7] The Water Companies' Association, *Water Supply Companies Factbook*, 1993-1994.
[8] NatWest Securities Ltd., *U.S. Wastewater Privatisation*, p. 7.
[9] "Thames Water Makes Waves," *Management Today* (Jul. 1991), p. 36.
[10] *This Common Inheritance: Britain's Environmental Strategy* (London, May 1994), p. 98.
[11] Anglian Water plc, *Annual Report 1994*, p. 18.
[12] U.S. industry official, telephone interview by USITC staff, Aug. 23, 1994.
[13] For a more complete description of the British firms' U.S. holding, see "Europeans Stake Out U.S. Water Market," *EBJ* (Nov./Dec. 1994), pp. 8-11.
[14] *International Environment and Trade Project*, p. A.43.
[15] DOC, Market Research Reports, *United Kingdom -Water Pollution Control Equipment*, ISA9403 (Sept. 27, 1994).
[16] Ibid.

As indicated in table A, the British water companies are quite profitable, with operating profits averaging 31 percent and net profits 16 percent of revenues. Operating profits are calculated by subtracting operating costs from revenues. Net profits are calculated by further subtracting or adding interest, taxes, and profits or losses from or to associated undertakings.

In 1993, in the regulated business of water supply and wastewater treatment, there were approximately 45,000 full-time equivalent employees working in the 32 water companies, with revenues over $8 billion. Through a network of 1,255 water treatment plants and 6,424 sewage treatment works, they provided 19.4 million domestic customers and 1.7 million nondomestic customers with water--a total of 50.2 million people--and 19.0 million domestic customers and 1.3 million nondomestic customers with sewage services--a total of 50.3 million people.

Table A
British water companies' revenues and profits, 1993

Company	Revenues from water and wastewater	Other revenues	Total revenues	Net profit	Net profit as a share of revenues	Operating profit	Operating profit as share of revenues
	(Million dollars)				*(Percent)*	*(Million dollars)*	*(Percent)*
Anglian	879.4	153.8	1,033.2	71.8	7	251.9	24
Welsh	585.2	184.0	769.2	139.2	18	219.9	29
Northumbrian	306.6	141.9	448.5	59.9	13	116.6	26
North West	1,095.4	292.7	1,388.1	261.6	19	486.2	35
Severn Trent	1,182.8	316.2	1,499.0	268.1	18	495.6	33
Southern	479.9	42.4	522.2	118.2	23	200.7	38
South West	313.2	64.7	377.9	81.0	21	159.8	42
Thames	1,308.2	333.7	1,642.0	201.0	12	426.6	26
Wessex	326.2		326.2	94.5	29	138.5	42
Yorkshire	719.0	78.0	797.0	135.0	17	249.9	31
Subtotal	7,195.9	1,607.4	8,803.3	1,430.3	16	2,745.7	31
Water Supply Companies	[1]895.2						
Total	8,091.1						

[1] 1992.

Table B
British water companies' revenues by region, 1993

Company	UK	Europe	Americas	Asia	Other
	(Million dollars)				
Anglian	961.3				71.9
Welsh		[1]701.7		33.8	33.6
Northumbrian	416.1				[3]32.4
North West	1,158.9	35.9		166.1	27.2
Severn Trent	1,392.7				106.3
Thames	1,472.7	53.3	72.5	37.2	[3]6.2
Yorkshire	not given[4]				

[1] Including the United Kingdom.
[2] Rest of Europe, Middle East, and Far East.
[3] Africa.
[4] Yorkshire operates overseas but does not break out revenues by region.

Table C
Employment by class of business, 1993

Company	Water & sewer	Engineering	Waste management	International	Other	Total
Anglian	5,180	729		10	112	6,031
Welsh	3,102	2,671			827	6,600
North West	5,426			102	2,485	8,013
Northumbrian	1,360				1,954	3,314
Severn Trent	6,954		1,955		1,874	10,783
Southern	2,388				1,088	3,476
South West	2,141				919	3,060
Thames	6,893				3,248	10,141
Wessex	1,852					1,852
Yorkshire	3,854				914	4,768
Water Supply Companies[1]	6,356					6,356
Total	45,506	3,400	1,955	112	13,421	64,394

[1] 1992.

Table D
Population served and number of treatment works owned by British Water Companies, 1993

Company	Population served—water	Population served—wastewater	Water treatment works	Wastewater treatment works
	(Millions)			
Anglian	3.9	5.1	157	1,072
Welsh	2.8	3.1	163	986
Northumbrian	1.2	2.6	8	385
North West	6.8	6.8	191	620
Severn Trent	6.9	8.3	26	1,010
Southern	2.2	4.1	116	402
South West	1.5	1.5	55	599
Thames	7.3	11.7	120	377
Wessex	1.1	2.5	36	351
Yorkshire	4.4	4.6	129	622
Water Supply Companies	12.1	[1]	254	[1]
Total	50.2	50.3	1,255	6,424

[1] The 22 water supply companies only supply water; they do not treat wastewater.

Source: 1994 Annual Reports and *Waterfacts '93*, Water Services Association.

France

Although France's W&WW treatment services industry is well established and a strong international competitor, its domestic W&WW treatment lags behind that of other developed countries. According to figures released by the Ministry of the Environment, one third of industrial wastewater and over half of municipal wastewater is not treated before being released into waterways.[17] This is due in large part to low population density, although many large towns, especially on the coast, have no proper treatment works. Nearly 10 million people in rural areas do not have access to a public sewage system.

France has not gone as far in privatizing as has the United Kingdom. Although French waterworks and wastewater treatment facilities are often operated by private companies, ownership of the facilities generally remains in government hands. Seventy percent of the distribution of water in France is provided by private companies, the two largest of which are CGE and Lyonnaise. At the end of 1992, CGE had over 6 million subscribers, consisting of a population of almost 25 million.[18] Over 54 percent of French cities subcontract the management of their W&WW systems to one of these two companies and 90 percent of private water distributors' customers are municipalities. The management of wastewater collection and treatment is also increasingly in the hands of private companies;[19] for instance, CGE collected wastewater from some 3 million people at the end of 1992.[20]

Both CGE and Lyonnaise were founded at the end of the nineteenth century to assist French municipalities in organizing their water supplies. Lyonnaise initially assisted municipalities with gas and power needs as well, but these activities were nationalized in 1946. Since that time, both companies have diversified considerably into such services as waste management, energy technologies, communications, urban maintenance, media and entertainment, health care, and even mortuary services.

CGE ranks first in the world in drinking water distribution, with approximately 26 percent of its $25 billion in revenues coming from water treatment and supply and waterworks construction in 1993. Lyonnaise ranks second in the world in water treatment. Forty one percent of its $15.9 billion in revenues came from water resources and environmental management in 1993. CGE had some 204,000 employees in 1992; Lyonnaise, approximately 120,000. CGE derives 28 percent of its sales from abroad and employs 66,160 people outside France, whereas Lyonnaise's foreign operations accounted for 42 percent of its 1993 revenues.[21] Lyonnaise supplies W&WW treatment services to 54 million customers in 14 countries.[22]

Both of these companies have substantial holdings in W&WW companies across the United States. Most of these U.S. holdings are through mergers with U.S. companies. In 1994, CGE's key U.S. water management unit, Professional Services Group, Inc. (PSG), merged with Air & Water Technologies Corp. of Branchburg, NJ, which already held one of PSG's biggest U.S. rivals, Metcalf & Eddy, Inc. This has created a company with nearly twice the water-management revenue of the nearest U.S. competitor.[23] PSG has several large contracts, including a 5-year contract for overall management of W&WW treatment services at Plaquemines Parish, LA; management of

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[17] U.S. State Department telegram, message reference No. 168466, prepared by the U.S. Embassy, Paris, Sept. 1994.

[18] Compagnie Générale des Eaux, *Annual Report 1992*, p. 64.

[19] DOC, Market Research Reports, *France–Domestic/Industrial Water Pollution Control Equipment*, ISA9303 (Sept. 27, 1994).

[20] CGE, *Annual Report 1992*, p. 64.

[21] *The French Company Handbook* (International Herald Tribune: 1994), pp. 65 and 110.

[22] "Water With a French Touch," *Forbes* (Sept. 12, 1994), p. 212.

[23] "Two Big French Environmental Firms Expand in the U.S. Through Mergers," *Wall Street Journal* (Apr. 6, 1994).

W&WW services at Athens, NY; wastewater treatment at Crossville, TN; and W&WW services at Mustang, OK. CGE also directly holds 15 and 20 percent, respectively, of the capital in two water supply companies, Philadelphia Suburban Corp. and Consumers Water Co.[24]

In the spring of 1994, Lyonnaise merged its main U.S. municipal water unit, General Waterworks Corp. of Wilmington, DE, of which it acquired control in 1982, with United Water Resources, Inc. of Harrington Park, NJ. Together, they not only manage water works for municipal owners but also own local utilities, mostly in the Northeast.[25] The merger of General Waterworks into United Water Resources reduces Lyonnaise's ownership to 25 percent, with the balance held by the public; but it makes United Water Resources the second-largest private water utility in the United States after American Water Works. In November 1993, Indianapolis awarded a 5-year, $72 million contract to manage the city's wastewater treatment facilities to a consortium that includes Lyonnaise.

CGE and Lyonnaise participate in W&WW markets worldwide. Lyonnaise has won contracts to supply water for Guangzhou, China within the past 2 years. In 1993, it won a $300-million-a-year, 30-year contract to provide water to Buenos Aires' population of 9 million: the largest drinking water contract ever awarded to a private company.[26] CGE and Lyonnaise participate in the British market as well, where CGE owns 4 of the 22 water-only companies and holds minority shares in 3 others, whereas Lyonnaise controls 2.[27] They are both also involved in the initial stages of privatizing water services in Mexico.

According to industry sources, in addition to early privatization, one factor that may help the French companies to be successful is the fact that the French stock market operates differently from that in the United States and in the United Kingdom. In general, stocks are in the hands of banks and large financial institutions, enabling companies to take a long-term view as opposed to merely looking ahead to the next quarter's profits, a frequent practice in the United States and the United Kingdom, where stocks are more often held by individual share holders who expect to see quicker returns. This ability to look to the long term is especially important in such projects as W&WW treatment facilities where the payoff is generally a long way off.[28]

French companies operate under one of two broad types of arrangement: leasing or concessions, depending on the individual municipal contract. Under a leasing arrangement, the network is initially financed out of public funds, and the operator is paid by the local authority to manage the facility for anywhere from 5 to 20 years. Under a concessions arrangement, a private company builds and finances a distribution or collection network and then operates it for 20 to 30 years, after which it hands over control to the municipality. The company is responsible for expansion and renovation of networks. It negotiates the price of water or sewage treatment, which determines its revenues, with the public authority concerned. At the end of the agreement, the company relinquishes control of the system to the municipality. Concessions arrangements cover 75 percent of the total volume of water supplied by private companies. Although only 35 percent of wastewater is collected by private companies, the amount is increasing.[29]

The U.S. and Foreign Commercial Service (US&FCS) estimates that total demand in France for water pollution control equipment was $6.5 billion in 1992 and that total French imports of water pollution control equipment in 1992 were $450 million.[30] Imports from Germany dominate the

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[24] CGE, *Annual Report 1992*, pp. 70-72.
[25] "Two Big French Environmental Firms Expand in the U.S. Through Mergers"
[26] "Water with a French Touch," p. 212.
[27] "Water," *New Civil Engineer* (Oct. 1993), pp. 45-48.
[28] U.S. industry official, telephone interview by USITC staff, Aug. 23, 1994.
[29] "The Organization of Water Supply and Drainage Services in France," *WATER/Engineering and Management* (Dec. 1994), pp. 37-38.
[30] *France--Domestic/Industrial Water Pollution Control Equipment.*

market with an approximately 35 percent share of the import market, whereas the U.S. accounts for an estimated 5 percent.[31]

Germany

Historically in Germany, of the entities that provide water and collect and treat wastewater have been organized separately and run independently of one another. This independence, combined with the differing political structures of the various regions, has resulted in different structures of water resources management in the different regions. The situation is further complicated by the fact that water resources management tends to be centered around water systems, such as rivers or lakes, that do not necessarily coincide with political and administrative boundaries. This combination of factors has led to diverse water systems with a variety of structures.

The Federal Republic of Germany amended its Water Management Act in 1986, but a major restructuring was not undertaken. At the municipal level, water supply and wastewater treatment are almost always handled separately. Because of their local nature, most wastewater disposal decisions are made locally, with the next level of administration becoming involved only in regional projects. Because of their regional nature, water supply decisions are made at either the county or the provincial level of administration. At the county (Landkries) level, wastewater treatment and water supply are in separate departments, although some coordination between these two departments takes place. At the regional (Regierungsbezirk) level, further integration takes place in the administration of the two services. Under the constitution, the provinces (Länder) control water services, and it is only at this level that the two services are combined in one department--the Ministry of the Environment. Constitutionally, the Federal Ministry of the Environment, which shares some powers with the Ministry of Health concerning drinking water quality control can make only framework decisions.[32]

In Germany, 98 percent of the population was connected to a public water supply system by 1992.[33] More than 6,300 water supply entities managing approximately 14,000 facilities supply western Germany with water. More than $1.2 billion was spent on the public water supply in 1991.[34] Water in Germany costs almost twice that in the United Kingdom and is expected to double or triple in price by 2005 because of the high level of investment needed. In 1989, about 6,500 public waterworks supplied 94.5 percent of the population in eastern Germany with drinking water. Much of this water is not properly treated, however, because of outdated equipment that is in disrepair, and 15 percent of the water is not treated at all.[35]

Communities spent more than $7.2 billion on public wastewater treatment in 1991.[36] The Association for the Promotion of Sewage Treatment Technologies predicts that $176 billion will need to be invested over 15 years to modernize Germany's public wastewater treatment facilities. At an annual average of $11.7 billion, this would be almost triple the $4.4 billion spent in 1991. Two thirds of this amount would be spent in western Germany and one third in eastern.[37]

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[31] Ibid.
[32] Hermann H. Hahn, *The Water Industry of the Federal Republic of Germany*, pp. 5-7.
[33] The Federal Minister for the Environment, *Umweltpolitik: Water Resources Management in Germany* (Bonn, Jan. 1992), p. 25.
[34] Ibid., p. 26.
[35] Ibid., p. 27.
[36] Ibid., p. 29.
[37] *International Environment and Trade Project*, p. A.18.

Ninety-two percent of western German households and 73 percent of those in eastern Germany were connected to wastewater treatment plants by 1994.[38] Wastewater from households and businesses was treated in approximately 8,800 public facilities.

At the beginning of the 1990s, discussion was initiated concerning the privatization of wastewater collection and treatment. The market potential for investment in construction from 1990 to 2000 was estimated as follows: $25 to 50 billion for renovation of public wastewater collection; $12 billion for the renovation of industrial wastewater collection; $12 to 22 billion for renovation and expansion of public wastewater treatment; and $6 to 12 billion for renovation and expansion of industrial wastewater treatment.[39]

Industrial wastewater was treated at 6,700 industrial wastewater clarification plants in 1990. Twelve percent of factories had their own treatment facilities. The most important wastewater-producing industries are steel production, chemicals, mining, and pulp and paper. At industrial wastewater treatment plants 37 percent of waste was treated by mechanical treatment, 34 percent by chemicophysical treatment, 19 percent by biological and additional treatment, and 10 percent by simple biological treatment.[40]

Enactment of relatively strict legislation affecting water quality and effluents treatment has encouraged the development of a high level of expertise and innovation in this field. Three of the world's top eight water treatment equipment companies are German, with a total output of $6.6 billion in 1990.[41] More than $4 billion of Germany's exports were in this field. Because of Germany's relatively small domestic market, German environmental technologies producers have had to export in order to survive.[42]

Nearly half of eastern Germany's rivers and 99 percent of its lakes are too heavily polluted to be used for drinking water. The OECD estimates that $91 billion needs to be invested in eastern Germany for W&WW during 1992-2000. Ownership of eastern Germany's utilities is being transferred from the federal privatization trust authority to municipal and district authorities.[43]

Japan

Japan is significantly behind North America and Europe in the introduction of modern sewage systems. Although 95.1 percent of the population was served by one of Japan's 16,568 water supply facilities by 1992,[44] only 62 percent of the population had flush toilets at the end of 1988,[45] and 47 percent of Japanese residents had centralized sewage treatment in 1992 according to the Ministry of Construction.[46] The Five-Year Program for Sewerage Construction and Basic Program for Public Investment anticipates sewage services for 70 percent of Japan's residents by 2000.[47] Scheduled investment will largely be in rural areas, although improvement of residential septic systems is also taking place. In urban areas, the high cost of land means that the most

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[38] European Construction Research, *EuroBuild*, No. 88 (Glostrup, Sept. 16, 1994), p. 8.
[39] Association of Consulting Engineers, *Engineering Consultancy in the European Community: West Germany* (London, 1990), p. 36.
[40] Ibid., p. 35.
[41] OECD, *The OECD Environment Industry*, p. 9.
[42] U.S. Department of Commerce, Trade Promotion Coordinating Committee Environmental Trade Working Group, *Environmental Technologies Industry and Global Markets* (Apr. 1994), pp. 31-32.
[43] *International Environment and Trade Project*, p. A.17.
[44] Japan Water Works Association, *Waterworks in Japan* (1994), pp. 2-3.
[45] *Environment and Development: Japan's Experience and Achievement: Japan's national report to UNCED 1992* (Dec. 1991), p. 38.
[46] OECD, *Environmental Performance Reviews: Japan* (1994), p. 72.
[47] OTA, *Industry, Technology, and the Environment*, p. 105.

important innovations will be in reducing the size-to-capacity ratio of facilities. High-end systems that allow for the recycling and re-use of post-processing wastewater help address the problem of limited water resources faced in many urban areas. New technologies that make such systems possible will be in demand in Japan.

The US&FCS estimates that Japan's market for wastewater treatment was $4.2 billion in 1993.[48] In 1990, Japan's budget for sewage systems was $16 billion. The goal for 1991-95 is to increase the percentage of population served by sewers to 55 percent, a total expenditure of $122.5 million at 1991 exchange rates.[49] There are approximately 900 municipally owned sewage treatment plants in Japan and some 50,000 privately owned industrial wastewater treatment plants.[50]

Industry sources state that both the Japanese Government and industry are extremely hesitant to do business with foreign firms, particularly in the environmental arena, although there have been a few exceptions.[51] Joint ventures, local partnerships, or acquisitions are almost a requisite for participation by foreign firms. U.S.-Japanese collaboration is more likely to consist of cooperative research and development efforts than outright Japanese procurement of U.S. goods and services.[52]

In 1990, Japan manufactured approximately $3 billion worth of water pollution control equipment. The size of the market changed very little during the 1980s. Fluctuating between $2-3 billion, it grew by 14 percent in 1990 and is expected to increase by the end of the decade to roughly $6 billion. Seventy-nine percent of the demand for water pollution control equipment is from governmental bodies.[53]

Industry accounted for 18 percent of water pollution control equipment purchased. Although its outlook is not as strong as that of the municipal market, it is likely that the demand for high-end industrial effluent treatment and recycling equipment will grow as more firms (75 percent in 1990) strive to process and re-use their wastewater.[54]

According to the OECD, Japan is believed to export about 6 percent of its production of environmental goods, while import penetration is less than 3 percent of consumption.[55]

Structure of the Industry

Services

Engineering and Construction Services

Producers

As in the United States, the foreign engineering and construction industries serving the W&WW market include firms of various sizes and with a variety of market orientations. Unlike in the United States, however, where engineering and construction firms tend to operate in a variety of

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[48] DOC, Market Research Reports, *Japan–Waste Water Treatment Overview*, IMI940426 (Oct. 28, 1994).
[49] *Environment and Development: Japan's Experience and Achievement*, p. 85.
[50] *Japan–Waste Water Treatment Overview* (Oct. 28, 1994).
[51] Peter Illig, Ecology & Environment, "Taiwan Leads Pacific Rim Market," *Environmental Business Journal* (Mar. 1991), p. 8.
[52] *International Environment and Trade Project–A Strategic Approach*, p. A.57.
[53] JETRO, *Your Market in Japan: Environmental Pollution Control Equipment*, No. 38 (Tokyo, Mar. 1992), pp. 6-7.
[54] Ibid., pp. 8-9.
[55] OECD, *The OECD Environment Industry*, p. 22.

industrial sectors, many foreign firms, especially in France and Great Britain, are larger and more fully integrated, and often operate primarily in the W&WW market. In addition, foreign firms are more likely to offer turnkey engineering and construction services than U.S. firms.

In the United Kingdom, firms such as Severn Trent, North West, Wessex, and Thames offer integrated water services ranging from equipment to design to operations; some also provide construction services. For example, Thames Water's activities include the provision of W&WW services to customers, the design and construction of W&WW treatment plants, the supply of water-related products, and other activities, including overseas consultancy and environmental and waste management services.[56]

The United Kingdom's small domestic market has encouraged British engineers to look for revenues overseas.[57] As a result of their close ties with countries that once comprised the British Empire, British engineering firms have been able to globalize their operations quite easily. After World War II, as the British colonies became independent, purely British partnerships evolved into partnerships with entities in the newly formed nations.

In the United Kingdom, the Association of Consulting Engineers reports 158 member firms offering water supply and treatment engineering consultancy services, and 211 firms offering wastewater treatment services.[58] (Some firms offering both may be counted twice.)[59] These firms employ approximately 8,000 people.[60] The British consulting engineering industry operating in the W&WW market is somewhat concentrated, with a small number of medium to large firms accounting for a large share of overall output.[61]

Dominated by the two giants CGE and Lyonnaise, the French engineering and construction industry servicing the W&WW market is quite integrated, offering design engineering, construction, and operation and maintenance services. In addition, the industry is also quite concentrated, with these two firms accounting for large portions of the market.

Germany reportedly is a strong global player in engineering services and is also active in build-own-transfer bidding.[62] The German construction industry in well sinking, waterworks construction, and pipework construction comprises 275 firms.[63] The German engineering and construction industry serving the W&WW market is believed to be somewhat concentrated, with more concentration in the industrial market than in the municipal market. The German construction industry in well sinking, waterworks construction, and pipework construction employs 3,373 workers.[64]

The Japanese industry supplying the W&WW market is likely the most integrated of the major global competitors, and believed to be moderately concentrated. Japanese firms compete as conglomerates or trading companies, where every component required for a project is included--consulting, engineering, construction, equipment, supplies, materials, and financing. This degree of

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[56] Thames Water Plc, *Annual Report and Accounts 1993*, p. 21.

[57] Brian J. Lewis, "Engineers and Contractors Go Global," *Worldwide Projects*, vol. 2, No. 1 (spring 1994), p. 21.

[58] The Association of Consulting Engineers, located in London, represents approximately 60 percent of the consulting engineering industry in the United Kingdom. E.A. Mansfield, The Association of Consulting Engineers, London, telephone interview by USITC staff, July 8, 1994.

[59] Mansfield written communication.

[60] Ibid.

[61] Ibid., July 8, 1994.

[62] Industry officials, interview by USITC staff, June 29, 1994.

[63] Zentralverband des Deutschen Baugewerbes, written communication to USITC staff, Aug. 5, 1994.

[64] Ibid.

integration provides Japanese firms with immense purchasing and bargaining power and enables them to offer very competitive bids.[65] The Japanese industry, which is currently trying to establish joint ventures with U.S. firms, is reportedly stronger in exports of equipment than in overseas construction[66] or engineering.[67]

In Japan, the Association of Japanese Consulting Engineers reports that 234 engineering concerns employing 38,600 people are members of the Association of Water and Sewage Works Consultants, Japan, which represents most of Japan's major consulting firms in W&WW.[68] Some of these employees, however, may be employed in capacities other than W&WW engineering.[69] Types of workers range from highly skilled professionals to manual laborers.

Revenues

Since statistics are generally not kept specifically for W&WW engineering and construction, it is difficult to determine revenues for these sectors and yet more difficult to compare these sectors in different countries. For example, the British consulting engineering industry represented by the Association of Consulting Engineers reports revenues of approximately $150 to 375 million in the British W&WW market;[70] while the German construction industry engaged in the well sinking, waterworks construction, and pipework construction sector reports its yearly revenues to be approximately $30.5 million;[71] and revenues for Japanese engineers in W&WW are reported to be approximately $1.3 billion.[72]

In Germany, the principal clients for environmental service firms are private industry and, increasingly, municipalities and water service companies, because of the recent trend toward privatization of public wastewater treatment plants.[73] The market for engineering consultants in wastewater is $60.5 million for master planning and consulting. Design, tendering, and supervision account for 4 to 5 percent of the investment for water collection and treatment, or a projected $2 to 3 billion during 1990-2000.[74] In this field, public and semiprivate entities generally hire local engineering companies, whereas industry tends to hire large engineering consultants, who compete with the plant operation and the building industries.[75]

Exports

Global competitors tend to work consistently in particular regional markets. For example, more than 70 percent of overseas revenues for Japanese consulting engineers in water supply and wastewater treatment come from the Asian market; the remaining 30 percent come principally from African, South American, and Middle Eastern markets.[76]

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[65] Henry Michel, "Can the United States Compete?" *Worldwide Projects*, spring 1993, p. 37.
[66] Industry officials, interview by USITC staff, June 29, 1994..
[67] Metcalf and Eddy official, telephone interview by USITC staff, Oct. 12, 1994.
[68] Association of Japanese Consulting Engineers official, written communication to USITC staff, Oct. 4, 1994.
[69] Ibid.
[70] Mansfield written communication.
[71] Zentralverband des Deutschen Baugewerbes written communication.
[72] Association of Japanese Consulting Engineers official communication.
[73] Thomas Telford Ltd., *Engineering Consultancy in the European Community* (London, 1990), p. 33.
[74] Ibid., p. 36.
[75] Ibid.
[76] Association of Japanese Consulting Engineers, written communication to USITC staff, Oct. 18, 1994.

The United States faces competition from German, British, and, to a lesser extent, French firms in the Middle East.[77] Particular markets that are important for British engineers include: in the Middle East--United Arab Emirates, Brunei, and Saudi Arabia; in Africa--Algeria, Libya, and Botswana; in Asia--Pakistan, Malaysia, and the Philippines; and elsewhere--Australia and the Netherlands.[78] The strength of British firms in the Middle East stems from the presence of Army engineers in the region at the turn of the century. Civilian engineering grew out of that presence, and a relationship of reliance and trust followed and continues today.[79] The fact that Britain has not focused on Latin American markets is due partly to the lack of the type of relationship discussed above and partly to relatively slow growth in the region.[80]

The British consulting engineering industry represented by the Association of Consulting Engineers earns approximately $150 million in revenues from overseas W&WW projects.[81] Export revenues for British engineering firms, therefore, can range from 40 to 100 percent of the value of domestic revenues--a very high percentage when compared with U.S. overseas earnings. W&WW revenues for the Japanese engineering industry represented by the Association of Water and Sewage Works Consultants are approximately $63 million, or less than 5 percent of total revenues.[82] This is more in line with export revenues in the United States. Japanese industry sources report that over 90 percent of Japanese W&WW engineering exports are financed by Japan's overseas development assistance.[83]

Marketing practices

Foreign engineering and construction firms generally participate in overseas W&WW markets by establishing subsidiary offices or joint ventures with local firms or by acquiring local firms. Foreign firms without a local presence rely principally on project listing services.

Other countries' design and construction industries tend to include many firms that are fully integrated in environmental services and able to offer turnkey services that include engineering, construction, equipment, and operation and maintenance of water facilities. This is a definite competitive advantage when these firms compete against U.S. firms in non-U.S. markets.[84] The global leader in operation or in integrated water companies is France.[85] The United Kingdom believes it presently has a "window of opportunity" to strengthen its W&WW facility operations services before other potential competitors fully privatize and become serious competitors.[86] The emphasis in W&WW is moving toward full service providers and facility operators and away from traditional engineers and contractors where value added is relatively low and British firms are not very competitive internationally.[87]

U.S. industry sources report that in the United States, the consulting engineer works for the client, not for the contractor, helping the client write the specifications and the bid package for the construction portion of the project. Reportedly, this is not the case overseas, where the engineering firm is often also the construction firm. Also, unlike in U.S. contracts, in overseas contracts, the equipment provider is often chosen first. Foreign service providers tend to be further integrated into

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[77] Black and Veatch official, interview by USITC staff, July 20, 1994.
[78] Association of Consulting Engineers official, London, telephone interview by USITC staff, Oct. 13, 1994.
[79] Ibid.
[80] ECOTEC, *The U.K. Environmental Industry*, p. 53.
[81] Mansfield communication.
[82] Association of Japanese Consulting Engineers communication, Oct. 4, 1994.
[83] Ibid.
[84] Industry officials, interview by USITC staff, June 29, 1994..
[85] NatWest Securities, *U.S. Wastewater Privatisation*, p. 11.
[86] ECOTEC, *The U.K. Environmental Industry*, p. 64.
[87] Ibid.

the equipment side of W&WW than those in the United States, putting the United States at a competitive disadvantage in these types of overseas contracts.[88]

As mentioned above with reference to CGE and Lyonnaise of France, large, well-capitalized companies have significant advantages in international competition. Among these are the ability to research foreign markets thoroughly, to acquire companies in foreign markets or enter into joint ventures through large equity stakes, to devote resources to research and development or to acquire technology from other firms, to access capital more easily, and to provide integrated, turnkey services.[89] The French and British large integrated water companies and the Japanese integrated trading companies do have these competitive advantages compared with their U.S. counterparts.

Another key competitive factor in the international W&WW market is the ability to bring financing to a project. In fact, according to the OTA report, U.S. sources report that "the attractiveness of financial packages is often more important than the technological credentials of competing environmental companies,"[90] a finding that holds true for W&WW companies as well.[91] International lending institutions such as the World Bank reportedly account for less than one-tenth of 1 percent of the total annual value of worldwide construction.[92] U.S. industry has criticized the U.S. Trade Development Program as being underfunded and the U.S. Agency for International Development (AID) assistance as being a political weapon.[93] Questionnaire responses point to a perceived lack of coordination between the U.S. Trade and Development Agency and AID. Industry officials have reported that, in general, many foreign competitors provide "more project grant seed money, business development cost subsidies, direct marketing and sales support, below-cost project finance and mixed credits, and other market-entry support to their national firms. As a result, U.S. companies are finding it increasingly difficult to win in international competition."[94]

According to OTA, European and Japanese competitors receive more export promotion (for instance, export planning and marketing, export financing) assistance and funding from their governments than do U.S. firms. This source reports that European and Japanese firms (1) have more access to concessional financing offered by their governments to developing countries, (2) receive more assistance in seeking and utilizing government export promotion services from private sector entities such as chambers of commerce and industry associations, (3) receive government financial assistance for participation in trade fairs, (4) benefit from better-funded and more fully staffed overseas commercial services that assist firms in identifying and pursuing trade opportunities, and (5) benefit from more high-level advocacy on the part of their governments.[95] Some of these findings were confirmed specifically for W&WW firms by questionnaire responses that list subsidies to foreign competitors; lack of financing, including government-backed financial packages, grants, tied aid, and loan guarantees; lack of government-sponsored export conferences and seminars; and lack of U.S. Government support (especially compared with France, Germany, and Britain) as factors that affect their ability to compete in non-U.S. markets.

Another factor affecting ability to obtain financing is that European private sector banks are often shareholders, either directly or indirectly, in engineering and construction consortia.[96] Further, in Japan, banks are trading company members of holding company groups that include a fully

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[88] Industry officials, interview by USITC staff,June 29, 1994.
[89] OTA, *Industry, Technology, and the Environment*, p. 125.
[90] Ibid., p. 126.
[91] Questionnaire responses.
[92] "Can the United States Compete?" *Worldwide Projects* (spring 1993), pp. 36-37.
[93] Ibid.
[94] Ibid., p. 37.
[95] OTA, *Industry, Technology, and the Environment*, pp. 153, 160, 167, 168, and 173.
[96] "Can the United States Compete?" p. 37.

integrated set of companies, such as engineering firms, construction firms, and equipment manufacturers.[97]

Environmental Testing Services

Producers

In the EU, there are public sector, university-related, and commercial environmental testing entities. In the United Kingdom, there are a variety of public sector entities that perform environmental monitoring, including the Ministry of Agriculture, Forestry and Fishing; Her Majesty's Inspectorate of Pollution; National Rivers Authority; Government laboratories; and local authorities.[98] In addition, there are reportedly some very large commercial laboratories in the United Kingdom.[99] The current trend in the environmental testing industry in Europe is a move toward increased privatization. While some industry sources report that there is a regional (that is, European) rather than a domestic focus in the European environmental testing industry,[100] other sources indicate that very few environmental testing firms in the EU have developed facilities that enable them to operate on an EU-wide basis.[101] European laboratories that operate outside their own domestic markets do so mostly in other European countries.

Many of the testing needs in Europe are reportedly met by universities and research institutions,[102] but industry participants report that there is also a significant commercial environmental testing industry. One source indicates that, while there are numerous small independent laboratory testing entities and laboratories that are part of larger environmental engineering firms, there are six independent commercial laboratories that dominate laboratory testing in the EU, four of which are British.[103] These major laboratories are not large by manufacturing firm standards--revenues for these firms for all types of testing performed range between $100 million and $200 million per year.[104]

Competition in the commercial environmental testing industry in the EU reportedly has been intense and growing in recent years. Similar to the situation in the U.S. industry in the 1970s, increased environmental awareness in Europe in the 1980s led to the flooding of the environmental testing industry with new entrants, resulting in overcapacity. This overcapacity, coupled with recessionary conditions, has led to consolidation in the European environmental testing industry, manifested in company failures, mergers, and acquisitions.[105]

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[97] Ibid.

[98] National Economic Development Office, *The Environmental Monitoring Business: What Buyers Want, Need and Can Afford* (London, Oct. 1992), p. 32.

[99] U.S. industry official, telephone interview by USITC staff, Oct. 17, 1994.

[100] Ibid.

[101] Frost and Sullivan, *European Environmental Laboratory Testing Services Markets*, press release (June 1994).

[102] Joan B. Berkowitz, *The Environmental Protection Industry: Outlook 2001* (Washington, D.C.: Farkas Berkowitz and Co., 1992), p. 17.

[103] U.S. industry official, telephone interview by USITC staff, Oct. 17, 1994.

[104] Ibid.

[105] "Pollution Control Measures Expected To Boost Laboratory Test Market in Europe," *Waste Tech News* (Sept. 12, 1994).

Revenues

The growing size of the European environmental monitoring and testing services market is expected to drive revenues to close to $2 billion by the year 2000.[106] These expectations are just slightly lower than those for the U.S. environmental testing industry.

Marketing practices

Environmental testing laboratories market themselves by associating themselves with large environmental engineering firms, attending trade shows, attending quasitechnical meetings that bring laboratories and clients together, or by marketing themselves directly to particular firms or municipalities where market opportunities are perceived.

Contracts in the EU are awarded to laboratories irrespective of nationality; the market in the EU is capability- and quality-driven.[107] In fact, one industry observer reports that, in some European markets, a laboratory's reputation can be more important than price when awarding a contract.[108]

British laboratories have several advantages over their principal competitors. One of these is the good reputation for quality work, and another is the lower cost of professional labor in the United Kingdom. Although reputation is often the most important factor, price is also a significant issue, and, since labor is the principal cost in laboratory services, the British laboratories have a distinct price advantage over their German and French counterparts.

There is a general perception that studies performed at European laboratories are regarded more favorably by EU regulatory bodies. Similarly, companies setting up operations in the United States may prefer to use U.S. laboratories.

Goods

Instruments

The instruments produced by the foreign instrument industry range from low to advanced technology products and, with few exception, do not differ significantly from the instruments made in the United States in terms of quality and sophistication. Some of the analytical instruments of the most advanced technology produced overseas, however, are made by subsidiaries of U.S. instrument manufacturers.

Producers

Approximately 55 percent of the world's production of process control instruments, analytical instruments, and on-line analyzers are produced outside the United States, along with about 80 percent of water meters. The foreign instrument industry consists of several thousand manufacturers, and is capable of producing a growing number of sophisticated instruments and systems needed by end users.[109] A large number of these manufacturers are capable of producing instruments and

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[106] Frost and Sullivan, *European Environmental Laboratory Testing Services Markets*.
[107] U.S. industry official, telephone interview by USITC staff, Oct. 17, 1994.
[108] Frost and Sullivan, *European Environmental Laboratory Testing Services Markets*.
[109] Based on information obtained from DOC, Market Research Reports, including *Analytical Instruments - Japan* (May 1994); *Process Control Equipment - Japan* (May 1994); *Fluid Measurement & Control Instrumentation - Germany* (May 1994); *Laboratory Automation Equipment - Germany* (May 1994); *Analytical Instruments -United Kingdom* (May 1994); *Industrial Control Instrumentation - Canada* (May 1994); and *Flow and Liquid Level Instruments - Switzerland* (July 1993).

systems for the treatment of W&WW. However, several hundred manufacturers manufacture the bulk of them. The primary foreign producers of instruments are located in Japan, Germany, the United Kingdom, Italy, and France and account for most of the instruments produced. Germany is the largest producer of instruments in the EU, accounting for 50 percent of the value added, followed by the United Kingdom with 31 percent, Italy with 10 percent, and France with 4 percent. Total EU production of measuring, precision, and control instruments was $7.8 billion in 1993.[110] There have been a significant number of mergers and acquisitions in the industry, including the purchases of a number of the leading U.S. instrument manufacturers.

In foreign countries with a significant instrument industry, most of the instruments used for W&WW treatment are supplied by domestic producers. Purchasers of technology-intensive instruments and systems generally prefer local suppliers because of their preference for suppliers capable of providing services, such as assistance relating to preliminary engineering, detailed system design, installation, startup, training, and maintenance.[111]

There are many foreign manufacturers producing process control instruments and water meters, none of which accounts for a high proportion of total production. However, a relatively small number of producers manufacture a major portion of the more sophisticated analytical instruments and on-line analyzers. Many of the analytical instruments used for foreign W&WW treatment are produced by U.S. subsidiaries of analytical instrument manufacturers located overseas or are imported from the United States.

Virtually all of the firms producing instruments for W&WW treatment also produce instruments for other end uses, and water-related sales generally account for a relatively small portion of total sales. Only a small number of instrument manufacturers produce instruments designed specifically for water treatment; most of these firms are small enterprises and generally produce a small number of specialty instruments.

The British market for instruments used for W&WW treatment was about $175 million in 1990. Because many British companies are small, they are at a disadvantage when compared with large multinationals. They do not have the resources to invest in and exploit advanced technology.[112]

In 1993, foreign manufacturers of process control instruments, analytical instruments, and on-line analyzers for the treatment of W&WW employed approximately 10,000 people.[113] The Japanese industry employed an estimated 3,000 people; the German, 2,600; and the British, 1,600. Skilled workers and professionals account for the largest share of the work force. Foreign manufacturers producing water meters employed about 14,500 people, most of them low-skilled workers.

Production

In 1993, foreign producers shipped approximately $1.2 billion worth of process control instruments, analytical instruments, and on-line analyzers for W&WW treatment. Process control instruments are believed to have accounted for about 47 percent of total shipments, analytical instruments for 49 percent, and on-line analyzers for 4 percent. The leading producing nations were Japan, with about 30 percent; Germany, with 26 percent; the United Kingdom, with 16 percent; and the rest of the world, with 28 percent.[114] As in the United States, the growth in the value of

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[110] European Commission, *Panorama of EU Industry 94*, p. 12-8.
[111] *The Environmental Monitoring Business*, p. 33.
[112] Ibid.
[113] Estimated by the staff of the USITC.
[114] Statistics on foreign shipments of instruments to the water treatment industry are not published by foreign governments or by the private sector. The data cited in this study were estimated by the
(continued...)

producers' shipments of these instruments was primarily driven by the proliferation of environmental laws and regulations as well as emerging technologies, a development which has induced the W&WW treatment service providers to invest more in instruments and systems, especially computerized process control instruments, sophisticated laboratory analytical instruments, and continuous on-line analyzers. During the same period, the estimated value of foreign producers' shipments of water meters rose at an average annual rate of 2 percent, to $1.3 billion. Because water meters are generally low-technology instruments, virtually all nations manufacture them for domestic consumption.

Exports

In 1993, the estimated value of foreign exports of process control instruments, analytical instruments, and on-line analyzers, for use in the treatment of W&WW was $480 million.[115] The leading exporting countries were Germany, Japan, the United Kingdom, Italy, and France. The United States, the nations of the EU, and the countries of the European Free Trade Association were the primary markets. It is believed that less than 10 percent of water meters produced in foreign countries are exported.

Marketing practices

Most of the medium and large foreign producers market most of their instruments domestically through direct sales and provide engineering and aftersales service through their own facilities. Small companies market most of their instruments through independent distributors, and the remaining ones through direct sales or factory representatives. Foreign firms that have production facilities overseas generally market and service instruments produced domestically through these subsidiaries. Other foreign producers with large foreign markets have wholly-owned sales, engineering, and aftersales servicing facilities in key overseas markets. Foreign producers with small and medium overseas markets generally have their sales, engineering, and aftersales service handled by independent local firms.

Foreign instrument manufacturers are exposed to considerable domestic and foreign competition. Although the price of a product is important to the purchaser, other factors considered include quality, the degree to which the product meets technical specifications, operating costs, ability to meet desired delivery date, level of presale and aftersale service assistance offered, and product compatibility with the existing system. Another factor that has an impact on pricing and purchasing decisions is the growing formation of strategic relationships between purchasers and producers of instruments.

Process Equipment

As a result of domestic sourcing requirements for municipal projects, many countries have developed strong process equipment industries to supply their W&WW treatment markets. Even developing nations without other significant industrial manufacturing capacities often have at least some domestic production of W&WW treatment process equipment. However, most nations also import a large part of their process equipment, generally from certain developed nations. Only

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[114] (...continued)
staff of the USITC based on information extracted from DOC, Market Research Reports; from data cited in *International Environment and Trade Project*, vol. II; and from other sources.

[115] Statistics relating to the value of exports of instruments for sale to the water treatment industry are not published by foreign governments, or the private sector. The export data cited in this study were estimated by the staff of the USITC, based on information extracted from DOC, Market Research Reports and from other sources.

France and the United States have domestic industries that satisfy more than 90 percent of their own domestic requirements for W&WW treatment process equipment.

Producers and production

Domestic production of process equipment in most nations satisfies, on average, between 55 and 70 percent of domestic requirements (see table 4-2). Certain nations' establishments base their production capacities on supplying large export volumes to a variety of markets. Although precise data for production and exports of process equipment are not available, indications are that the export-to-production ratios for these nations often exceed 50 percent.[116]

Table 4-2
Foreign water and wastewater treatment process equipment[1] production and market data, 1991-93

Country	Domestic industry's share of domestic market	Estimated value of production	Exports	Imports	Export to production ratio
	(Percent)	*(Million dollars)*		*(Percent)*	
Canada	70.0	1,530.0	263.0	545.0	17.2
France	93.1	8,150.0	2,100.0	450.0	25.8
Italy	73.7	366.0	234.0	47.0	63.9
Japan	[2]	10,500.0	[2]	[2]	[2]
Netherlands	58.5	308.0	108.0	142.0	35.1
Spain	50.4	86.3	26.1	59.2	30.2
United Kingdom	61.7	267.0	147.0	74.6	55.1

[1] The data included in this table may not be absolutely comparable, as the definition of the product category used to compile the data was not precisely equivalent throughout the different reports from which the data were compiled.
[2] Not available.

Source: Compiled from DOC, Market Research Reports, Dec. 1992-Sept. 1994; The Japan Society of Industrial Machinery Manufacturers, *Introduction of Japanese Advanced Environmental Equipment, 1993*; and the UK Department of Trade and Industry, *The UK Environmental Industry: Succeeding in the Changing Global Market*, 1994.

Some countries have made serious efforts to encourage multinational firms to participate in the domestic industry either by investing in existing producers or by establishing new facilities. A growing domestic demand for the products of the industry involved encourages such investment by multinational firms. In France, domestically owned firms dominate a strong domestic industry along with significant involvement from approximately 8 U.S.-affiliated companies. Domestically owned firms dominate the Japanese market, with about 20 foreign-affiliated firms also active in Japan.[117] Canada, Mexico, Japan, and Spain all have a number of domestic producers that are affiliated with foreign companies. These firms are often the major producers of process equipment in these markets and tend to dominate the smaller domestically owned firms.[118]

[116] Information compiled from DOC, Market Research Reports (Dec. 1992-Sept. 1994).
[117] Ibid.
[118] Ibid.

Exports

The major international exporters of W&WW treatment process equipment are France, Germany, and Japan. These nations account for major shares of other nations' purchases of process equipment. Table 4-3 provides examples of several nations' import market shares in certain consuming nations.

Table 4-3
Exporting nations' market shares in certain consuming nations

(*Percent*)

Market country	Source country/region	Share of import market
Canada	United States	77
	Germany	5
	United Kingdom	4
	Japan	3
Chile	United States	40
	Western Europe	30
	Asia	30
Mexico	United States	60
	Japan	15
	Germany	14
	France	9
Spain	France	35
	Germany	13
	Italy	11
	Israel	8
	United States	7
	Denmark	7
United Kingdom	United States	27
	France	13
	Germany	11
United States	Canada	28
	Germany	14
	Japan	12

Source: Compiled from DOC, Market Research Reports, Dec. 1992-Sept. 1994.

Expansion of production capacity in those countries currently exporting throughout the world (and potentially other new exporting nations) depends on continuous refinements in environmental regulations, which necessitate continual refinements in the treatment processes. The best potential markets for water resources equipment and services, according to the DOC, are shown in table 4-4.

Table 4-4
Water resources equipment and services, best markets, 1993

Country	Total market value 1992 (*Million dollars*)	Total market value Average annual growth 1992-94 (Percent)	Import market value 1992 (*Million dollars*)	Import market value Average annual growth 1992-94 (Percent)	Imports from U.S. 1992 (*Million dollars*)	Imports from U.S. Average annual growth 1992-94 (Percent)	Receptivity to U.S. goods (1-5)[1]	Competition (1-5)	Market barriers (1-5)
Italy	655.0	6	170.0	5	75.0	5	4	3	5
S. Arabia	420.0	5	400.0	5	100.0	4	3	2	4
Spain	300.0	20	250.0	25	40.0	20	4	3	4
Brazil	270.0	5	35.0	5	6.0	8	4	3	4
U.A.E.	255.8	5	316.7	7	64.8	8	5	1	5
Egypt	170.0	15	175.0	17	60.0	15	5	3	5
Algeria	160.0	20	140.0	20	16.0	20	5	2	5
Malaysia	155.0	10	105.0	10	16.0	10	4	3	3
Turkey	84.0	20	38.0	25	9.0	25	4	3	4
Morocco	74.8	20	75.0	20	11.2	15	5	3	5
Kuwait	50.0	15	50.0	15	30.0	15	4	3	4
Venezuela	24.0	30	15.0	60	7.5	62	3	3	4
Korea	7.8	12	5.6	12	0.5	9	3	1	5

[1] The 1 through 5 scale used to indicate receptivity to U.S. goods, competition, and market barriers should be interpreted as follows: the higher the number, the more favorable the situation to U.S. exporters. Therefore, a score of 5 in all three areas indicates high receptivity to U.S. goods, little competition, and minimal market barriers to imports from the U.S.

Note: In some cases imports may exceed market value due to the fact that products are transshipped through these countries and do not enter the commerce of that country.

Source: US&FCS publication *Best Markets: FY1993*, Feb. 1993. Information presented concerning the 1993 best country markets for U.S. exporters of water resources equipment and services based on either (1) near-term growth potential, or (2) a large market receptive to additional U.S. suppliers.

Marketing practices

Sales of process equipment are generally based on several different factors, depending on the particular market. In a developed market, such as Belgium, a primary factor would be the assurance of dependable aftersales service provided through local affiliates, followed by price, and then references in an established market, such as the United States.[119] However, in the process equipment market in France, labor cost savings are reported to be very important, since rising labor costs have made many local producers less competitive.[120]

In nations with rapidly growing markets, such as Mexico, the dominant sources of equipment are foreign-based multinationals or imports. In Mexico, U.S.-made products are reported to be very price competitive and also to maintain their high market share based at least partially on confidence in a high-quality product.[121] Third-country exporters to Mexico report that they have difficulty competing against U.S.-made products.[122] In other markets located further from the United States, such as Egypt, there is strong competition from major European-based exporters. Most local production in such nations involves delivery equipment, while process equipment is generally imported. When equipment is not available, military companies are periodically called upon to become involved in producing it.[123]

In Korea, Japanese and European firms market their products aggressively, whereas U.S. firms maintain a lower profile. For example, there is less pressure placed on the direct sales of process equipment to Korean purchasers, as U.S. firms have assistance in this market from the United States-Asia Environmental Partnership. This organization provides financial support and professional exchange programs that support domestic industries that use U.S.-based technologies.[124]

Delivery Equipment

Producers

The industry producing delivery equipment for W&WW is largely concentrated in the United Kingdom, France, Germany, and Japan, and includes companies that design, manufacture, and maintain delivery equipment. Until recent years, the industry has been highly fragmented, consisting primarily of small and medium-sized firms, with most specializing in production of particular kinds of delivery equipment, such as pumps or valves. Most firms produce equipment that can be used in a variety of applications. There are numerous other firms, however, (mostly small and medium-sized establishments) that produce and market delivery equipment specifically for use in the W&WW market.[125] For the most part, it is a mature, capital intensive, slow-growth industry. There has recently been considerable consolidation through numerous mergers and acquisitions, within countries as well as internationally.

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[119] DOC, Market Research Report, *The Water Pollution Control Equipment Market in Belgium* (Mar. 1993).
[120] DOC, Market Research Report, *The Domestic and Industrial Water Pollution Control Equipment Market in France* (Mar. 1993).
[121] DOC, Market Research Report, *The Water Pollution Control Equipment Market in Mexico* (May 1994).
[122] Ibid.
[123] DOC, Market Research Report, *The Water Pollution Treatment Equipment Market in Egypt* (Jan. 1993).
[124] DOC, *Telegraphic report on wastewater treatment projects in Korea* (Jan. 1993).
[125] "Water/Wastewater Markets Remain Diverse," *EBJ*, vol. VI, No. 3 (Mar. 1994), p. 3.

In 1993, there were an estimated 110 producers of delivery equipment that employed approximately 18,250 production workers in the United Kingdom.[126] The largest 10 firms account for approximately 85 percent of all production. A large number of these firms are also sales or manufacturing subsidiaries of overseas (mainly European or U.S.) companies. Most of the leading British delivery equipment producers are also mechanical engineering firms. In recent years, there have been many mergers and acquisitions in the industry, resulting from stagnant economic growth and increasing foreign competition. According to the Commission of the European Communities, merger and acquisition activity will likely increase as manufacturers pursue rapid expansion of their product lines and enter emerging global environmental markets.[127] In the United Kingdom, as in other manufacturing nations, another factor adding to the pressure to consolidate is the growing need to purchase such expensive technologies as computer aided design and computer aided manufacturing systems and advanced micro-electronic sensor technology. These technologies are necessary to remain competitive but are beyond the financial reach of many firms.

The W&WW delivery equipment industry in France is concentrated among two major firms with a multitude of small businesses (suppliers and subcontractors) sharing the remainder of the domestic market. The major firms, CGE and rival Lyonnaise, through numerous diversified subsidiaries, are involved in virtually all segments of the W&WW delivery equipment market. CGE and Lyonnaise distribute their product lines globally through direct export, wholly-owned foreign subsidiaries, or licensing arrangements.[128]

In 1993, there were approximately 100 French delivery equipment producers, mostly pump and pumping equipment firms.[129] The majority of French W&WW delivery equipment producers are located in the Northeast part of the nation, as is nearly 80 percent of all industrial activity.

In 1993, the German industry producing delivery equipment for W&WW consisted of an estimated 151 producers and employed about 11,500 production workers.[130] Germany is the largest producer in the EU of all categories of delivery equipment for W&WW. The majority of firms in this industry are of medium size and specialize in one or two branches of the delivery equipment market. In recent years, the industry in Germany has attempted to accelerate its globalization by entering into a number of mergers and acquisitions with other pan-European firms. The largest companies are multinational firms that distribute their products globally through direct exports, wholly-owned foreign subsidiaries, or licensing arrangements.

In 1993, the Japanese industry producing W&WW delivery equipment consisted of approximately 225 mostly medium to large firms, employing an estimated 14,000 people. The top 10 firms accounted for an estimated 90 percent of total Japanese production. In recent years, leading Japanese delivery equipment producers have shifted their production facilities abroad because of labor shortages, difficulty with procurement of reasonably priced raw materials, and high wages in Japan. Japanese companies have established facilities in such industrially advanced countries as the United States, Germany, and the United Kingdom, as well as in such countries as Korea, Thailand, India, and China. As a result of the subsequent reduction in Japanese production of delivery equipment, imports have gained an increased share of the Japanese market, resulting in heightened price competition.

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[126] Officials of the Process Plant Association of Great Britain, interview by USITC staff Sept. 30, 1994.

[127] "Liquid Pumps," p. 8.57.

[128] Andre Larane, "Water Purification in France: A Tradition With Much to Offer," *Water/Engineering & Management* (Mar. 1992), p. 17.

[129] Estimated by USITC staff.

[130] Netherlands Economic Institute, "Liquid Pumps," in EU Commission, *Panorama of EU Industry 1993*, p. 8.55.

Production

Production of delivery equipment outside the United States is estimated to account for approximately 55 percent of total world shipments. Germany is believed to average about 20 percent of total non-U.S. shipments, followed by Japan with 15 percent, the United Kingdom and Italy with 5 percent each, France with 4 percent, and the remaining world shipments with 6 percent. The European Union is the largest producer of pumps and pumping equipment, one of the principal components of delivery equipment, with a production level almost twice that of the United States, and nearly three times as large as Japan's.[131]

Marketing practices

In the United Kingdom, delivery equipment for W&WW is typically sold by producers directly to end users. However, delivery equipment producers also employ local and national distributors for standard equipment (for instance, submersible pumps). Most distributors also support related product lines, for example, pipe fittings and accessories such as centrifugal blowers. Distributors are responsible for a significant proportion of sales of items such as pumps and pumping equipment. Industry sources indicate that approximately 18 percent of all industrial pumps and pumping equipment are handled by local distributors. This delivery equipment is normally simpler, relatively standardized apparatus with low average prices. The primary competitive factors for producers of W&WW delivery equipment are competitive pricing, quality, adherence to local, EU, and International Standards Organization technical standards, and personal contact with suppliers and contractors.

In Japan, manufacturers customarily sell standard delivery equipment for W&WW to government agencies, which in turn sell it to end users. However, Japanese producers often sell custom-designed equipment directly to end users.

Japanese firms' marketing efforts for sales outside Japan typically combine competitive pricing, long-term financing, and after-market servicing to gain local government contracts in such emerging markets as East and Southeast Asia. Japanese firms generally do not export or market delivery equipment exclusively, but instead rely on government technology transfer programs to supply developing countries.[132] According to industry sources, nearly 82 percent of all Japanese W&WW delivery equipment is distributed in the Asia Pacific region.[133] Japan is the largest distributor of W&WW delivery equipment in the Asia Pacific region, followed by the United States, and the European Union.

Chemicals

The chemical industry is international in scope, both in production of basic or building-block chemicals (those from which other chemicals and chemical products are made) and specialty chemicals. Certain significant W&WW treatment chemicals are considered to be basic chemicals, such as chlorine (and its derivatives) and primary filter materials (such as charcoal), while others are considered specialty chemicals, such as certain polymeric materials used as filtration devices, or other advanced filter media.

Many nations, especially those that are mineral-rich, produce the basic chemicals that constitute a major share of the world's demand for W&WW treatment chemicals. The specialty chemicals that are used in more advanced process technology W&WW treatment systems are

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[131] "Liquid Pumps," p. 8.55.
[132] "Environmental Equipment Industry in Japan," *Digest of Japanese Industry & Trade*, Feb. 28, 1994, p. 28.
[133] Ibid., pp. 24-25.

generally produced in nations with highly developed specialty chemicals industries, such as the United States, Japan, and Western European countries. Demand for these advanced specialty W&WW treatment chemicals, which accounts for the fastest growing sector of the water treatment chemical industry, is estimated for 1989 and 1993 in the following tabulation (in millions of dollars):[134]

	1989	1993
United States	1,466	1,821
Western Europe	[1]	746
Japan	639	764

[1]Not available.

The use of such water treatment chemicals as chlorine is declining.[135] The use of these specialty chemicals, however, increased at an average annual rate of nearly 7 percent in the United States between 1989 and 1993, though growth is anticipated to slow to an annual rate of about 4 percent during 1993-97. In Western Europe, the anticipated rate of increase in the use of these chemicals during 1993-97 is closer to 3 percent, and in Japan, closer to 6 percent.

Chlorine is produced throughout the world; in addition to the approximately 254 producers in the United States there are 7 producers in Canada and more than 120 producers in Europe. Chlorine is also produced throughout East Asia. Bromine, which can act as a replacement for chlorine, is primarily produced in Israel and Russia, in addition to the United States. Together, these two simple chemical items are the largest volume chemicals produced for water treatment internationally, although only a small share of the material produced is used for water treatment.

Of the other large-volume chemical products used in W&WW treatment, activated carbon is produced in Japan (approximately 20 producers), Belgium, France, Germany, Italy, the Netherlands, and the United Kingdom. To a lesser extent, activated carbon is also produced in some East Asian countries, though by a limited number of firms. Although chelating agents are used to assist in the filtration and separation processes in the U.S. municipal and industrial market, Western European nations and Japan tend not to use these chelating agents in their water treatment processes.

Ion exchange resins, however, are produced in Japan, throughout Eastern and Western Europe (France, Germany, Italy, Russia, and the United Kingdom), and, to a lesser extent, in Brazil, Canada, China, India, Korea, and Mexico. These materials are used primarily for water treatment throughout all of these nations, accounting for between 55 and 75 percent of most nation's production.

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[134] "Sector Lags the Recovery; Large Firms Suffer the Most," *Chemicalweek* (May 11, 1994), p. 41.

[135] The European Commission is examining the possibility of reducing (currently) and eventually eliminating chlorine and chlorinated compounds. "Heading Toward a Chlorine Ban," *WATER/Engineering & Management*, June 1994, p. 12. Chlorine use is declining at a rate of approximately 1 to 2 percent annually in the United States.

CHAPTER 5

GOVERNMENT POLICY AND PROGRAMS

Export Promotion

Overview

W&WW projects are often large, public, infrastructure projects in which governments play direct roles in design, contracting, and implementation. They are therefore greatly affected by government policies and programs. These policies and programs can also affect exports of environmental technology. This chapter first discusses export promotion programs, such as education, market information, and trade fairs; overseas presence and advocacy; feasibility studies; research, development, demonstration, and commercialization; technology training and cooperation; and finance and insurance, for each of the surveyed countries. Then foreign aid programs are discussed, including practices of tying a country's exports to its aid program and the use of feasibility studies to promote exports. Regulation is another aspect of government policy that influences the market for environmental technology. Strong domestic regulation fosters domestic development of products and services to satisfy these regulations; these products and services are often competitive in foreign markets. Accordingly, the environmental regulation programs of the surveyed countries are presented and discussed.

Detailed information to evaluate the effects of government programs is difficult to obtain for W&WW. In addition to the definitional questions discussed earlier, the different practices and approaches by the surveyed countries in their respective programs further complicate comparisons and evaluations. In addition to a lack of data, no country has attempted to determine if exports have increased as a result of increased spending or of coordination or focus of programs to increase exports.

Government programs to support export sales are common to all countries in this study, but all programs vary in organization, magnitude of funds, directness of support, and the degree to which they are industry specific. Although some countries could be viewed as trying to support environmental exports, few could be considered as supporting exports specifically for W&WW goods and services.

The difficulty of measuring the effectiveness of U.S. export promotion programs for all products and services and evaluating them in comparison to those of our competitor nations was described by Secretary of Commerce Ron Brown:

> While information concerning U.S. trade promotion efforts remains difficult to obtain, accurate assessments of foreign trade promotion activities are even more elusive. Consistent comparisons of competitor-nation promotion efforts are difficult even within a particular promotion activity because of different market structures, budgetary reporting standards, and trade promotion delivery mechanisms. Comprehensive comparisons of competitor-nation promotion efforts equivalent to the programs or promotion activities described in this Report are virtually nonexistent.[1]

To assess export promotion programs that focus strictly on environmental technologies is equally difficult.

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[1] DOC, ITA, statement by Secretary Ronald H. Brown quoted in *The National Export Strategy, Second Annual Report*, reprinted in *Business America*, vol. 115, No. 9, special issue, Oct. 1994, p. 119.

> Most OECD government export promotion agencies do not keep data on environmental technologies in any systematic way. . . . Thus, it is difficult to make any reliable generalisations about such things as the share of export promotion activities directed to environmental technologies[.][2]

United States

Federal Government support of U.S. exports of all products and services is administered by many agencies and departments that, without a central plan, have demonstrated a poor history of coordination and integration of effort.[3] Both Congress and the Executive Branch have moved to address this problem. In the Export Enhancement Act of 1992, Congress established the Trade Promotion Coordinating Committee (TPCC) as a permanent institution to set strategic priorities, eliminate duplication, and improve integration.[4] This act also established the objective of supporting exports of U.S. environmental technologies, goods, and services, and directed the President to establish the Environmental Trade Working Group (ETWG) as a subcommittee of the TPCC to address these issues and formulate a strategy to expand environmental exports.

On Earth Day 1993, April 21, President Clinton requested that key agencies develop a strategy for trade development, promotion, and assistance to increase exports, create jobs, and improve the environment. In the view of OTA, the overall export strategy announced by the TPCC in September 1993[5] was a first step towards a strategic plan for the United States.[6] ETWG released its recommendations for environmental exports on November 22.[7] The Strategic Framework lists 18 action items to encourage partnerships between the U.S. Government and U.S. businesses. The goals of the Strategic Framework are to strengthen the innovation, development, and commercialization of environmental technology in the domestic market; to help U.S. businesses gain access to foreign markets where their products and services are needed; and to improve the coordination of U.S. Government export programs. Table 5-1 lists some of the Federal agency programs that could support these goals.

The Office of Environmental Technology Exports in the DOC set up in 1994, demonstrates the priority that the administration places on environmental exports. The office has been active in providing information on U.S. Government environmental export programs to the business community, and fostering public-private partnerships.[8] The office received an appropriation of $4.1 million for 1995, after existing on slightly less than $1 million in funding from various sources during 1994. The office has taken a lead role in the activities of the ETWG and is charged with the implementation of all action items of the Environmental Technology Export strategy. One major objective of the strategy is to target markets with the greatest potential for returns. To date, market plans have been produced for Mexico, Chile and Argentina, South Korea, Poland, the Czech Republic, and the China Economic Area (China, Hong Kong, Taiwan). These plans are a guide to each country's environmental situation and priorities, the business climate, and U.S. Government assistance for companies interested in entering these markets. The office is the contact point

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[2] OECD, *Export Promotion and Environmental Technologies*, Environment Monographs No. 87, OCDE/GD (94)9 (Paris: OECD, 1994), p. 11.

[3] GAO, *Export Promotion, A Comparison of Programs in Five Industrialized Nations*, GAO/GGD-92-97 (Washington DC, June 1992), p. 15.

[4] The TPCC had already been initiated by President Bush in 1990 for similar objectives.

[5] TPCC, *Toward a National Export Strategy* (Washington, DC, Sept. 1993).

[6] OTA, *Industry, Technology, and the Environment*, p. 160.

[7] Interagency Environmental Technologies Exports Working Group, *Environmental Technologies Exports*.

[8] Ray Vickery and David Gardiner, memorandum to Secretary Ronald H. Brown, Chairman, TPCC, "TPCC Environmental Trade Working Group 1994 Report," Oct. 5, 1994.

Table 5-1
Selected U.S. Government agency programs affecting environmental exports

Agency/program	(*Million dollars*) 1994 funding	1995 funding	Program description
Department of Commerce			
Office of Environmental Technology Exports	1.0	4.1	Facilitates the increase of U.S. environmental technology exports.
Department of Energy			
Export Assistance Program	1.5	1.6	Provides studies and analysis in support of the National Export Strategy.
International Market Development, Energy Conservation	3.1	7.8	Promotes energy conservation, establish database for energy efficient products.
Coal Technology Export Program	1.6	0.8	Supports coal technology exports.
Committee on Renewable Energy Commerce and Trade (CORECT)	0.9	1.9	Promotes U.S. exports of renewable energy products and services.
Committee on Energy Efficiency Commerce and Trade (COEECT)	0.7	1.1	Promotes U.S. exports of energy efficient products and services.
Environmental Protection Agency			
U.S. Technology for International Environmental Solutions (U.S. TIES)	11.0	[1]	Promotes the use of U.S. technologies and expertise in solving international environmental problems.
Trade and Development Agency	6.1	[2]	Funds export promotion activities for water and environment.
Export Import Bank	1,095.0	[2]	Provides direct loans and guarantees with an environmental purpose.
Overseas Private Investment Corporation (OPIC)			
Environmental Enterprise Development Initiative	1.0	[1]	Gives pre-investment assistance to U.S. companies planning to establish environmental operations in eligible Asian countries.
Global Environment Fund	70.0	[1]	An investment partnership created to realize long term capital appreciation through investments that promote environmental improvement.
Multi-funded Programs			
Environmental Training Institute	2.5	5.2	Provides training to foreign government officials to facilitate U.S. technology transfer.

[1] No new funding.
[2] Estimate is not available.

for the recently formed Environmental Technologies Trade Advisory Committee (ETTAC), 35 individuals who represent the private sector in the ongoing activities of the ETWG.

United Kingdom

Unlike the United States and Germany, the United Kingdom has a strategic plan for promoting exports. The British Government's involvement and integration of export programs is significantly higher than Germany's, if not as high as that of France.[9] Although international comparisons are difficult, according to the DOC, in 1992 the United Kingdom was the leading spender in non-agricultural export promotion, with a budget of $286 million. Its expenditure ranking as a percentage of exports and GDP was significantly higher than all other major suppliers.[10]

France

Export promotion in France is one of the most highly funded and the most highly centralized and integrated programs of any of the countries studied here.[11] Its 1992 export-assistance budget was $239 million, second only to the United Kingdom.[12] Operations are different from in the United States because they fall largely under one organization, the Ministry of Economic Affairs, Finance, and Budget, which formulates trade policy as well as carrying out the operations of export promotion.

Germany

According to a ranking by the General Accounting Office (GAO)[13], the German Government's involvement and participation in export promotion programs is the lowest of the major trading countries of Europe. Although it asserts that it has no formal export strategy or plan, and provides little or no support for exports or commercial research assistance,[14] the German Government does offer other types of assistance.[15] It gathers market information and supports private and quasi-private organizations, such as chambers of commerce. National Government funding is provided to these organizations and for selected promotional activities. The Ministry for Economic Affairs oversees these efforts. Its Federal Office for Foreign Trade Information gathers and distributes information through a worldwide network of correspondents. The diplomatic corps assists by obtaining information from its posts.

The principal role in export market promotion is provided by private and semiprivate organizations. Local and international chambers of commerce are organized through a national umbrella organization, the Association of Chambers of Industry and Commerce, that functions as a

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[9] GAO, *Export Promotion,* p. 15.

[10] DOC, ITA, *National Export Strategy, Second Annual Report*, p. 153. Budget figures for the United Kingdom in this report are in line with those in the GAO Comparison report of June 22, 1994, but are significantly higher than those of a DOC report of 1987, referred to in OTA, p. 162.

[11] GAO, *Export Promotion,* p. 15.

[12] DOC, ITA, *National Export Strategy, Second Annual Report*, p. 153.

[13] GAO, *Export Promotion,* p. 15.

[14] German Embassy official, telephone interview by USITC staff, Aug. 22, 1994.

[15] According to the recently issued second annual ITA report on *National Export Strategy*, Germany committed $3.5 million in 1994 to promote exports of its environmental technologies. A total of $8.8 million has been spent on technical assistance in the past few years; 24 technical experts were assigned to the Mexico City Metropolitan Commission for Environmental Protection and other government agencies on an as needed basis. Ibid., p. 53.

clearing house for distributing information to its members.[16] The German Government apparently plays no active role in this process. The local chambers advise and educate their membership through programs and seminars on the details and intricacies of exporting. They provide documentation, legal requirements, and referral services. These local chambers are independent and self-supporting with no government funding.[17]

Japan

Japan spends less on traditional export promotion activities than the United States.[18] Although it does not have a formal strategic plan, Japan has structured its foreign aid to foster exports. Major organizations involved are the Ministry of International Trade and Industry (MITI), the Ministry of Finance, the Economic Planning Agency, the Ministry of Foreign Affairs, the Japan External Trade Organization, the Small Business Corporation, and the Export-Import Bank of Japan (JEXIM).

Export Education, Market Information, and Trade Fairs

United States

The DOC, the Small Business Administration (SBA), and the Agency for International Development (USAID) offer programs to introduce businesses to the export market. In addition to these agencies, the Department of Energy, the Environmental Protection Agency (EPA), the Overseas Private Investment Corporation (OPIC), and the Trade and Development Agency (TDA) provide market information and sponsor trade missions. State agencies, local trade associations, chambers of commerce, and other private entities, such as bar associations, institutes, and congresses also conduct export activities. An extensive account of specific programs for export promotion, can be found in the OTA reports. The use of electronic bulletin boards for export education and information, such as DOC's National Trade Data Bank has increased, as well as systems that match customers with suppliers. For example, the United States-Asia Environmental Partnership (US-AEP) sponsors the Environmental Technology Network for Asia, an electronic service that uses faxes to alert registered companies to specific opportunities for environmental technology orders in nine cities in Asia.

Companies can present their offerings to assembled customers at trade fairs or meet potential customers by participating in a trade mission. DOC sponsors or conducts about 80 international fairs and approximately 50 trade missions annually, usually in conjunction with other agencies. In 1994, DOC sponsored 10 trade missions and 12 trade fairs focused on pollution control and water resources equipment.[19]

Two large environmental congresses and associated trade fairs being held in Berlin in early 1995--UTECH '95 and KLIMA '95--may be indicative of the lack of U.S. participation in overseas

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[16] TPCC, *Environmental Technologies, Industry and Global Markets*, p. 92.

[17] The Ministry of Industry provides some funding for specific market research to the local and international chambers of commerce and industry. TPCC, *Environmental Technologies, Industry and Global Markets*, p. 91.

[18] DOC, ITA, *The National Export Strategy, Second Annual Report* shows Japan spending only $94.3 million in 1992, compared with $149.4 million spent by the United States, p. 153. But these funds largely reflect expenditures by the U.S. Department of Commerce and not by other providers of assistance. Total nonagricultural trade promotion spending by the U.S. Government was $1,102 million in 1993, and $1,486 million was requested for 1995, p. 106. OTA reported Japan's total budget for 1989 to be $285 million. p. 162. OTA reported U.S. spending in 1987 to be $257.2 million.

[19] US&FCS, written communication, Nov. 17, 1994.

fairs. According to the U.S. Embassy in Berlin, participation by U.S. firms hardly occurs.[20] UTECH '95 represents almost $137.5 billion of environmental remediation business in eastern Germany alone. No U.S. exhibitors attended UTECH '94 and none have registered for UTECH '95, which is already sold out. In lieu of exhibiting, the United States and Foreign Commercial Service (US&FCS) in Berlin is offering a Gold Key Program in which separate meetings are arranged for visiting U.S. firms. KLIMA '95 is the follow-up to the Rio Summit of 1992; authorities expect 3,000 representatives from 166 nations and only a small amount of exhibit space is still available. US&FCS Berlin is promoting its Gold Key Program for KLIMA as well.

United Kingdom

The British Overseas Trade Board (BOTB) of the British Department of Trade and Industry administers the export promotion program.[21] BOTB also advises on policy and develops a 3-year plan to coordinate both domestic and foreign trade promotion. This plan usually targets a specific region. Japan was targeted in 1988 in a 3-year plan to double British exports. The United States was targeted in 1993.

BOTB has 11 regional offices whose export departments provide worldwide commercial service in coordination with the British Foreign Office. In 1990, there were 185 British foreign commercial posts with 523 commercial officers and 961 foreign nationals providing commercial assistance for a total personnel of 1,484, this was another high, although France followed closely with 1,230.[22]

The British Government works closely with the private sector, although not as closely as the German Government. BOTB is advised by 185 representatives from the private sector in 17 advisory groups, and private groups provide practical assistance to exporters.[23] The Association of British Chambers of Commerce, the London Chamber of Commerce, the Confederation of British Industries, and specific industry associations all provide various forms of export support. These range from export clubs with volunteers to advise prospective exporters to chambers providing a comprehensive range of services to exporters.

Chambers are supported by member subscriptions and do not receive government support. But government support can play an important role in financing some programs, such as market research. The Association of British Chambers of Commerce (ABCC) is funded by BOTB under the Export Market Research Scheme to provide free professional advice to firms with less than 200 employees.[24] In this program BOTB will also pay up to one-half the cost up to a maximum of approximately $40,000 for a professional consultant to conduct export market research for a firm, provided the market is outside the EU. Approximately 600 research projects are approved each year.[25] If the firm does its own research, BOTB will fund a substantial portion of this expense, including up to one-third of the cost of already published market research. ABCC also operates a regional network of 34 export advisors to assist local chambers. The Similar Trade Procedures Board assists businesses in preparing export documentation.[26]

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[20] U.S. Department of State telegram, "IMI: UTECH '95 and KLIMA '95--Berlin's Bid to Make the 1995 Environmental Summit in Berlin a Forum for Business," message reference No. 003510, prepared by U.S. Embassy, Berlin, Dec. 6, 1994.

[21] GAO, *Export Promotion*, p. 21.

[22] Ibid.

[23] Ibid.

[24] William E. Nothdurft, *Going Global: How Europe Helps Small Firms Export* (Washington, DC: Brookings Institution, 1992), pp. 43-44.

[25] Ibid., p. 44.

[26] TPCC, *Environmental Technologies, Industry and Global Markets*, p. 96.

Trade shows are another means of export promotion subsidized by BOTB. For at least three trade shows in a selected market, BOTB pays up to 50 percent of the costs of space and associated display activity, such as stands. Companies focusing on a targeted market area, such as Japan or the United States, may receive more assistance.[27] BOTB also supports reverse trade missions by foreign buyers by providing 50-75 percent of their expenses. The New Products from Britain Program subsidizes the cost of marketing specific products in targeted markets.[28]

France

The Direction des Relations Economiques Extérieures (DREE) supervises agencies providing export promotion and credit activities, such as the Centre Francais du Commerce Extérieur (CFCE) and the Poste d'Expansion Economique. CFCE provides domestic contact with businesses through a Paris office and 24 regional offices. It conducts export counseling and seminars, disseminates trade and marketing information, and manages overseas trade events such as trade fairs. The Poste d'Expansion Economique provides overseas support in 180 posts in 80 countries.[29] Overseas posts gather and report market information, assist visiting French firms at local trade events and in contacting commercial agents and distributors, and advise them of opportunities. The French Committee for External Economic Events organizes or sponsors more than 200 annual trade events. It helps exhibitors with their booths, but businesses pay all costs of participation.[30] The Agency for International Promotion of Small and Medium-Sized Enterprises has 17 offices in 15 countries, which assist small and medium-size firms for 2 to 3 years in their efforts to penetrate specific foreign markets. This agency will conduct audits of a firm's capabilities and test-market its products.

An extensive system of private organizations both at home and abroad also provides assistance. Chambers of commerce and associations set up trade missions, provide information services, and help firms devise market-opening strategies. The Federation of Small and Medium-Sized Industries helps these firms to establish foreign subsidiaries. All of these organizations receive some form of government support.

Some regional governments are very active in assisting their businesses. The Regional Mission for the Coordination of International Trade with Brittany offers customized assistance to small firms on a fee basis, but will subsidize 30 percent of export-related costs, assisting individual firms in specific market-opening efforts.[31] The Regional Assistance and Consultancy Fund is a a subsidy program in which regional governments and chambers of commerce retain consultants to conduct customized market research for targeted foreign markets.

Germany

Approximately 43 international chambers, the Chambers of Commerce Abroad, serve in effect as a German foreign commercial service.[32] They obtain foreign market intelligence in their respective countries and provide assistance in locating contacts for agents and distributors. They conduct market analyses at government-subsidized cost. Their funding is through dues, service fees, and from the German Government.[33]

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[27] GAO, *Export Promotion*, p. 27.
[28] TPCC, *Environmental Technologies, Industry and Global Markets*, p. 96.
[29] GAO, *Export Promotion*, p. 25. Data are for 1990.
[30] EPA, *Global Markets For Environmental Technologies*, p. E-7.
[31] Ibid., p. 91.
[32] TPCC, *Environmental Technologies, Industry and Global Markets*, p. 92.
[33] EPA, *Global Markets for Environmental Technologies*, EPA 160-R-92-001, Dec. 1992, p. E-9.

The German Industry Council for Exhibitions and Trade Fairs coordinates both domestic and international fairs involving private sector organizers, chambers of commerce, and trade associations. The German Government subsidizes 30 percent of firms' participation costs and also provides some funds for special research projects. The council is a private organization that is viewed as the trade fair expert of the EU.[34]

Individual states can have very aggressive export promotion programs.[35] The State of North Rhine-Westphalia provides significant support for trade fairs; 60-65 percent of its export promotion budget is for this purpose. Booth set-up and staffing costs are subsidized. The North Rhine-Westphalia Foreign Trade Institute is a joint venture between the State government and chambers of commerce that will pay one-half of the cost of a private consultant to assess a firm's export readiness.

Japan

It is unclear how much general market information is provided by the Government of Japan; OTA suggests that France, Germany, Japan, the United Kingdom, and the United States all offer similar services, but does not provide any detail on Japanese Government support for market research, trade fairs, or trade missions.[36] Although Japan maintains relatively few personnel abroad in comparison with those of European countries,[37] these personnel are concentrated in markets of interest and are supplemented by the commercially oriented Japanese diplomatic service. In addition to gathering information about the host country and promoting exports, increasing effort is being focused on the promotion of imports of foreign products to Japan in response to its chronic trade surplus.

Overseas Presence and Advocacy

United States

In 1990, the US&FCS had 155 commercial officers in 123 posts supplemented by 460 foreign nationals.[38] The Export Enhancement Act of 1992 provided for greater emphasis on environmental training and staffing in the US&FCS. This had been discussed by EPA and DOC and a memorandum of understanding was signed to that effect. Informal discussions were held by DOC and EPA to train US&FCS personnel in Asia under US-AEP. Similar cooperation to establish environmental business centers in Russia and the former Soviet Republics has been authorized by Congress.

The Clinton Administration has moved to address the relative lack of high-level official advocacy of commercial interests by the United States compared with the other surveyed countries. One initiative was the establishment of an Advocacy Center at the DOC in November 1994 to coordinate the activities of a network of nineteen government agencies, which it coordinates in developing strategies to support U.S. companies seeking advocacy assistance. Its staff is creating an automated computer database to track foreign projects in order to alert high government officials of

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[34] Ibid, p. 92.

[35] DOC, Market Research Report, *Environmental Technology Exports: Strategic Framework*, June 29, 1994, p. 12.

[36] OTA, *Industry, Technology, and the Environment*, p. 165.

[37] Japan has 76 overseas posts with 300 commercial officers and 300 local staff for a total commercial service of 600 in 1992. Ibid., p. 171.

[38] Both the OTA and GAO studies faulted the levels of staffing for the service compared with that of the major competitor countries.

projects that they may be in a position to support during the course of their foreign travel or other contacts with foreign government or business officials.

Feasibility Studies

United States

Capital projects, such as any for W&WW, often involve feasibility studies. These studies often lead to contracts for goods and services. Although several Federal agencies fund these studies, TDA is the principal player. In 1992, TDA spent $39 million on program activities, of which $25 million was for bilateral grants for 79 feasibility studies, and $2.5 million was for evaluations by multilateral development banks; another 12 percent of program spending was for water and environment. Appropriations for 1993 and 1994 were $40 million each, although the administration requested $60 million. One feasibility study costing $680,000 in 1992 was for an industrial and municipal wastewater treatment facility in Paraguay. TDA reported that the project represented potential U.S. exports of over $149 million.[39]

In 1993 TDA devoted 15 percent of its budget, or $6.4 million, to water and environment projects. These projects included $752,500 for wastewater treatment in Poland; $212,275 for sewer renovation in Singapore; $44,750 for water supply in Venezuela; $19,937 for water treatment in the Dominican Republic; and $9,682 for water treatment in Turkey. TDA also maintains a $610,000 trust fund with the World Bank to fund feasibility studies in multiple regions for multiple U.S. firms.[40]

Research, Development, Demonstration, and Commercialization

United States

Estimates of public funding for environmental technology research and development range from $1.8 to $5 billion dollars. However, these estimates are based on different definitions of research and development and environmental, and may or may not include demonstration or commercialization programs.[41] The most thorough attempt to measure Federal funding for all categories of environmental research and development including environmental technology has been made by the Committee on Environment and Natural Resources of the National Science and Technology Council. Although the database is still under development, the Committee's initial assessment of funding for environmental technology research and development across all Federal agencies is between $2 and $2.5 billion dollars a year.[42]

The National Environmental Technology Strategy, a White House initiative due for release on Earth Day 1995, will present a vision of a sustainable future and a plan to incorporate the use of environmental technologies to achieve the vision. Research and development is integral to the plan, with some programs already fully operational. Table 5-2 lists some of these programs. The EPA Environmental Technology Initiative (ETI), funded at $36 million in 1994 and $68 million in 1995, supports environmental technology from its development in the lab to its use in foreign markets. The international element of ETI is called the U.S. Technology for International Environmental Solutions and is budgeted at $11 million in 1994. The program serves the dual function of promoting U.S. technologies and expertise to solve environmental problems and improving the ability

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[39] TDA, *1993 Annual Report*.
[40] Ibid.
[41] OTA, *Industry, Technology, and the Environment*, p. 294
[42] National Science and Technology Council official, telephone interview by USITC staff, Jan. 1995.

of U.S. businesses to compete in the global market.[43] The Manufacturing Extension Partnership of the National Institute of Standards and Technology (NIST) helps smaller manufacturers implement technologies and techniques that will help them to be environmentally competitive.[44] OTA had characterized the transfer of environmental technology from the laboratory to the market as weak. At the White House Conference on Environmental Technology in December 1994, Vice President Gore announced the Rapid Commercialization Initiative (RCI) to ensure that technology for environmental solutions successfully reaches the market.[45]

Japan

Japan has embarked on an ambitious, worldwide environmental agenda.[46] New Earth 21 is a 100-year plan to repair damage to the earth that has occurred since the beginning of the Industrial Revolution. The plan concentrates attention on damage from greenhouse gases by developing solutions through energy efficiency and conservation, clean energy sources, environment-oriented technology development, carbon dioxide absorption, and future generation energy-related technologies. New Earth 21 was begun in 1990 when MITI, who administers the program, budgeted $41.4 million yen for research and development, including $13.8 million yen for the private sector. The five initiatives all began in 1990, but will mature in 10-year intervals. New Earth will promote its agenda by a worldwide diffusion of technologies developed by the initiatives; the Research Institute of Innovative Technology for the Earth and the International Center for Environmental Technology Transfer will be the primary institutions.

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[43] EPA, *Environmental Technology Initiative: 1994 Program Plan*, EPA 543-K-93-003 (Jan. 1994), p. 15.

[44] NIST, *Manufacturing Extension Partnership Environmental Strategy*, (Aug. 1994).

[45] Gore, speech, Dec. 12, 1994, and RCI memo, Jan. 1995.

[46] Information in this paragraph was taken from TPCC, *Environmental Technologies Industry and Global Markets*, p. 93.

Table 5-2
Selected U.S. Government environmental research, development, and demonstration programs

(Million dollars)

Agency/program	1994 funding	1995 funding
Department of Energy		
Environmental Management, Office of Technology Development	393.0	417.0
National Industrial, Competitiveness through Efficiency, Environment, Energy and Economics (NICE^3)[1]	3.5	5.5
Clean Coal Technology Demonstration Program	225.0	37.0
Center for Environmental Technologies	1.2	1.5
Department of Defense		
Strategic Environmental Research and Development Program (SERDP)	160.0	60.0
National Defense Center for Environmental Excellence (NDCEE)	30.0	8.9
Department of Commerce		
National Oceanic and Atmospheric Agency Environmental Technology Laboratory	12.0	12.0
National Institute for Standards and Technology, Environmental Technology Development	0.0	7.0
Environmental Protection Agency		
Superfund Innovative Technology Evaluation Program (SITE)	14.5	16.0
Committee to Develop On-Site Innovative Technology (DO IT)	1.5	0.5
Environmental Technology Initiative (includes funding for U.S. TIES)	36.0	68.0
Office of Research and Development		
Wastewater and sludge research	1.5	1.5
Pollution prevention, industrial wastewater	1.0	1.0
Drinking water research	6.4	6.4
Department of the Interior		
Bureau of Mines, Environmental Technology	21.0	25.0

[1] This program also receives EPA funding.

Source: USITC staff

Technology Training and Cooperation

United States

The United States has a modest training program to educate foreign industry and government officials about the availability and advantages of U.S. environmental technologies. In 1992, TDA spent $7.4 million on training on capital projects and $0.5 million on technical seminars. The United States Environmental Training Institute (U.S. ETI) is a nonprofit joint effort of U.S. Government and business to train developing country officials. Participating firms provide training at their own expense; such agencies as EPA, TDA, and USAID supply instructors. The U.S. ETI budget in 1993 was $3.4 million, including $2.1 million of private funding from over 20 firms, and $1.3 million in public funds from 9 Federal agencies and the World Bank and International Finance Corp. Environmental fellowships are provided by US-AEP, administered by the Asia Foundation, which plans 125 fellowships during 1993-95.[47]

Finance and Insurance

A primary competitive factor facing exporters is the availability of finance and insurance.[48] Exporters usually require some means of expediting payment, whether with a letter of credit, a longer period of payment, or a guarantee or insurance. Even loans to pay for product development or production are included in broad definitions of export finance. Private sector banks are the customary source of these services, but there has always been some government involvement to assist or supplement these private sources. This government support has frequently been a source of contention between countries, and agreements have attempted to bring some order to this competition.[49] A recent OECD paper indicates that the overall level of export credits given by OECD countries has declined, while the export promotion activities described here are increasing.[50]

United States

The U.S. Government agencies providing export finance are the Export-Import Bank (Ex-Im Bank), OPIC, and SBA. Ex-Im Bank offers a comprehensive program of export assistance. OPIC traditionally focuses on insuring foreign investment, but also provides some export assistance in the form of loans. SBA has a small export financing program, but has not been very active in export finance relative to its other activities. All of these agencies' efforts are being increasingly directed to small exporters and to environmental considerations.

Ex-Im Bank's mission is to counter the offers of subsidized export credit by other governments and to provide credit in circumstances where the private sector will not. As a result only a small share of total U.S. exports receive support under Ex-Im Bank programs. Indeed, while

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[47] USAID, among others, supports U.S.-AEP with approximately $20 million annually. OTA, *Industry, Technology, and the Environment*, p. 177.

[48] 30 percent of equipment producers and 31 percent of service providers for water and wastewater treatment responding to the USITC questionnaire named the lack of project finance among the top five financial barriers affecting their ability to compete in non-U.S. markets.

[49] An arrangement under the auspices of the OECD in 1992 is supposed to bring order to tied-aid financing, a special form of support where development assistance is tied to purchases from the donor country. OECD, *Export Promotion and Environmental Technologies*, p. 9.

[50] The level of credits and the degree of subsidization have been declining since the early 1980s; the contract value of export credits supported by governments peaked in 1982. Ibid., pp. 5 and 9.

the amount of exports financed has increased, overall exports have increased even more rapidly, causing the share of exports financed to fall relative to overall exports.[51]

In the past 2 years, Ex-Im Bank authorizations have increased. Of an authorized limit of $15.5 billion in 1993, Ex-Im Bank provided $15.1 billion in financing, compared with less than $10 billion in 1990. Authorized loans attained a new level of $0.8 billion in 1992 and doubled to $1.7 billion in 1993. Export guarantees were up sharply, beginning in 1990, and had tripled by 1993. Working capital guarantees, although small, were double the average of recent years.

Prior to 1993, Ex-Im Bank was limited to a total of $40 billion of loans, guarantees, and insurance outstanding at one time.[52] Estimates of demand for Ex-Im Bank-supported exports in 1994 exceeded $18 billion, which would require a minimum subsidy allocation of $1.1 billion.[53] The administration's budget request was for $757 million in 1994, the same as in 1993. This sum was reduced to $700 million by the House.

In terms of mission, Ex-Im Bank is constrained by its needs-based agenda of only meeting government-supported competition or when there is an unwillingness by the private sector to provide finance.[54] Substantial evidence for one position or the other must be gathered in order to justify Ex-Im Bank support. Gathering this evidence can be so time consuming that the market opportunity passes. Financing institutions of major competitors manage much more flexible programs in which access is automatic once the parameters are met. This difference in approach is pointed up by Ex-Im Bank's recent reversal in the reorganization of its new tied-aid program. Documentation procedures for the program were so onerous that Chairman Kenneth Brody called the system "DOA--dead on arrival," as constituted.[55] The Ex-Im Bank response was to make a "willingness to match" indication early on, but still require firmer evidence as it surfaced.

Ex-Im Bank has made other changes to respond to criticism of its service.[56] In response to criticisms of its slowness, Ex-Im Bank instituted a policy in May 1993 whereby it has achieved an average response time of 7.5 days. Although almost all of its past authorizations were to governments, most current authorizations have shifted to respond to private buyers.[57] The Ex-Im Bank Advisory Committee was generally critical of limited country coverage, and the Ex-Im Bank significantly increased its loan terms, guarantees, and insurance in 40 countries, while increasing its fees in these markets to make up for the increased risk.[58] Small business authorizations increased in number to over a thousand, but fell below $2 billion in value. Ex-Im Bank formed a Project Finance Division and intends to aggressively pursue infrastructure projects worldwide.[59]

Responding to initiatives/incentives by the Congress and the administration, Ex-Im Bank has made the environment a focal point of its revised agenda. Its twin goals are to take environmental

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[51] GAO, *Export Finance: The Role of the U.S. Export-Import Bank*, GAO/GGD-93-39 (Washington, DC, Dec. 23, 1992), p. 12. and James S. Altschul, *The Export Finance Crisis* (Washington, DC: Economic Strategy Institute, 1992), p. 11.

[52] In 1993, this limit was increased to $75 billion.

[53] Advisory Committee statement in Ex-im Bank, *Report to the U.S. Congress on Export Credit Competition and the Export-Import Bank of the United States* (Washington, DC, July 30, 1993).

[54] Ibid., p. 9.

[55] Bureau of National Affairs (BNA), *International Trade Reporter*, vol. 11, Aug. 10, 1993, p. 1232.

[56] Kenneth Brody, Advisory Committee statement on Ex-Im Bank's Competitiveness, transmittal letter on the Report on Export Credit Competition; and *Survey of U.S. Exporters and Commercial Bankers*, part IV, Aug. 4, 1994, pp. 25-37.

[57] Ex-Im Bank, *Annual Report, 1993* (Washington, DC: Export-Import Bank of the United States), p. 2.

[58] BNA, *International Trade Reporter*, vol 12, July 27, 1994, pp. 1160-61.

[59] Ex-Im Bank, transmittal letter.

consequences into account in its financing decisions and to promote increased exports of environmental technology products and services.[60] Ex-Im Bank began to account explicitly for the environmental export value of its financing. It used $464 million in support of environmentally beneficial exports in 1993 for 20 projects in 12 countries.[61] It had used more than $1 billion in support of such exports for 22 projects in 9 countries as of September 30, 1994.[62]

In an effort to increase its support for environmental goods and services, Ex-Im Bank combined environment and its small business initiative in a special Environmental Exports Program. This program qualifies small businesses exporting environmentally beneficial products or services and offers several enhanced services and provisions for single and multiple buyers. A discretionary credit limit allows exporters to use their own credit procedures to qualify foreign buyers. A tenfold reduction in minimum premiums for insurance allows much smaller export transactions to qualify for insurance.

OPIC encourages U.S. private business investment in developing countries by offering programs to lessen the risks of overseas investment. It assists investors through loans and loan guarantees, by insuring investments against political risk, and by offering other investor services. Projects representing $3.7 billion in total investment were assisted in 1993; these projects are expected to generate $1.6 billion in U.S. exports.[63]

OPIC has also been active in the environmental arena. It must review potential projects for their environmental impact and conduct environmental assessments of sensitive ones. In 1991 four projects were rejected on environmental grounds.[64] OPIC is also underwriting the Global Environment Emerging Markets Fund, the first environmentally oriented U.S. Government-backed investment fund.[65] The Fund is capitalized at $70 million and could generate $500 million or more in U.S. projects worldwide.[66] It is focused on industry sectors developing, operating, or supplying infrastructure projects, including the delivery of potable W&WW treatment.

SBA also provides export financing, but only to a limited extent, under $100 million.[67] Recent initiatives such as the Export Enhancement Act and the administration's National Export Strategy are attempting to change this. The SBA has made its Export Revolving Line of Credit more responsive, and the new Export Working Capital Program will provide preliminary commitments from the SBA to small borrowers prior to approaching a lender.[68] SBA personnel work in coordination with other Federal agencies to train and develop the skills of small business exporters. The Export Trade Assistance Partnership prepares small businesses to participate in international trade shows and trade missions. Another initiative is UNISPHERE, a program to match small and medium-size U.S. firms with international companies in joint ventures and partnerships in four high technology sectors, including environmental technology.

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[60] Ex-Im Bank, *Annual Report, 1993*, p. 11.
[61] Compiled from Ex-Im Bank, *Transactions with an Environmental Effect*, Report No. ACMR610-2 (Nov. 2, 1993).
[62] Compiled from Ex-Im Bank, *Transactions with an Environmental Effect*, Report No. ACMR610-2 (Sept. 30, 1994).
[63] OPIC, *Annual Report, 1993* (Washington, DC, Mar. 1994), p. 4.
[64] OPIC, *Annual Report, 1992*.
[65] OPIC, *Annual Report, 1993*, p. 3.
[66] Ibid, pp. 3-4.
[67] GAO, *Export Promotion: Problems in the Small Business Administration's Programs*, GAO/GGD/92-77 (Washington, DC, Sept. 2, 1992), pp. 8-11.
[68] DOC, ITA, *The National Export Strategy, Second Annual Report*, p. 118.

United Kingdom

The United Kingdom has no official institution for export credit financing or refinancing.[69] A government organization, the Export Credit Guarantee Department (ECGD), provides export insurance and guarantees, including investment insurance to supplement commercial foreign exchange facilities. Interest subsidies are available for exports with credit terms of 2 years or more according to the terms of the OECD Arrangement.

Mixed credit or associated financing of exports under the Aid and Trade Provision (ATP) are jointly administered by the Department of Trade and Industry and the Overseas Development Administration in coordination with the ECGD. Projects must meet certain commercial and developmental criteria, and terms will normally meet the OECD Consensus Arrangement unless matching another country's offer.[70]

Integrated credits or soft loan facilities are also available under the ATP. Commercial banks finance the loans which are guaranteed by ECGD and supported by the Overseas Development Administration. Soft loans are offered when considered to be more effective than an aid grant along with an export credit in matching offers made by other OECD countries.[71]

France

The Compagnie Francaise d'Assurance pour le Commerce Extérieur (COFACE) is the French Government agency for export finance under the coordination of DREE. Although it does not provide short-term direct credits or refinancing for French exports, another organization, the Banque Francaise du Commerce Extérieur, does participate in export credits with maturities greater than 2 years. Short-term credits are all handled by the commercial banking system at market rates. COFACE provides insurance and guarantee cover for both commercial and political risk and for both the period of manufacture and the export credit.[72] The insurance is always less than 100 percent, generally in the range of 85-90 percent for various programs, depending on the nature of the goods and the country. Repayment periods vary from 5 to 10 years according to country development. Other insurance programs are available for foreign exchange risk, cost escalation, and performance.

COFACE operates a network of 22 regional offices to provide insurance for market research.[73] If market research is unsuccessful, 50 percent of the costs of two development missions and from 50 to 60 percent of exploration costs are covered. Up to 75 percent of the costs of market studies are guaranteed for small and medium-size firms with innovative products. Large firms receive guarantees of up to 75 percent of the fixed costs to investigate foreign markets.[74]

Germany

Estimates of the value of export credit provided by the German Government are difficult to compile because, as in much of the German export promotion program, both public and private efforts are involved. Official German export credit financing was 6 percent of total exports in 1991-93.[75]

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[69] OECD, *Export Credit Financing*, p. 138.
[70] Ibid., p. 144.
[71] Ibid.
[72] OECD, *Export Credit Financing*, p. 46.
[73] TPCC, *Environmental Technologies, Industry and Global Markets*, p. 90.
[74] Ibid.
[75] DOC, ITA, *National Export Strategy, Second Annual Report*, p. 156.

Medium or long-term export credit financing in Germany is facilitated by a private credit institute, Ausführkredit-Gesellschaft (AKA), backed by 54 commercial banks.[76] AKA is a private company not responsible to any governmental body.[77] Applications for finance are made through the banks, but AKA approves the loan. Kreditanstalt für Wiederaufbau (KfW) provides official financing that may include government-subsidized credits.[78]

Insurance for exports and foreign investment is provided by a consortium consisting of a private company, Hermes Kreditversicherungs AG, and a quasi-public institution, Treuarbeit AG.[79] Most insurance is extended on a profit-making basis, but Hermes does provide official export insurance in combination with official export financing by KfW.

Japan

Japan has a highly developed official program of export finance and insurance, supporting an average 39 percent of total exports during 1990-1993, with a high of 44 percent in 1992.[80] Export credits are administered by the JEXIM. There is no official subsidy of interest rates, which are supposed to be in agreement with OECD Arrangement guidelines.[81]

The Export-Import Insurance Division (EID), a division of MITI, provides a comprehensive insurance program for exports, investment, foreign exchange, performance bonds, and service payments. JEXIM supplies guarantees when the credits cannot be covered by EID.[82]

Development Assistance

In 1992, total net resource flows for all purposes to all developing countries was a record $159 billion.[83] The United States provided a total of $11.7 billion, $7.9 billion for bilateral aid and $3.9 in multilateral contributions.[84] Donor countries are directed by the OECD Development Assistance Committee (DAC) to examine their priorities for allocating and using ODA effectively, and are encouraged to work closely with recipient countries to determine the most effective administration of aid.[85]

Total long term resource flows for the surveyed countries have varied during 1989-92 (table 5-3). In 1989 Japan became the leading source of total resource flows as well as of ODA. The United States was first in ODA in 1990 and has continued so through 1992. Japan's total net disbursements exceeded the United States' in 1990-91 because of larger private flows. Total resource flows from the United States were substantially higher than any other country in 1992 as private flows increased by $10 billion and total flows were $33 billion in 1992, $17 billion larger

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[76] GAO, *Export Promotion*, p. 31.
[77] OECD, *Export Credit Financing*, p. 58.
[78] DOC, ITA, *National Export Strategy, Second Annual Report*, p. 156.
[79] Ibid., p. 156.
[80] Ibid., fn. 5, p. 155. This very high average percentage, twice that of France, the second largest, could be viewed as inflated because a large portion is short term, market risk business that would be handled by commercial banks in other countries. That a central government organization in Japan supplies this financing, instead of banks, also reflects the degree that Japan has been willing to assist exports.
[81] OECD, *Export Credit Financing*, p. 221.
[82] Ibid., p. 214.
[83] In constant 1991 prices. OECD, *Development Co-operation 1993: Efforts and Policies of the Members of the Development Assistance Committee*, (Paris: OECD, 1994), p. 62.
[84] Ibid., p. 183.
[85] Ibid., p. 10.

than those of Japan. ODA from France, Germany, and the United Kingdom in 1992 was $8.3 billion, $7.6 billion, and $3.2 billion, respectively.

Table 5-3
The flow of financial resources to developing countries and multilateral organizations, 1989-92

Net disbursements	1989	1990	1991	1992
		Million dollars		
Official development assistance:				
France	5,802	7,163	7,386	8,270
Germany	4,948	6,320	6,890	7,572
Japan	8,965	9,069	10,952	11,151
United Kingdom	2,587	2,638	3,201	3,217
United States	7,676	11,394	11,262	11,709
Other official flows:				
France	932	642	824	558
Germany	1,025	2,110	1,868	-
Japan	1,544	3,367	2,582	3,266
United Kingdom	459	628	516	297
United States	(496)	(450)	(776)	1,305
Grants by private volunteer agencies:				
France	159	187	187	-
Germany	679	757	763	763
Japan	122	103	168	190
United Kingdom	262	327	379	438
United States	1,877	2,505	2,671	2,812
Private flows at market terms (long term):				
France	(1,630)	(2,287)	(1,918)	-
Germany	5,494	4,374	3,578	-
Japan	11,364	4,690	10,788	1,547
United Kingdom	6,159	2,934	1,527	744
United States	7,325	(2,356)	7,599	17,666
Total resource flows (long term):				
France	5,262	5,705	6,478	-
Germany	12,146	13,560	13,098	-
Japan	21,995	17,229	24,490	16,154
United Kingdom	9,468	6,527	5,623	4,696
United States	16,382	11,093	20,756	33,492

Source: OECD, Development Co-operation 1993: Effects and Policies of the Members of the Development Assistance Committee, 1994, pp. 174-75, 177, and 182-183.

ODA is broken down into bilateral contributions, which are controlled by donor countries, and contributions to multilateral institutions, which are administered by the institution (table 5-4). During 1990-1992 total bilateral ODA from the United States fell 6 percent, while multilateral aid increased 27 percent. Total bilateral ODA of France (12 percent), Germany (17 percent), Japan (24 percent), and the United Kingdom (15 percent) increased during the period. Their total contributions to multilateral institutions increased by 21 to 30 percent.

Table 5-4
Bilateral Official Development Assistance and contributions to multilateral institutions, 1989-92

Net disbursements	1989	1990	1991	1992
	Million dollars			
Bilateral ODA:				
France	4,487	5,612	5,772	6,302
Germany	3,175	4,479	4,575	5,231
Japan	6,779	6,786	8,860	8,385
United Kingdom	1,463	1,474	1,818	1,699
United States	6,827	8,367	9,396	7,859
Contributions to multilateral institutions:				
France	1,315	1,551	1,614	1,968
Germany	1,773	1,841	2,315	2,341
Japan	2,186	2,282	2,092	2,766
United Kingdom	1,124	1,164	1,382	1,518
United States	850	3,027	1,866	3,850
Total ODA:				
France	5,802	7,163	7,386	8,270
Germany	4,948	6,320	6,890	7,572
Japan	8,965	9,069	10,952	11,151
United Kingdom	2,587	2,638	3,201	3,217
United States	7,676	11,394	11,262	11,709

Source: OECD, Development Co-operation 1993: Effects and Policies of the Members of the Development Assistance Committee, 1994, pp. 174-75, 177, and 182-183.

Using aid programs to assist or promote a donor country's exports by linking the assistance to exports is called tied aid and has been a source of controversy for a number of years. For the surveyed countries, tied aid as a share of official ODA in 1991 ranged from lows of 10.8 percent for Japan and 17 percent for the United States to tied aid shares of 41 percent for France and the United Kingdom, followed closely by Germany with 38 percent.[86] An OECD tied aid agreement in 1992 established rules to reduce trade distortions and increase transparency through a notification and consultation process. Notifications of tied aid offers decreased significantly in 1993 to $7 billion from $15 billion in 1992. According to industry sources, however, Japan frequently ties aid donations unofficially to future contracts.[87]

[86] Ibid., p. 196.
[87] Industry official, interview by USITC staff, Nov. 3, 1994, and questionnaire responses.

The United States maintains an Ex-Im Bank "war chest" to counter the use of tied aid. Its funding increased from $100 million in 1987 to $200 million in 1993, but actual use of the fund has been much less than authorized, except in 1991 when $146 million was committed. No war chest funds have been directed at countering tied aid in water or wastewater projects. As a result of planning and coordination by the TPCC, a new $150 million Tied Aid Capital Projects Fund has been set up to conduct a proactive policy of countering competitors' tied-aid offers in a more timely and expeditious manner than had been the case. A new letter of interest is issued as soon as an exporter suspects there is tied aid; this is very different from the old system, which waited until the OECD process was largely complete, often too late for any effective action by the U.S. exporter.

USAID is the primary administrator of U.S. bilateral development assistance. USAID's budget for foreign assistance for the environment increased from $611 million in 1994 to $623 million in 1995. This funding was spread over many different projects (see table 5-5).

The Overseas Economic Cooperation Fund administers Japan's bilateral ODA loans. These loans amounted to $4.6 billion in 1992. Most were for direct loans, of which 12.1 percent were for social services, including waterworks projects. In 1992 there were 11 waterworks projects valued at approximately $500 million.

Total contributions by DAC countries to multilateral institutions were $20 billion in 1992, up substantially from $15 billion in 1991. Capital subscription payments and similar expenditures to regional development banks were $9 billion, up significantly from $6 billion in 1991. The World Bank and the various regional development banks[88] are the principal multilateral sources of ODA.

DAC members are beginning to identify their aid according to its environmental content. As of May 1993, 9 of the 21 DAC countries had reported bilateral environmental aid to the OECD, but the DAC has not yet provided estimates of total environmental aid. OTA estimated that over $3 billion of the multilateral assistance budget in 1992 was for environmental projects or projects with a significant environmental component.[89] This, together with at least $2 billion in bilateral assistance, amounts to total assistance for environmental projects in excess of $5 billion per year. The Global Environment Facility was created in 1990 as a mechanism for developing countries to access multilateral funds to finance environmental projects. The U.S. contribution to the GEF in 1995 was $90 million dollars.

The Multilateral Development Bank's (MDB's) administration of their aid programs can also have an influence on associated exports. Although they have strict procurement rules that prevent discrimination, donor countries can attempt to influence procurement under the multilateral programs to the advantage of their own exports. This usually is attempted in the early stages of preparing a project and uses bilateral aid.[90] A MDB budgets a certain amount for the entire project but requires the recipient country to fund the feasibility study for the project, including consultants and any necessary goods and services.[91] This approach places the recipient country in the difficult position of a significant financial responsibility, often with less than adequate sources of funds. This presents a prime opportunity for a donor country to offer bilateral aid, with the understanding that the follow-on contract will be awarded to the donor country. Countries maintain trust funds with MDBs for financing project preparatory work.[92]

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[88] For example, the Asian Development Bank and the Inter-American Development Bank.
[89] OTA, *Development Assistance*, pp. 27-28.
[90] Ibid., pp. 28-29.
[91] World Bank, *A User's Guide to the International Business Opportunities: Monthly Operational Summary* (Washington, DC, Oct. 1994), p. 4, and industry official, interview by USITC staff
[92] TDA maintains a trust fund of $610,000, whereas other countries maintain trust funds of several million dollars.

Table 5-5
Selected U.S. Government foreign assistance programs for the environment

Agency/program	(Million dollars) 1994 obligated funding	1995 obligated funding	Program description
U.S. Agency for International Development (USAID)	611.0	623.0	Total funding obligated for projects supporting environmental activities.
Bureau for Global Programs	66.0	67.0	
Energy Efficiency Project	0.0	6.4	Development of long-term projects to reduce energy consumption and CO_2 emissions.
Energy Technology Innovation Project (ETIP)	6.7	2.4	Assistance to developing countries in the implementation of innovative energy technology.
Energy Training Project	2.6	3.2	Training for energy & environmental professionals in energy resource management.
Environmental Health Project	2.5	2.1	Assistance for health problems stemming from environmental change.
Environmental Pollution Prevention Project (EP3)	1.9	3.0	Technical assistance to reduce environmental pollution associated with urbanization and industrialization in developing countries.
Environmental Planning and Management II	5.3	4.7	Strengthen the capabilities of public and private institutions in developing countries to manage and conserve their natural resources.
Renewable Energy Applications and Training Project (REAT)	4.7	4.0	Promotion of the application of economically and environmentally sustainable renewable energy technologies in developing countries.
Bureau for Africa	62.0	75.0	
Action Program for the Environment, Uganda	3.8	2.9	Assistance in natural resource management via planning and policy reform.
Natural Resources Management, Southern African Region	14.0	4.0	Support for wildlife management and land use reform.
Sustainable Approaches via Environmental Management	7.7	7.6	Support for national plans through sustainable community development in threatened natural areas.
Bureau for Asia/Near East	254.0	227.0	
Alexandria, Egypt Wastewater Systems Expansion	28.0	0.0	Design and construction of a modern wastewater disposal system for the city.
Alexandria, Egypt Sewage II	0.0	32.0	Design and analysis of water treatment alternatives.
ASEAN Environmental Improvement Project (EIP)	0.0	2.0	Training in technical and administrative aspects of pollution reduction.
Cairo Sewerage II	20.0	0.0	Construction of integrated wastewater system.
Canal Cities II	50.0	23.0	Provision of sustainable W&WW services to Egypt's canal cities.
Environmental Support Project II	1.5	1.5	Assistance for urban and industrial pollution control activities.

Table 5-5—Continued

Agency/program	1994 obligated funding (Million dollars)	1995 obligated funding (Million dollars)	Program description
Project in Development and Environment (PRIDE)	1.0	2.0	Treatment of natural resource degradation through economic development and environmental management.
Trade in Environmental Services and Technology (TEST)	1.4	2.0	Provision of services and resources for Indian and U.S. firms to develop environmental business ventures.
United States-Asia Environmental Partnership (US-AEP)	16.0	20.0	Linking of U.S. environmental businesses with opportunities in Asia.
Bureau for Europe and Newly Independent States	183.0	192.0	
Environmental Initiatives	15.0	9.0	Improvement of indigenous capacity to address environmental and energy management problems.
Regional Energy Efficiency	29.0	24.0	Improvement of the climate for private investment in energy system modernization.
Krakow Clean Fossil Fuels & Energy Efficiency	3.2	0.0	Promotion of market approaches to environmental improvement; i.e. commercialize cost effective ways to reduce air pollution from small boiler emissions.
Environmental Training Project	3.0	2.5	Training to build institutional and human resource capacity for environmental management.
Energy Efficiency and Market Reform	55.0	60.0	Technical assistance for energy conservation while promoting U.S. private sector opportunities in areas of U.S. comparative advantage.
Environmental Policy and Technology	62.0	68.0	Assistance in ensuring that economic and social restructuring in the NIS is achieved in an environmentally sound manner while encouraging U.S. private sector participation in the region's environmental management.
Bureau for Latin America and the Caribbean	41.0	54.0	
Environmental Protection, El Salvador	3.2	2.5	Improve environmental management, demonstrate sustainable natural resource management, provide environmental education.
Environment/Global Climate Change	5.0	5.0	Reduce greenhouse gas emissions in the region.
Regional Environmental & Natural Resource Management	4.3	5.5	Provide broad-based management and conservation of Central America's natural resources.

Source: Datex, Inc., Environment and Natural Resources Information Center, USAID.

The Regulation of Water and Wastewater

Summary

The countries reviewed in this report--the United States, the United Kingdom, Germany, France, and Japan--all have in place some form of water pollution control program, although the stringency of standards and effectiveness of enforcement varies.

Of the nations reviewed, the United States and Germany have what appear to be the most detailed permit requirements and the most stringent treatment standards for industrial and municipal wastewater. The United States and Germany also have the largest percentage of population served by municipal wastewater treatment systems. For example, primary treatment is required for virtually 100 percent of the U.S. population, except for those with septic systems that do not discharge to POTWs. All U.S. POTWs were required to meet secondary treatment standards as of 1988; however, about 13 percent of POTWs have not met this deadline.

The EU has adopted a series of directives relating to W&WW that set minimum standards that must be met by all EU member states. Germany has adopted standards that exceed the minimum EU standards in many respects, but France and the United Kingdom, for the most part, have not adopted more stringent standards.

The expansion of domestic markets for W&WW equipment and services seems to be driven by stringent environmental requirements, including the secondary treatment of wastewater by municipal systems, only to the extent that compliance with such requirements is strictly enforced. Consequently, although strict regulations and their rigorous enforcement, particularly in the United States and Germany, may create domestic demand for new or expanded W&WW equipment and services, such conditions do not appear to be directly linked with the economic competitiveness of domestic companies offering those goods and services.

Approach to Regulation

In general, the five countries reviewed here employ a two-pronged approach in setting standards to control water pollution: (1) effluent standards for municipal and industrial dischargers, and (2) ambient water-quality standards based on national water-quality objectives. Effluent standards and ambient water-quality standards are largely health- or risk-based; thus, a regulated facility may use any means or technology to meet these standards. The United States, Japan, and Germany, however, also employ technology-based or technology-forcing standards. Specific technologies may be mandated, or the use of the "best available," "best conventional," or "best practicable" control technology may be required for specific industries or effluents. In the EU, especially in Germany, the trend in water-pollution control is to move away from the end-of-pipe approach and toward a control-at-the-source approach. Thus, the newer approach emphasizes changes in manufacturing process, choice of materials used, and waste recovery/reclamation and reuse rather than over-reliance on the capability of the industrial facility or treatment plant to adequately treat discharges.

Enforcement practices between countries often differ significantly. In the United States, for example, violators can be subject to civil and criminal liability,[93] and environmental litigation is common. Japanese regulations also include civil and criminal penalties for violators,[94] but compliance is generally pursued through negotiation and persuasion. U.S. citizens may sue violators for compliance if regulators fail to enforce regulations, but U.S. law does not provide for personal

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[93] See 33 U.S.C. 1319.
[94] Japan Water Pollution Control Law of 1970, ch. IV, arts. 19 through 20-5, and ch. VI.

injury suits for damages caused by such violations.[95] Japanese law permits the filing of law suits against polluters to seek compensation for damages in cases where human life and health is damaged as a result of industrial discharges of harmful substances.[96]

United States

The principal U.S. legislation regulating water pollution is the Federal Water Pollution Control Act (FWPCA),[97] more commonly known as the Clean Water Act. The Act makes "the discharge of any pollutant by any person . . . unlawful", unless the discharge conforms with certain provisions of the Act.[98] The Act required the EPA to establish a system of minimum national effluent standards for each industry, or point source, as well as water-quality objectives for specific water bodies.[99] The statute also created a discharge permit program to translate the effluent standards into enforceable limitations, as well as additional programs addressing toxic pollutants, nonpoint source discharges such as storm water and agricultural runoff, and grants for the construction of POTWs, among others.[100] Under regulations promulgated by EPA, municipal drinking water quality is also regulated by maximum concentration limits for specific parameters, including inorganic and organic compounds, pesticides, microbes, and other parameters.[101]

Under the FWPCA permit program, each POTW must obtain a permit regulating the amount and content of effluent released into any body of water. The permits require pretreatment of industrial wastewater prior to its discharge to a POTW. As of July 1988, all POTWs were required to have secondary-treatment systems.[102] Additional FWPCA requirements that address the treatment of sludge residue from secondary treatment, and outdated combined stormwater/sewer overflow systems that release raw sewage during heavy rainfalls became effective in 1993 and 1994, respectively.[103]

To assist States and localities in financing the construction of treatment facilities to meet State water pollution control obligations under the FWPCA, the Act was amended in 1972 to provide funding, under a special grants program, of up to 75 percent of the construction costs of treatment facilities.[104] This program was phased out in 1990 under 1987 amendments to the FWPCA,[105] and

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[95] 33 U.S.C. 1365.

[96] Japan Water Pollution Control Law of 1970, ch. IV. Japan's experience with mercury and cadmium poisoning has led to the inclusion of such provisions.

[97] 33 U.S.C. 1251. Initially enacted in 1948, the Act has been amended numerous times. As originally enacted, the Act gave the States the lead in preventing, controlling, and abating water pollution, with the Federal Government serving in the more limited role of supporting and assisting the States. Federal enforcement authority was limited to interstate pollution problems. The current U.S. Federal approach to controlling water pollution dates to 1972 and the enactment of the FWPCA Amendments of 1972. Pub. L. No. 92-500, 86 Stat. 816. For a brief history of Federal water pollution law prior to the 1972 amendments and the reasons for the amendments, see Senate Report (Public Works Committee) No. 92-414, Oct. 28, 1971, reprinted in *1972 U.S. Code Cong. and Adm. News*, p. 3668. For an overview of the FWPCA and its history, see W. Andreen, "Beyond Words of Exhortation: The Congressional Prescription for Vigorous Federal Enforcement of the Clean Water Act," 55 *Geo. Wash. L. Rev.* 202 (1987).

[98] 33 U.S.C. 1311.

[99] 33 U.S.C. 1311(b).

[100] 33 U.S.C. 1311, 1342.

[101] See 40 CFR parts 130, 131, and 133.

[102] 33 U.S.C. 1311. As of July 1, 1977, POTWs were to require effluent sources to apply the "best practicable control technology currently available" prior to discharge to the POTW. 33 U.S.C. 1314(b)(1)(A).

[103] See 33 U.S.C. 1345 and 1342.

[104] FWPCA Amendments of 1972, Pub. L. No. 92-500, 86 Stat. 816; codified at 33 U.S.C. 1282.

replaced by a new State water pollution control revolving funds program, under which the Administrator of EPA was authorized to enter into capitalization grant agreements with States.[106] According to a 1992 report by the GAO, the revolving loan program has not generated enough funds to close the gap between wastewater treatment plant needs and available monetary resources.[107]

To date, about 13 percent of the estimated 16,000 U.S. POTWs, including some for large urban areas such as Boston, have not met the 1988 secondary-treatment deadline.[108] The scarcity of data on U.S. water quality precludes assessing industrial and municipal wastewater dischargers' compliance with overall water-quality requirements.[109] Although there have been improvements in dissolved oxygen deficit, fecal bacteria, and phosphorus levels due to improved wastewater treatment, concentrations of nitrogen, chloride, and dissolved solids from fertilizer use and other nonpoint sources appear to be increasing.[110]

European Union

Although the EU, formerly the European Economic Community, was established in the 1950s, it had no environmental program until after 1972, when the Council of Ministers endorsed the general principles of an environmental policy.[111] Environmental action programs addressing water quality were adopted in 1973, 1977, 1982, and 1987. Environmental regulation in the EU has become increasingly centralized in Brussels, but member countries themselves must enact and enforce national laws that implement EU directives. The pace of implementation of EU directives has varied considerably among the EU member states. Although the EU has no independent inspection or enforcement authority, it can identify violators and prompt action. In the event that a directive is not complied with, any action taken by the EU is directed against the national government rather than against the public or private operator. Member states that fail to enact appropriate laws and regulations implementing directives can be brought before the European Court of Justice.

The EU has adopted directives governing urban wastewater treatment,[112] drinking water,[113] bathing water,[114] and the control of discharges of dangerous substances to ground and surface

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[105] (...continued)

[105] See 33 U.S.C. 1282, as amended Feb. 4, 1987, Pub. L. No. 100-4, 10 Stat. 15.

[106] 33 U.S.C. 1383. The program was added by the Water Quality Act of 1987, Pub. L. No. 100-4, approved Feb. 4, 1987, 101 Stat. 15.

[107] GAO, *Water Pollution: State Revolving Funds Insufficient to Meet Wastewater Treatment Needs*, GAO/RCED-92-35 (Jan. 1992).

[108] *NatWest Washington Analysis*, "U.S. Wastewater Privatization" (Jan. 1993), p. 5.

[109] The Council on Environmental Quality, *Environmental Quality, 22nd Annual Report* (Washington, DC. 1992), p. 187.

[110] Ibid.

[111] *Comparison of International Environmental Policies*, chap. IV, p. 12 (March 1993 draft).

[112] Council Directive Concerning Urban Waste Water Treatment, 91/271/EEC, *OJ* L 135/40, May 30, 1991.

[113] Council Directive Concerning the Quality Required of Surface Water Intended for the Abstraction of Drinking Water in the Member States, 75/440/EEC, *OJ* No L 194, June 16, 1975; Council Directive Concerning the Methods of Measurement and Frequencies of Sampling and Analysis of Surface Water Intended for the Abstraction of Drinking Water in the Member States, 79/869/EEC, *OJ* No L 271, Oct. 9, 1979; Council Directive Relating to the Quality of Water Intended for Human Consumption, 80/778/EEC, *OJ* No L 229, July 15, 1980.

[114] Council Directive Concerning the Quality of Bathing Water, 76/160/EEC, *OJ* No L 31/1, Dec. 8, 1975.

waters,[115] among others. There are considerable differences in the economic regulation of water services among countries of the EU. Achievement of a cohesive European environmental policy has been hampered by this lack of uniform response by member nations to EU environmental directives.[116]

Urban wastewater treatment was addressed for the first time in the council directive of May 21, 1991.[117] This directive has been implemented by France, Germany, and the United Kingdom, although the United Kingdom has challenged the validity of certain standards in the directive. The urban wastewater treatment directive sets minimum standards of treatment for municipal wastewater and the disposal of municipal sewage sludge.[118] It requires secondary treatment of municipal wastewater as a minimum, although collection systems and secondary treatment for populations of more than 15,000 are not required to be in place until December 31, 2000, at the latest, and by December 31, 2005, at the latest for populations of between 2,000 and 15,000.[119] In areas designated as less sensitive, primary treatment alone may be permitted.[120] Conversely, if an area is designated as sensitive, it will be subject to more stringent treatment than non-sensitive areas.[121] The directive requires elimination of dumping municipal sewage sludge at sea by the end of 1998.[122]

Under the urban wastewater directive, member states were required to insure that the discharge of industrial wastewater into collecting systems and urban wastewater treatment plants is subject to prior regulation and or specific authorizations by the competent member state authority by December 31, 1993.[123] Also by the end of 1993, member nations were required to have established industry-specific parameters for biodegradable wastewaters.[124] Member states are required to monitor discharges from urban wastewater treatment plants to verify compliance.[125]

United Kingdom

Originally, domestic British water supplies were controlled by small, local private water companies. In 1974, as part of a major reorganization, 10 regional water authorities were created to cover all of England and Wales. These water authorities were responsible for regulating discharges to surface waters, ground waters, and treatment plants, and for supplying drinking water. In 1992, the Secretary of State for the Environment announced the formation of a new Environment Agency that would bring together all of the functions of the National Rivers Authority (NRA), Her Majesty's Inspectorate of Pollution, and the waste regulation and water supply of the regional water authorities.[126] The Environment Agencies Bill, introduced in the U.K. Parliament on December 1,

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[115] Council Directive on Pollution Caused by Certain Dangerous Substances into the Aquatic Environment of the Community, 76/464/EEC, *OJ* No L 129, May 18, 1976; Council Directive on the Protection of Groundwater Against Pollution Caused by Certain Dangerous Substances, 80/68/EEC, *OJ* No L 20, Jan. 26, 1980; Council Directive on Limit Values and Quality Objectives for Discharges of Certain Dangerous Substances Included in List I of the Annex to Directive 76/464/EEC, 86/280/EEC, *OJ* No L 181, July 4, 1986.

[116] *Comparison of International Environmental Policies*, chap. IV, p. 17 (March 1993 draft).

[117] Council Directive 91/271/EEC, *OJ* No L 135, May 30, 1991, pp. 40-52.

[118] Ibid., table 1.

[119] Ibid., art. 3, 4.

[120] Ibid., art. 6.

[121] Ibid., art. 5.

[122] Ibid., art. 14.

[123] Ibid., art. 11.

[124] Ibid., art. 13.

[125] Ibid., art. 15.

[126] BNA, *International Environment Reporter*, No. 638 (July 27, 1994).

1994, provides for the establishment of the Environment Agency for England and Wales and the Scottish Environmental Protection Agency.[127]

The 1991 EU Urban Wastewater Treatment Directive affects approximately 6,400 sewage treatment works in England and Wales. The Director General of Water Services estimated that capital expenditures were likely to be needed at 1,125 sewage treatment works and 265 crude sewage outfalls serving populations over 2,000 in order to meet the EU-established deadline of 2000 and 2005. The existing sewerage networks cover about 75 percent of the total population. Enforcement authority over sewerage treatment works lies with the NRA under the EPA.[128]

The principal statutory authority regulating wastewater discharges and water supply is the Water Industry Act of 1991, which incorporates key provisions of the Water Act of 1989. The Private Water Supply Regulations of 1991 were promulgated under the Water Act to ensure that British water supplies would meet the standards set forth in EU directives, including the urban wastewater treatment directive.[129] For the first time, parameters were established for maximum admissible concentrations of numerous potential contaminants in controlled waters as well as values for standard drinking water-quality parameters such as pH, hardness, color, odor, and turbidity.[130]

Pursuant to the Water Act of 1989, "controlled waters" include surface waters, coastal waters, and ground waters. Permits must be obtained from the NRA for direct discharges of poisonous, noxious, or polluting matter or any solid waste, industrial effluent, or sewage effluent into controlled waters.[131] Prior to granting a permit, conditions such as the volume and composition of the effluent are evaluated and effluent limits are established for the discharger according to local ambient water-quality objectives. Under a charging system introduced in July 1991, by the NRA waste dischargers must now pay for water pollution regulation.[132] Annual charges for regulation are based upon the discharger's waste volume and pollutant content, as well as the character of the receiving waters.[133]

In 1989, in response to a new EU directive on discharges of dangerous substances,[134] the United Kingdom developed a so-called "Red List" to control the direct discharge of 24 hazardous pollutants to surface waters and treatment plants. Red List pollutants are listed in the Trade Effluents regulations, which are divided into two categories of industrial effluent for special control. The first category consists of the 24 listed hazardous pollutants, which are stringently regulated if discharged in concentrations greater than background. The second category consists of effluents produced by specific industries.[135]

Contamination from lead piping and nitrates from farm pollution has made it difficult for the United Kingdom to meet the EU directive of 50 milligrams per liter of drinking water for each of

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[127] BNA, *International Environment Reporter*, No. 1038 (Dec. 14, 1994).

[128] See the Water Resources Act 1991.

[129] Council Directive 91/271/EEC, Concerning Urban Waste Water Treatment, *OJ* No L 135, May 30, 1991, pp. 40-52.

[130] Private Water Supplies Regulations 1991 (SI 1991, No 2790), § 4, Pt. II.

[131] Water Act of 1989, 107, 108.

[132] "New Pollutant Discharge System Set Up By National Rivers Authority," BNA, *International Environment Reporter*, No. 389 (July 17, 1991).

[133] Ibid.

[134] See Council Directive on Limit Values and Quality Objectives for Discharges of Certain Dangerous Substances Included in List I of the Annex to Directive 76/464/EEC, 86/280/EEC, *OJ* No L 181, July 4, 1986.

[135] *Comparison of International Environmental Policies* (March 1993 draft), chap. IV, pp. 31-32.

these substances.[136] Lead pipes are still in place in many parts of the United Kingdom, and because the contaminant standard must be met at the tap, the only way to achieve the required standard is to remove the pipes, or to treat the water to reduce its ability to dissolve lead. Similarly, specified nitrate levels are difficult to achieve due to widespread, nonpoint agricultural runoff.[137] The United Kingdom has challenged the validity of the EU standard as not having been proved necessary from a human health standpoint. The EU has continued to press for compliance and has resorted to the European Court of Justice to resolve the conflict. Because public and private suppliers are required to meet the standards of the EU Drinking Water Directive, the European Court of Justice has upheld the EU claim against the United Kingdom for failing to implement this directive.[138]

A recent study states that water quality in England and Wales continues to deteriorate.[139] Limited enforcement and delays in setting standards appear to have slowed the cleanup. The NRA's enforcement record has also been severely criticized.[140] Even though water pollution incidents doubled in the early 1980's, only 40 percent of major pollution incidents resulted in fines, averaging $1,044.[141] Many major British companies are exceeding water-pollution limits set by the NRA. According to a London-based firm of investment analysts, 128 out of 590 companies surveyed had exceeded discharge permit limits in the 3-year period covered.[142]

Germany

The German system of water pollution control is administered much like the EU, where national policy is implemented by the individual states.[143] Under the German model, the national government enacts legislation based on EU directives and the individual state governments, in turn, enact individual implementing legislation.[144] The principal difference between the EU and German frameworks is that the EU concentrates on the control of individual pollutants, whereas Germany focuses on control at the source.[145] Individual states are also responsible for enforcement of pollution regulations.[146]

German water pollution control is guided by the Federal Water Act (Wasserhaushaltsgesetz or WHG) of 1957 which was most recently amended in 1986. This Act sets forth the "fundamental provisions concerning measures of water resource management (water quantity and water quality management)."[147] The scope of the Act includes surface waters (lakes and rivers), coastal waters and

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[136] Council Directive 80/778/EEC, Relating to the Quality of Water Intended for Human Consumption, *OJ* No L 229, Aug. 30, 1986. See *Comparison of International Environmental Policies*, chap. IV, p. 30.

[137] Ibid.

[138] Commission v. United Kingdom, C337/89. Z.O. Gresham and E.E. Deason, 1992.

[139] "Water Quality in England, Wales Still Declining, Draft Report Says," BNA, *International Environment Reporter*, No. 45 (Jan. 29, 1992).

[140] "Companies Violating Water Discharge Limits Despite Concern About Pollution, Study Says," BNA, *International Environment Reporter*, No. 301 (May 20, 1992).

[141] "Water Quality in England, Wales Still Declining, Draft Report Says," BNA, *International Environment Reporter*, No. 45 (Jan. 29, 1992).

[142] "Companies Violating Water Discharge Limits Despite Concern About Pollution, Study Says," BNA, *International Environment Reporter*, No. 301 (May 20, 1992).

[143] *Comparison of International Environmental Policies* (March 1993 draft), chap. IV, p. 19.

[144] "Foreign Environmental Legal Systems–A Brief Review," BNA, *International Environment Reporter*, No. 621 (Nov. 9, 1988).

[145] *Comparison of International Environmental Policies*, chap. IV, p. 21 (March 1993 draft).

[146] "Foreign Environmental Legal Systems."

[147] Federal Ministry for the Environment, *Environmental Protection in Germany* (June 1992), p. 148.

groundwater.[148] One of the main provisions, Article 7a regulates the discharge of wastewater containing hazardous substances.[149] Article 7a specifies that wastewater purification and manufacturing processes producing wastewater must comply with the state of the art, which applies to plants discharging effluent into public sewage systems.[150]

Under the Waste-Water Charges Act (Wasserabgabengesetz) of 1976, as amended most recently in 1990, polluters are charged by the quantity and quality of the waste that they produce. The charge under this "polluters pay" policy is based on chemical oxygen demand, toxicity to fish, heavy metals, absorbable organic halogenated compounds, nitrogen and phosphorus.[151] The charge acts as a deterrent as well as a means of funding the preservation of the environment. This legislation also applies to the former East German states.[152]

Other important legislation includes the Washing and Cleansing Agents Act (Wasch-und Reinigungsmittelgesetz) of 1975, amended in 1986, which specifies the biodegradability of surfactants, and the Drinking Water Ordinance (Trinkwasserverordnung), which specifies the allowable limits of harmful substances.[153]

The German legislation has had limited effectiveness in some areas, particularly with respect to bodies of water that are stagnant or slow-moving.[154] Significant progress has been made, however, in the biological quality of the Rhine, Danube, Neckar, Main, Weser and Leine Rivers.[155] There is a continuing problem with residual pollution from sewage treatment plants and storm water inflows in conjunction with scourings from agricultural areas and airborne pollutants.[156]

The former East German water basins remain heavily polluted, especially the Rivers Elbe, Saale, Mulde, Pleisse, Schwarze Elster and Weisse Elster.[157] The main problems stem from nutrient compounds such as phosphorus and ammonia, which have significantly depleted oxygen levels.[158] Heavy metals and hazardous organic micro-contaminants are also at high levels in this area.[159]

France

Like most member countries of the EU, France has incorporated the EU directives on environmental legislation.[160] France has a centralized system of water quality control through national implementing legislation or decrees from the Environment Ministry.[161] The Water Law of December 16, 1964 divided France into six regions, headed by local representatives of the Ministry, that control the discharge into waterways and water use in general.[162] The budget for each water region is derived from users fees paid by various local private and public entities. Fees are prorated

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[148] Ibid.
[149] Ibid., 152.
[150] Ibid.
[151] Ibid.
[152] Ibid., p 153.
[153] Ibid., pp. 153-54.
[154] Ibid., p. 44.
[155] Ibid.
[156] Ibid.
[157] Ibid.
[158] Ibid.
[159] Ibid.
[160] "Foreign Environmental Legal Systems."
[161] Ibid.
[162] Ibid.

according to either the quantity of water used or the pollutants discharged to receiving waters that cause "deterioration of water quality, water consumption, and modification of the environment."[163]

The Law on Regulated Facilities, enacted in 1976, required facilities conducting certain industrial activities to obtain authorization from the prefect, the central government's local representative, prior to construction or operation of the industrial facility. Regulated industrial activities fall into two categories, class A and class D. Class A activities are those that are the most potentially hazardous to the environment. Such activities are subject to prior authorization. Many manufacturing operations fall into this category. Class D activities are primarily commercial in nature. Generally, they require only notification but in limited instances may require prior authorization.

Enforcement is generally obtained through the administrative courts and then to the Council of State, on appeal.[164] Consistent with the strong tradition of separation of powers between the administrative and judicial bodies in France, judicial authorities have not been empowered to adjudicate the legality of administrative action and only may entertain civil and criminal environmental litigation that does not involve a public entity.[165] Recently, however, the highest court in France, the Court of Cassation, has held that private persons may have a right to bring criminal actions regarding the environment against the administration.[166]

A requirement for nationwide wastewater treatment was enacted in France by decree only as late as June 1994. Even though the number of wastewater treatment plants has quadrupled during the past 15 years, 1990 figures provided by the Ministry of the Environment show that one-third of industrial wastewater and over one-half of municipal wastewater is channeled to French waterways without prior treatment.[167]

Japan

The Japanese Environment Agency (JEA) was established in 1971 under provisions of the Environment Agency Establishment Law. Within the agency, the Water Quality Bureau is responsible for overseeing water use and water-pollution control. Municipal and industrial wastewater discharges and water pollutants are principally regulated under the Water Pollution Control Act of 1970.[168] Regulations include environmental quality standards applicable to municipal drinking water and ambient water quality, and national effluent control standards applicable to all regulated industrial facilities.[169] In addition to health-based effluent limits, specific technologies may be required for the removal or treatment of targeted pollutants such as oil.

Industrial effluent standards are established by ordinance of the Prime Minister's Office and are established in terms of maximum permissible concentrations for each substance considered harmful to human health or the environment.[170] Local prefectures may establish more stringent standards where deemed necessary.[171] The inspector general of the JEA may also "advise" local

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[163] U.S. Department of State telegram, message reference No. 168466, prepared by the U.S. Embassy, Paris, Sept. 1994.
[164] "Foreign Environmental Legal Systems."
[165] Ibid.
[166] Ibid.
[167] U.S. Department of State telegram, message reference No. 168466, prepared by the U.S. Embassy, Paris, Sept. 1994.
[168] JEA, Water Pollution Control Law, Law No. 138 of 1970, amended by Law No. 88 of 1971 and by Law No. 84 of 1972.
[169] JETRO, *Your Market in Japan.*
[170] JEA, ch. II, art. 3.
[171] Ibid.

prefectures to establish their own effluent standards when the national standards are considered insufficient to protect human health or the environment.[172] For nonattainment areas, JEA is to establish a "policy for reduction of total pollution load," which is to include annual pollution reduction targets.[173]

New industries or "specified factories" that discharge "harmful substances" are not required to obtain a formal permit but are instead required to notify the local prefectural governor prior to the construction of any specified factory. The notification must include a description of the type and structure of the facility as well as the proposed method of effluent treatment.[174] If, upon review, the prefectural governor determines that the facility's discharge will not satisfy applicable effluent standards, the facility owner may be ordered to change the structure of the facility or the treatment method, or to abandon plans for the facility's construction.[175] Existing facilities may be temporarily closed or ordered to alter operations if discharges do not satisfy the applicable effluent standard.[176] Industrial dischargers are required to monitor their effluent, keep records, and report to the prefectural governor upon his request; annual reporting is not required.[177] Discharges from sources other than specified factories are not subject to regulation but may receive "guidance, recommendation or advice" as required regarding pollution reduction.[178]

In 1992, the JEA revised its water-quality standards. Ambient water-quality standards are to be used as guidelines for tap water as well as other bodies of water, including ocean water, rivers, and lakes.[179] Under the standards set in 1971, the agency regulated nine hazardous substances; the new regulations include 10 additional hazardous substances, principally pesticides and wastes associated with high-technology manufacturing. Currently, the JEA "urges" operators of polluting plants to make corrections, but in most cases can only recommend changes.[180]

Japanese efforts to improve water quality have been hampered by a national policy that favors large treatment systems.[181] As a result, only 40 percent of the population is served by regional or municipal treatment plants.[182]

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[172] Ibid., art. 4.
[173] Ibid., arts. 4-2.
[174] Ibid., art. 5.
[175] bid., art. 8, 8-2.
[176] Ibid., art. 13.
[177] Ibid., art. 14, and ch. V, art. 22.
[178] Ibid., arts. 13-2.
[179] "Overhaul of Water Standards Planned, Including Regulation of 10 New Substances," BNA, *International Environment Reporter,* No. 410 (June 17, 1992).
[180] Ibid.
[181] Junko Nakanishi, "Japanese New Technology: The On-Site Sewage Treatment Plant," *Water Report: Quality, Resources, and Technology*, vol. 1, No. 3, 1991, p. 1; as cited in *Comparison of International Environmental Policies*, chap. IV, p. 47 (March 1993 draft).
[182] Ibid.

CHAPTER 6

THE COMPETITIVENESS OF U.S. INDUSTRY

Introduction

This chapter examines the competitiveness of the U.S. industry in the context of the factors identified by OTA and by the USITC during the research for this study. The chapter reviews the performance of the U.S. industry in terms of revenues in both domestic and foreign markets. The chapter also reports the results of the USITC survey on the relative importance of such competitiveness factors as price, quality, project financing, technology, and environmental regulation. The discussion of these factors of competition is set against the backdrop of the several themes that recur in the USITC study.

On the supply side, excess capacity is apparent in the W&WW industries of the United States and of major competitor countries. This excess capacity has precipitated both mergers and consolidations and has increasingly globalized both services and equipment firms. On the demand side, there is potential for growth in W&WW markets both domestic and foreign. There is a substantial need for both W&WW treatment facilities and infrastructure in the developing world and a need for upgraded treatment facilities in the world already "developed."

Technological improvements may increase competition between industry sectors rather than create a comparative advantage for a nation's W&WW industry. The shift from end-of-pipe approaches to pollution prevention, particularly in the industrial wastewater sector, presents both opportunities and problems for the industries serving the W&WW markets. Although better technology may mean more sales for some equipment manufacturers, better technology can also displace services and other types of equipment.

Chief OTA and USITC Findings

Revenues

OTA noted that most industry experts are forecasting significant growth in the overall environmental goods and services markets (see table 2-1). The OECD also estimated that the market for W&WW services and equipment would increase from $60 billion to $83 billion, or by nearly 40 percent during the decade. The USITC survey of service and equipment firms shows increases in both total revenues and in W&WW revenues from 1991 to 1993.

Services

Table 6-1 shows the gross revenues of the services firms responding to the USITC survey. These firms are classified into four services sectors by their primary function: (1) construction, (2) engineering, (3) laboratory, or (4) operation and maintenance. Some of these firms also often provide more than one type of service, and some of the services firms derive some revenues from equipment sales (table 6-2).

While all four services sectors showed increases in worldwide revenues from 1991 to 1993, the gains were not even (table 6-1). The engineering sector posted a 12.8-percent annual rate of growth in revenues, while the other sectors had annual increases ranging from 1.5 to 3.9 percent. For the engineering firms, foreign sales were about one-fourth of their total revenues in each of the 3 years, and foreign revenues rose at a faster annual rate, 16.7 percent, than domestic revenues, 10.7 percent. The other service sectors derive nearly all their revenues from the U.S. market.

Table 6-1
Gross revenues of service firms, 1991-93

	Worldwide gross revenues (Million dollars)	Share of worldwide gross revenues, by market: U.S. revenues (Percent)	Share of worldwide gross revenues, by market: Non-U.S. revenues (Percent)	Worldwide gross revenues from sales of W&WW equipment (Million dollars)	Share of worldwide gross revenues from sales of W&WW equipment, by market: U.S. revenues (Percent)	Share of worldwide gross revenues from sales of W&WW equipment, by market: Non-U.S. revenues (Percent)	Worldwide gross revenues from sales of W&WW services (Million dollars)	Share of worldwide gross revenues from W&WW services, by market: U.S. revenues (Percent)	Share of worldwide gross revenues from W&WW services, by market: Non-U.S. revenues (Percent)
1991:									
Construction services firms	8,743	97.7	2.3	7	100.0	0.0	768	94.7	5.3
Engineering services firms	10,008	77.7	22.3	9	0.0	100.0	1,295	90.9	9.1
Laboratories	375	99.0	1.0	0	0.0	0.0	82	99.9	0.1
Operation and maintenance services firms	2,467	96.7	3.3	33	95.5	4.5	1,290	100.0	0.0
Total, all service firms	21,593	88.3	11.7	49	78.4	21.6	3,435	95.4	4.6
1992:									
Construction services firms	8,768	97.9	2.1	5	100.0	0.0	797	94.2	5.8
Engineering services firms	11,036	71.7	28.3	9	2.6	97.4	1,457	88.6	11.4
Laboratories	389	98.1	1.9	0	0.0	0.0	87	99.9	0.1
Operation and maintenance services firms	2,855	96.3	3.7	30	95.1	4.9	1,369	99.9	0.1
Total, all service firms	23,047	85.2	14.8	44	76.5	23.5	3,709	94.3	5.7
1993:									
Construction services firms	9,006	97.6	2.4	16	100.0	0.0	817	91.7	8.3
Engineering services firms	12,744	74.3	25.7	10	8.8	91.2	1,606	87.1	12.9
Laboratories	395	98.5	1.5	0	0.0	0.0	82	99.9	0.1
Operation and maintenance services firms	2,663	95.9	4.1	64	91.1	8.9	1,504	99.6	0.4
Total, all service firms	24,809	85.5	14.5	90	83.5	16.5	4,009	93.0	7.0

Source: Questionnaire responses.

Table 6-2
Gross revenues by type of service provided, 1993

(Percent)

	Engineering services firms		Construction services firms		Laboratories		Operation and maintenance services firms	
	Share of total revenues	Share of revenues from W&WW services	Share of total revenues	Share of revenues from W&WW services	Share of total revenues	Share of revenues from W&WW services	Share of total revenues	Share of revenues from W&WW services
Design, engineering, and consulting	67.0	86.6	0.5	0.0	7.2	4.9	3.0	0.2
Construction	6.7	2.2	92.9	99.1	0.0	0.0	0.0	0.0
Design-build	20.1	4.1	4.8	0.6	0.0	0.0	0.0	0.0
Build-own-operate	0.0	0.0	0.1	0.2	0.0	0.0	3.6	6.0
Build-own-transfer	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Own-and-operate	0.0	0.0	0.0	0.0	0.0	0.0	43.0	73.9
Operation-and-maintenance	1.0	5.0	0.0	0.0	0.0	0.0	49.8	19.3
Laboratory testing	1.3	1.9	0.0	0.0	92.8	95.1	0.6	0.6
Other	3.8	0.1	1.7	0.0	0.0	0.0	0.0	0.0

Source: Questionnaire responses.

The pattern of growth in revenues from W&WW services during 1991-93 was similar to that of overall revenues. The engineering sector had the highest growth rate, at 11.4 percent, operation and maintenance sector was second at 7.8 percent, the construction sector was third at 3.1 percent, and the laboratory sector was fourth at 0.4 percent.

Non-U.S. revenues are becoming an increasing share of total revenues for both engineering and construction firms. The engineering and construction sectors' foreign revenues from W&WW grew faster than domestic revenues over the period. The engineering sector's W&WW revenues from foreign sources grew at a faster rate than the other sectors except for the operation and maintenance sector, for which no foreign revenues were reported for 1991.

Also, as shown on figure 6-1, both the equipment and services sectors expect revenues to increase in both the U.S. and non-U.S. markets over the next 2 year. All sectors appear more optimistic about the U.S. market than about foreign markets. The more than 80 percent of construction firms which reported no expectation of increasing non-U.S. revenues are those that currently are providing services only in the U.S. market.

The revenue distribution is uneven across services sectors, and revenues are unevenly concentrated within the sectors. The two sectors of engineering and construction have a significant share of their water- and wastewater-related revenues from non-U.S. sources, and the revenues are concentrated in the largest firms. Table 6-3 shows the revenues for engineering firms in terms of the percentage of revenues accounted for by the top 5 and top 10 firms and by each quartile. Each quartile represents 25 percent of the firms. For example, the first quartile represents the 25 percent of the firms that were the largest in terms of worldwide gross revenues. Table 6-4 shows the revenues for construction firms in terms of the percentage of revenues accounted for by the top 5 firms and by each quartile.

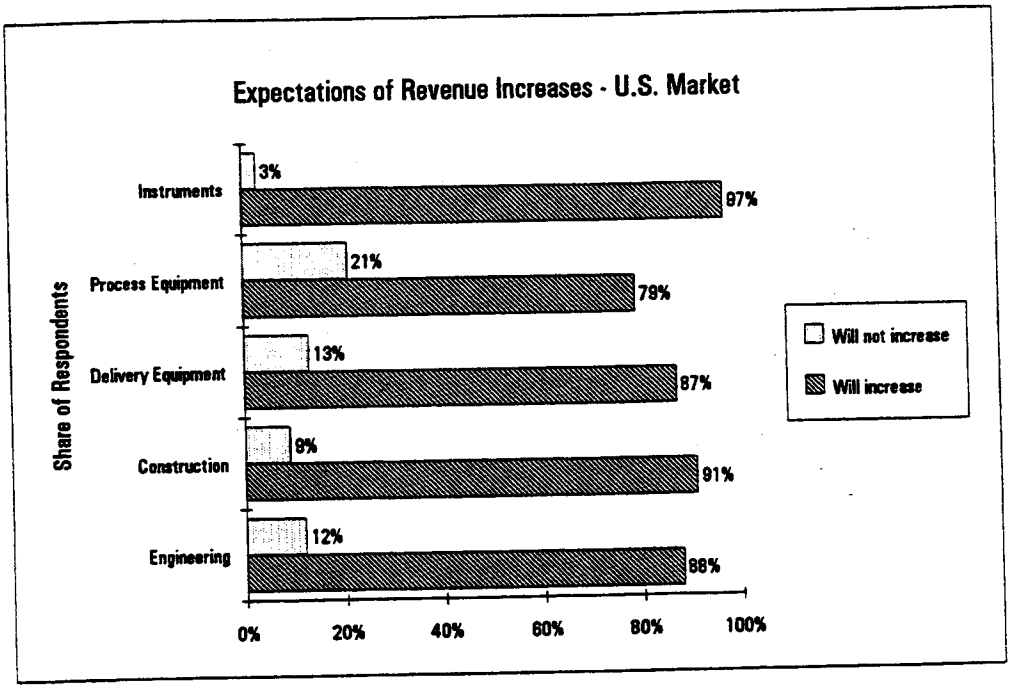
For engineering, the largest quarter of the firms accounted for just over 80 percent of worldwide gross revenues, about 80 percent of U.S. gross revenues, and more than 97 percent of non-U.S. gross revenues in 1991, 1992, and 1993. In fact, the five largest firms responding to the survey accounted for over 52 percent of the sector worldwide gross revenues and more than 83 percent of non-U.S. gross revenues.

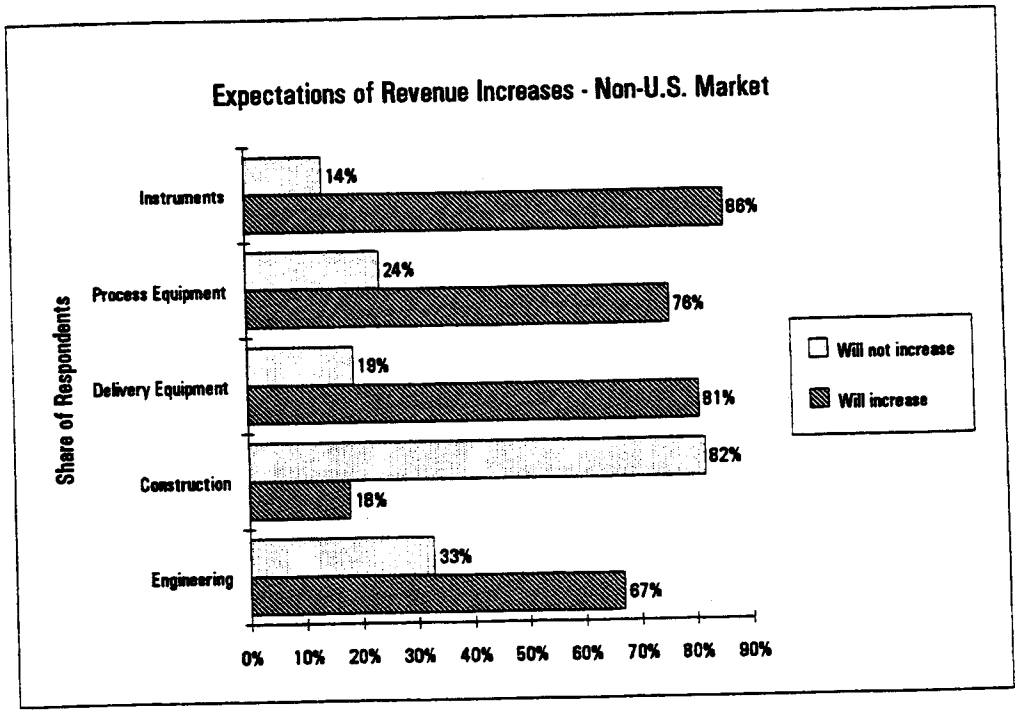
The revenues for the engineering sector from W&WW follow a similar pattern but are not quite as concentrated in the largest firms (table 6-3). The top quartile accounted for just under 70 percent of worldwide W&WW revenues, 65 to 67 percent of U.S. W&WW revenues, and about 90 percent of non-U.S. W&WW revenues. The five largest firms (in terms of worldwide gross revenues) accounted for only about 10 percent of worldwide and U.S. W&WW revenues, while their share of non-U.S. W&WW revenues declined from 33 to 22 percent. The 10 largest firms accounted for about 40 percent of worldwide and U.S. W&WW revenues, while their share of non-U.S. water and waste-water declined from 76 to 43 percent. Thus, the remaining engineering firms in the top quartile increased their share of the non-U.S. revenue significantly over the period.

Figure 6-2 illustrates the dominance of the largest firms, particularly in the non-U.S. markets. With the exception of some medium-sized firms in the second quartile who focus on the domestic market for W&WW services, the performance of the larger firms supports the notion that size and scale are important factors of competition.

For construction, the largest quarter of the firms accounted for about 60 percent of worldwide gross revenues and U.S. gross revenues, and more than 75 percent of non-U.S. gross revenues in 1991, 1992, and 1993. Like engineering, the revenues for the construction sector from W&WW follow a similar pattern and also are not quite as concentrated in the largest firms (table 6-4). In this case, the top quartile accounted for about 45 percent of both worldwide and U.S. W&WW revenues during 1991-93 and less than 50 percent of non-U.S. W&WW revenues in 2 of the 3 years. Only 4 of 39 construction firms reported foreign revenues and only 3 of these had water-related contracts.

Figure 6-1
Expectations of revenue increase, 1994 and 1995





Source: Questionnaire responses.

Table 6-3
Share of revenues of engineering services firms, by quartiles 1991-93

(Percent)

	Share of total revenues		Quartiles			
	Top 5	Top 10	1	2	3	4
Worldwide gross revenues:						
1991	52.1	71.2	82.2	11.0	4.4	2.5
1992	52.4	69.8	82.9	10.4	4.4	2.3
1993	55.9	71.9	84.1	9.6	4.2	2.1
U.S. gross revenues:						
1991	44.0	65.1	78.3	13.1	5.4	3.1
1992	41.0	61.1	77.8	13.3	5.8	3.1
1993	47.3	65.5	80.1	11.9	5.3	2.7
Non-U.S. gross revenues:						
1991	83.4	94.9	97.2	2.6	0.2	0.0
1992	85.2	94.5	97.5	2.0	0.4	0.1
1993	83.7	92.9	97.3	2.1	0.5	0.1
Worldwide gross W&WW services revenues:						
1991	10.7	42.0	67.2	22.3	5.1	5.4
1992	10.9	40.4	67.8	22.7	5.0	4.5
1993	11.6	39.1	69.8	20.8	5.2	4.1
U.S. gross W&WW services revenues:						
1991	8.5	38.7	64.9	24.0	5.1	6.0
1992	8.7	38.1	64.9	24.9	5.1	5.1
1993	10.2	38.6	66.9	22.9	5.5	4.7
Non-U.S. gross W&WW services revenues:						
1991	32.6	75.7	89.9	5.2	4.8	0.1
1992	28.1	58.7	90.4	5.0	4.7	0.0
1993	22.1	42.9	90.4	6.2	3.4	0.0

Source: Questionnaire responses.

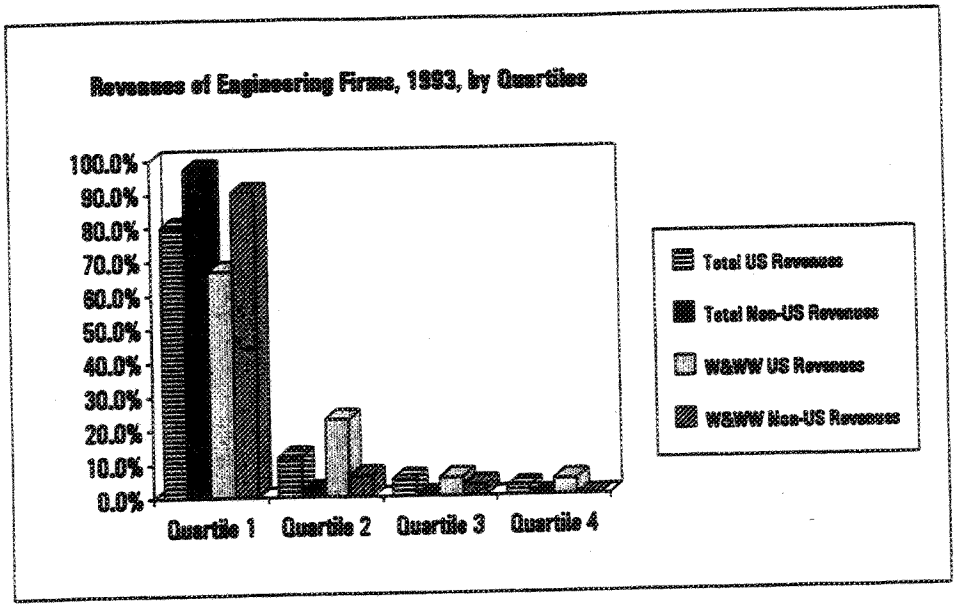
Table 6-4
Share of revenues of construction services firms, by quartiles 1991-93

(*Percent*)

	Share of total revenues				
		Quartiles			
	Top 5	1	2	3	4
Worldwide gross revenues:					
1991	45.1	60.7	27.8	7.8	3.7
1992	47.0	62.7	24.7	7.8	4.8
1993	45.6	62.3	24.1	9.1	4.5
U.S. gross revenues:					
1991	44.3	60.2	28.1	7.9	3.8
1992	46.5	62.4	24.7	8.0	4.9
1993	44.9	61.9	24.1	9.4	4.6
Non-U.S. gross revenues:					
1991	82.4	84.2	15.8	0.0	0.0
1992	70.6	77.0	23.0	0.0	0.0
1993	74.1	75.7	24.3	0.0	0.0
Worldwide gross W&WW services revenues:					
1991	21.6	43.7	33.2	17.3	5.8
1992	18.9	46.9	29.6	16.5	7.1
1993	20.6	43.0	28.7	20.3	8.0
U.S. gross W&WW services revenues:					
1991	20.0	43.3	32.3	18.3	6.2
1992	17.5	47.2	27.8	17.5	7.5
1993	20.4	44.9	24.3	22.1	8.7
Non-U.S. gross W&WW services revenues:					
1991	50.8	50.8	49.2	0.0	0.0
1992	41.0	41.0	59.0	0.0	0.0
1993	22.5	22.5	77.5	0.0	0.0

Source: Questionnaire responses.

Figure 6-2
U.S. and non-U.S. revenues of engineering firms, 1993, by quartiles



Source: Questionnaire responses.

Equipment

The revenue patterns for equipment firms are markedly different than those of the services firms (table 6-5). First, while each of the three sectors reported increased revenues from 1991 to 1993, the average annual growth rate was less than 2.0 percent. Revenues in the U.S. market increased 2.3 percent from 1991 to 1993 while non-U.S. revenues increased by 7.6 percent. Second, the equipment firms had significantly larger shares of their worldwide sales in foreign markets than did service firms. More than one-third of instrument sales was in non-U.S. markets, as was about one-sixth of process and delivery sales.

Revenues from sales of W&WW equipment by these firms accounted for just over one-fourth of their overall worldwide revenues in each of the 3 years. Non-U.S. revenues from W&WW equipment were a slightly smaller share of all W&WW equipment than the non-U.S. revenues were of the revenues from all equipment. Instruments and process equipment shares were only slightly lower, while that for delivery equipment was substantially lower.

The degree of dependence on the W&WW market varies significantly across the equipment sectors. For example, in 1993, the manufacturers of process equipment derived 56 percent of their worldwide gross revenues from the sales of W&WW equipment. In the same year, delivery equipment producers derived 33 percent of their revenues from the sales of W&WW equipment, while instrument manufacturers derived 14 percent of their revenues from the sales of W&WW equipment.

Although the equipment firms generally concentrate in either process, delivery, or instrument equipment, they also produce equipment in the other categories (table 6-6). In terms of all equipment sales, the instrument firms and process firms each derive nearly 80 percent of their production from their primary category. For instruments firms, most of the remainder is in delivery equipment, much of which is valves and actuators. For process firms, the remainder was primarily delivery equipment. The delivery firms derived 62 percent of their revenues from delivery equipment with most of their remaining revenues from unrelated production activities.

All three sectors are more specialized in terms of W&WW equipment sales than in terms of overall equipment. However, the delivery firms were the only group showing a significant difference with 92 percent of their sales coming from W&WW delivery equipment and most of the remainder in process equipment. The instrument firms and process firms derived 82 percent and 80 percent, respectively, of their revenues from their primary category.

Although equipment firms generally export a larger share of their production than service firms, the export shares are significantly different across sectors. Table 6-7 summarizes the values of shipments and exports for each of the three categories of equipment. The categories include all shipments of the equipment regardless of the type of firm. This table represents $10.9 billion of shipments of which $2.9 billion is water-related; equipment exports are nearly $3 billion, of which about $0.5 billion is water related. A significant share of the process equipment produced (61.1 percent) is for W&WW purposes. Each of the subcategories (i.e., filters and screens) has a substantial share of production going for W&WW purposes. Just over one-third of the shipments of delivery equipment are water related. About one-sixth of instrument production is water related.

In contrast to the services firms, a significant share of the equipment manufacturers are involved in exports. While a majority of the equipment firms report non-U.S. revenues, a minority of the services firm report non-U.S. revenues. For example, note that, of the 41 firms reporting shipments of instruments, 37 have equipment exports, and 36 of these report exports of W&WW equipment. However, only process equipment exports for W&WW as a share of total shipments are comparable to the performance of the engineering and construction sectors.

Table 6-5
Gross revenues of equipment firms, 1991-93

	Worldwide gross revenues	Share of worldwide gross revenues, by market		Worldwide gross revenues from sales of W&WW equipment	Share of worldwide gross revenues from sales of W&WW equipment, by market		Worldwide gross revenues from sales of W&WW services	Share of worldwide gross revenues from W&WW services, by market	
		U.S. revenues	Non-U.S. revenues		U.S. revenues	Non-U.S. revenues		U.S. revenues	Non-U.S. revenues
	(Million dollars)	*(Percent)*		*(Million dollars)*	*(Percent)*		*(Million dollars)*	*(Percent)*	
1991:									
Process equipment firms	1,407	84.0	16.0	783	85.6	14.4	46	76.3	23.7
Delivery equipment firms	3,847	85.2	14.8	1,256	93.7	6.3	3	94.7	5.3
Instruments	5,363	62.6	37.4	696	66.0	34.0	37	80.1	19.9
Total, all equipment firms	10,617	73.6	26.4	2,734	84.3	15.7	86	78.6	21.4
1992:									
Process equipment firms	1,418	83.9	16.1	807	84.0	16.0	45	77.0	23.0
Delivery equipment firms	4,011	83.9	16.1	1,329	90.6	9.4	4	92.4	7.6
Instruments	5,351	61.7	38.3	746	64.9	35.1	38	78.4	21.6
Total, all equipment firms	10,781	72.9	27.1	2,883	82.1	17.9	86	78.2	21.8
1993:									
Process equipment firms	1,469	81.6	18.4	829	83.7	16.3	48	77.4	22.6
Delivery equipment firms	4,090	83.8	16.2	1,358	91.3	8.7	4	88.3	11.7
Instruments	5,457	61.7	38.3	771	66.8	33.2	38	77.8	22.2
Total, all equipment firms	11,016	72.6	27.4	2,957	82.8	17.2	90	78.0	22.0

Source: Questionnaire data.

Table 6-6
Value of shipments for firms producing W&WW treatment equipment, 1993

	(1,000 dollars) Delivery equipment firms	Instrument equipment firms	Process equipment firms	All equipment firms
Total equipment shipments:				
Process equipment	89,287	135,194	1,130,342	1,354,823
Delivery equipment	2,489,892	871,386	166,944	3,528,222
Instruments	79,062	4,296,078	94,064	4,469,205
Other equipment	1,350,513	144,087	34,207	1,528,807
Total	4,008,754	5,446,745	1,425,557	10,881,056
W&WW equipment shipments:				
Process equipment	69,749	100,376	658,079	828,204
Delivery equipment	1,208,375	31,496	66,623	1,306,495
Instruments	20,206	636,492	94,064	750,763
Other equipment	16,864	9,830	10,270	36,964
Total	1,315,194	778,195	829,036	2,922,426

Source: Questionnaire responses.

Table 6-7 Equipment firms' revenues from equipment shipments, domestic and foreign, 1993

Description	Total equipment shipments: Number of firms reporting	Total equipment shipments: Value (Million dollars)	Total equipment exports: Number of firms reporting	Total equipment exports: Value (Million dollars)	Ratio of total exports to total shipments (Percent)	W&WW equipment shipments: Number of firms reporting	W&WW equipment shipments: Value (Million dollars)	W&WW equipment exports: Number of firms reporting	W&WW equipment exports: Value (Million dollars)	Ratio of water exports to water shipments (Percent)	Ratio of water shipments to total shipments (Percent)	Ratio of water exports to total shipments (Percent)
Process equipment:												
Process components	33	490	25	109	22.2	33	309	25	37	11.9	63.2	7.5
Filters and screens	23	211	17	32	15.2	23	116	15	13	11.6	54.8	6.4
W&WW treatment systems	23	244	17	23	9.3	23	147	17	22	15.2	60.3	9.2
Chemical and biological media	8	157	5	30	18.8	8	78	5	12	15.5	49.9	7.7
Other process equipment	23	253	16	51	20.2	23	177	16	48	27.0	70.2	18.9
Total	58	1,355	47	245	18.0	58	828	46	133	16.0	61.1	9.8
Delivery equipment:												
Pumps and pumping equipment	27	980	20	158	16.2	27	235	19	30	12.8	24.0	3.1
Industrial flow control valves and actuators	18	1,714	12	673	39.3	17	332	10	35	10.6	19.3	2.0
Pipes and tubes	10	740	7	56	7.6	10	683	7	54	7.9	92.3	7.3
Containment and storage tanks	8	94	5	7	7.5	8	57	5	5	8.9	60.4	5.4
Total	49	3,528	39	895	25.4	48	1,306	37	124	9.5	37.0	3.5
Instruments:												
Process control	20	1,087	18	346	31.8	20	169	17	47	28.0	15.5	4.4
Analytical and scientific	13	2,882	13	1,253	43.5	13	384	12	182	47.4	13.3	6.3
Continuous process on-line analyzers	8	81	5	39	48.3	8	16	5	5	29.0	20.2	5.9
Consumption registering water meters and other dispensing liquid meters	7	173	6	11	6.2	7	164	6	9	5.4	94.6	5.1
Other	8	246	7	83	33.6	6	18	4	1	4.6	7.2	0.3
Total	41	4,469	37	1,732	38.7	41	751	36	244	32.5	16.8	5.5
Other equipment	12	1,664	9	152	9.1	6	71	6	9	12.5	4.3	0.5
Total	121	11,016	107	3,022	27.4	121	2,956	102	510	17.3	26.8	4.6

Source: Questionnaire responses.

As shown on table 6-8, the revenues for equipment firms are concentrated in the largest firms.[1] In each of the three sectors, the largest quarter of the firms accounted for just approximately 80 percent of worldwide gross revenues and about 80 percent of U.S. gross revenues in 1991, 1992, and 1993. For process equipment firms, the largest quartile also receives about 80 percent of the sector's non-U.S. revenues. For instruments, the top quartile's share of non-U.S. revenues approaches 90 percent, while for delivery firms it is about 95 percent.

The revenues for the equipment sector from W&WW follow a similar pattern but are not as concentrated in the largest firms. For process firms, the top quartile accounted for about 70 to 73 percent of both worldwide and U.S. W&WW revenues, and just slightly less of non-U.S. W&WW revenues. For delivery equipment, the top quartile also accounted for just over 70 percent of both worldwide and U.S. W&WW revenues in each of the 3 years, but over 80 percent of non-U.S. W&WW revenues in 1992 and 1993. For instruments, the top quartile also accounted for less than 40 percent of worldwide W&WW revenues and less than 30 percent of U.S. W&WW revenues in each of the 3 years, but about 60 percent of non-U.S. W&WW revenues in 1992 and 1993.

The differences between figures 6-3 and 6-4 illustrate that the concentration of revenues in the equipment firms is different than that of the services firms. In terms of total revenues (figure 6-3), all 3 equipment sectors show dominance of the top quartile. However, in terms of W&WW equipment, the results are different for 2 of the 3 sectors, instruments and process equipment (figure 6-4). For instruments, the second quartile earns more than 50 percent of the U.S. revenues and more than 30 percent of the non-U.S. revenues from W&WW equipment. This is due to the specialization of a few medium instrument firms in water-related instruments.

From Cure to Prevention

Many current market opportunities are for well- established methods for municipal water treatment and delivery and wastewater collection and end-of-pipe treatment. This is true for both domestic and foreign markets. For example, approximately 70 percent of engineering revenues in both the U.S. and non-U.S. markets in 1993 were in the municipal markets.[2] Most of the remainder was in industrial wastewater, chiefly in end-of-pipe applications. Although W&WW treatment is specialized and highly technical, it is generally considered to be among the least sophisticated sectors of the environmental technology industry. Needed, new technologies are being developed for some projects, but it appears that the application of existing technologies, not new technologies, may yield the largest growth in the market, particularly for municipal W&WW in non-U.S. markets.

The world's countries see and want to cure their environmental problems, but a significant part of the effective demand is still going to stay in the developed countries during the next few years. For example, about 60 percent of the 1993 engineering revenues from non-U.S. industrial wastewater projects came from Western Europe, Canada, and Japan.[3] In time, the developing countries may account for a larger share. As pointed out in chapter 2, they greatly need W&WW infrastructure.

Despite the large market potential for environmental goods and services, most of the expenditures are for construction and operation of facilities. International trade accounts for only a small share of the goods and services consumed for W&WW treatment. The fact that items such as instruments are exported in higher proportions than other equipment tends to support OTA's point that the most promising markets for U.S. exports are those for sophisticated equipment and professional services.

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[1]Each quartile represents 25 percent of the firms. For example, the first quartile represents the 25 percent of the firms that were the largest in terms of worldwide gross revenues.
[2]Questionnaire responses.
[3]Ibid.

Table 6-8
Share of revenues of equipment firms, by quartiles 1991-93

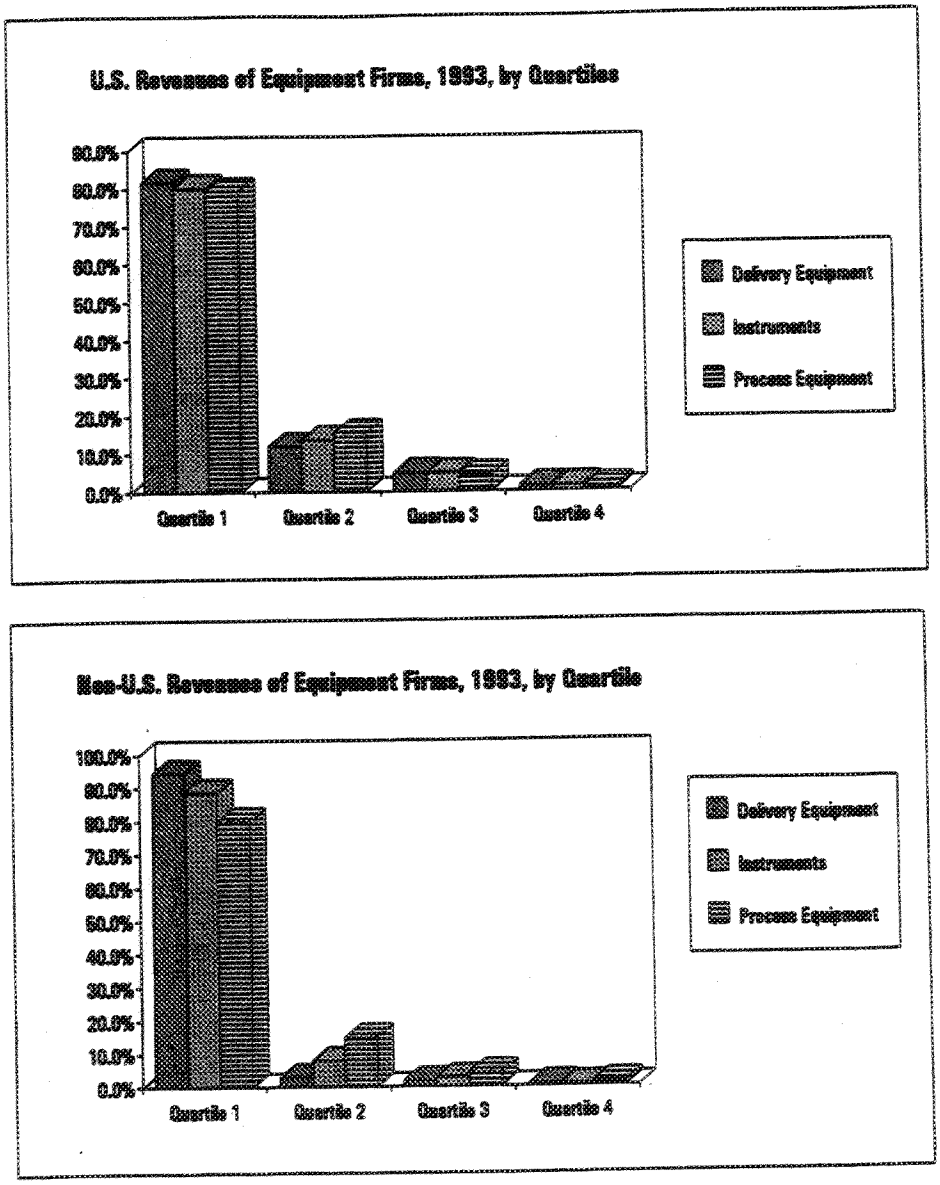
	(Percent)			
	1	2	3	4
Process Equipment				
Worldwide revenues:				
1991	80.1	15.2	3.9	0.9
1992	80.9	14.6	3.7	0.8
1993	79.4	15.4	4.3	0.9
U.S. revenues:				
1991	80.1	15.1	3.8	1.0
1992	81.0	14.2	4.0	0.8
1993	79.3	15.5	4.3	0.8
Non-U.S. revenues:				
1991	79.8	15.5	4.0	0.7
1992	80.5	16.3	2.2	0.9
1991	79.9	14.9	4.1	1.2
Worldwide W&WW equipment revenues:				
1991	71.8	20.4	6.3	1.5
1992	72.9	20.0	5.9	1.2
1993	69.6	22.0	7.0	1.4
U.S. W&WW equipment revenues:				
1991	72.4	20.0	6.0	1.6
1992	73.3	10.2	6.3	1.2
1993	70.7	21.1	6.0	1.3
Non-U.S. W&WW equipment revenues:				
1991	68.3	22.9	7.7	1.1
1992	70.4	24.3	3.8	1.5
1993	64.0	26.3	7.6	2.2
Delivery Equipment				
Worldwide revenues:				
1991	82.7	11.1	4.8	1.6
1992	84.3	9.8	4.5	1.4
1993	83.8	10.5	4.4	1.3
U.S. revenues:				
1991	80.5	12.3	5.4	1.7
1992	82.2	11.2	5.1	1.5
1993	81.5	11.9	4.9	1.4
Non-U.S. revenues:				
1991	95.0	3.0	1.2	0.8
1992	95.2	2.6	1.6	0.6
1993	94.5	2.9	1.8	0.8
Worldwide W&WW equipment revenues:				
1991	71.2	16.5	8.1	4.2
1992	73.9	14.7	7.9	3.5
1993	73.2	15.7	7.6	3.5
U.S. W&WW equipment revenues:				
1991	70.7	16.9	8.2	4.1
1992	72.7	15.6	8.1	3.6
1993	72.2	16.6	7.8	3.4
Non-U.S. W&WW equipment revenues:				
1991	78.2	10.7	6.0	5.1
1992	85.0	6.2	6.2	2.6
1993	83.8	6.7	5.2	4.3

Table 6-8 (continued)

	(Percent)			
	1	2	3	4
Instruments				
Worldwide revenues:				
1991	84.2	11.3	3.7	0.7
1992	83.6	11.7	3.9	0.9
1993	83.5	11.5	4.0	1.0
U.S. revenues:				
1991	81.3	13.4	4.3	0.9
1992	80.5	13.8	4.6	1.2
1993	80.2	13.7	4.8	1.3
Non-U.S. revenues:				
1991	89.1	7.9	2.7	0.3
1992	88.7	8.3	2.7	0.4
1993	88.7	8.0	2.8	0.5
Worldwide W&WW equipment revenues:				
1991	39.8	47.3	10.1	2.9
1992	39.1	47.4	9.9	3.6
1993	39.2	46.1	10.7	4.0
U.S. W&WW equipment revenues:				
1991	28.8	55.8	11.6	3.8
1992	28.3	55.6	11.3	4.7
1993	30.7	52.7	11.6	5.0
Non-U.S. W&WW equipment revenues:				
1991	61.2	30.7	7.0	1.1
1992	59.0	32.2	7.3	1.5
1993	56.3	32.9	8.9	1.9

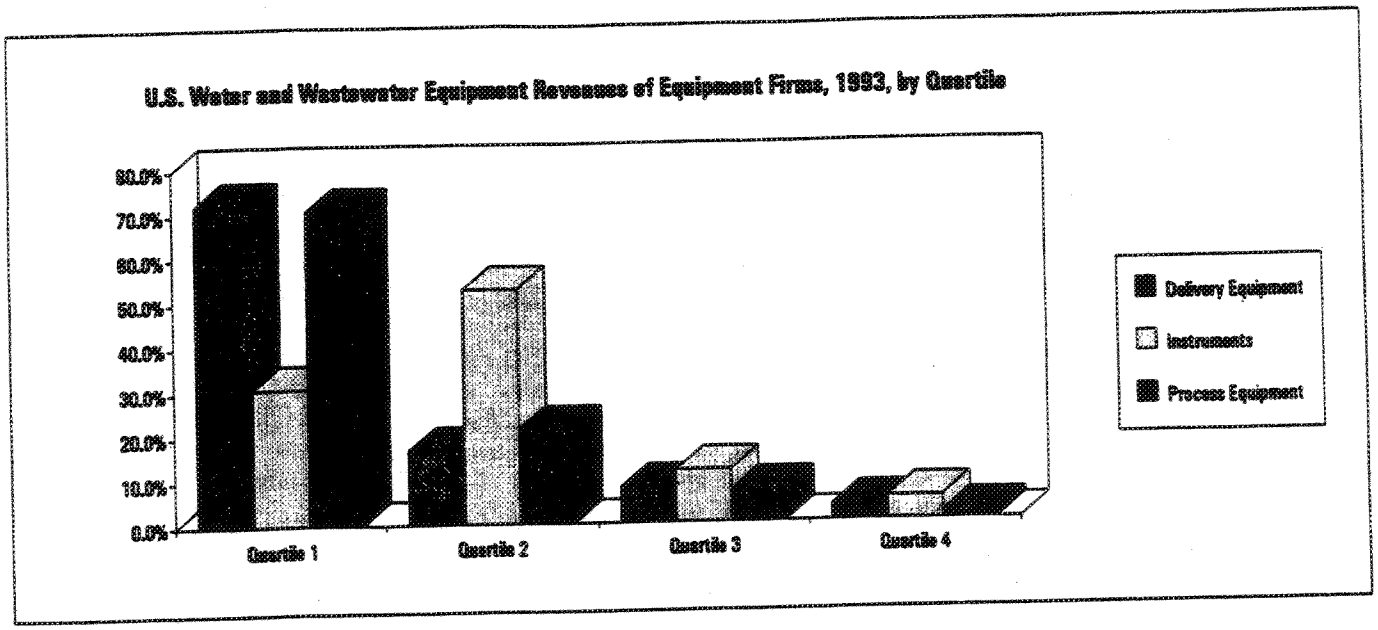
Source: Questionnaire responses.

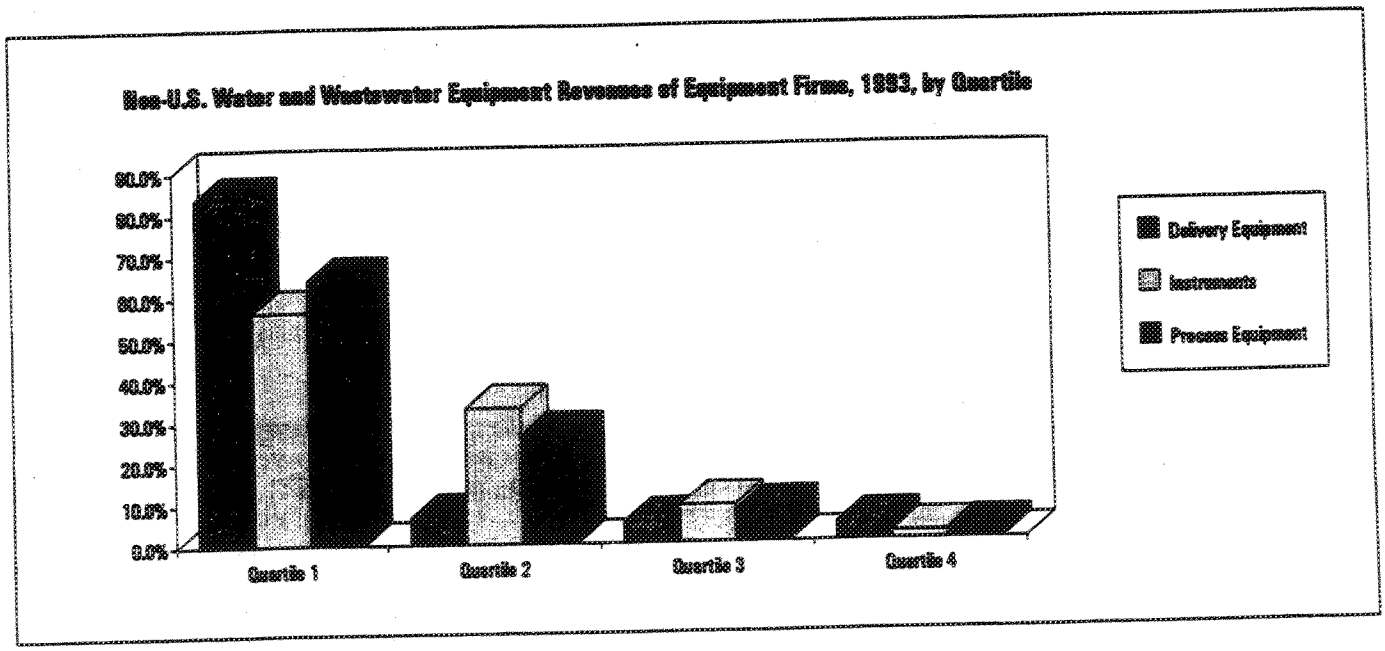
Figure 6-3
U.S. and non-U.S. revenues of equipment firms, 1993, by quartile



Source: Questionnaire responses.

Figure 6-4
U.S. and non-U.S. equipment revenues of equipment firms, 1993, by quartile





Source: Questionnaire responses.

Although most of the current market is for end-of-pipe approaches, the growth may occur in cleaner technology and production processes. The greatest potential growth market may be that for pollution prevention and waste minimization rather than for pollution abatement and remediation. This gradual shift may occur as industries build new facilities or upgrade existing plants and equipment. According to questionnaire responses, foreign markets may emphasize pretreatment or prevention before the waste stream enters a municipal system for treatment and disposal. U.S. service and equipment firms provide goods and services to a wide variety of industries in the United States and abroad for both water treatment and wastewater treatment. However, no current data are helpful to isolate the equipment and services used for pollution prevention in the domestic or foreign markets.

Environmental Regulation

Environmental regulation and enforcement will continue to drive the market in both the developed countries and in the developing countries. For example, as in the United States, the wastewater market in Europe is driven by enactment of laws relating to pollution discharges. Over the past five years, the EU has issued a number of directives requiring member states to meet specific environmental standards. To meet these benchmarks, the twelve member states are implementing legislation and procuring environmental equipment and services.

Environmental regulation may not be closely related to the competitiveness of the national industries pursuing business in the export markets. Certainly, the promotion of the environmental standards, practices, and testing protocols of the home country may further that country's technologies known toward meet standards and procedures needed abroad. However, as shown in chapter 5, the form of environmental regulation for W&WW is relatively similar in the major competitor countries. Implementation, or enforcement, is less even. For example, the United States has a larger percentage of its municipal wastewater subject to higher levels of treatment than does France. Yet the two large French firms are among the leading companies in the world. Other factors such as size, scale, overseas experience, and the ability to offer full-service contracts instead of a single service or piece of equipment, or even turnkey operations may give non-U.S. firms, particularly the British and French, an advantage in leading consortia to bid on large-scale infrastructure projects such as municipal W&WW facilities in developing countries. The degree of privatization of the home market and the size of the privatized W&WW systems may be significant in determining these competitiveness factors.

Factors of Competitiveness

The results of USITC survey about the importance of these competitive factors, including those identified by OTA, are shown in table 6-9. As expected, price and quality were the factors rated generally the highest in both the U.S. and non-U.S. markets, apart from quality being rated lower by the engineering and construction sectors for the non-U.S. market. The ability to meet specific needs and company reputation generally rated next.

The availability of project financing rated relatively higher in non-U.S. markets than in the U.S. market. The mechanisms used to finance foreign sales differ significantly for equipment and service firms (figure 6-5). The most commonly reported mechanism for equipment firms was the letter of credit. Open accounts and prepayment were also reported by equipment firms, as was financing by Ex-Im Bank. For service firms, funding by either Ex-Im Bank, USAID, or TDA was the leading mechanism, followed by financing by multilateral development banks.

The financial barriers to foreign sales were much more similar for the equipment and service firms (figure 6-6). Both segments reported the same top four factors: exchange rate uncertainty, payment assurance, high start-up costs, and import duties or taxes.

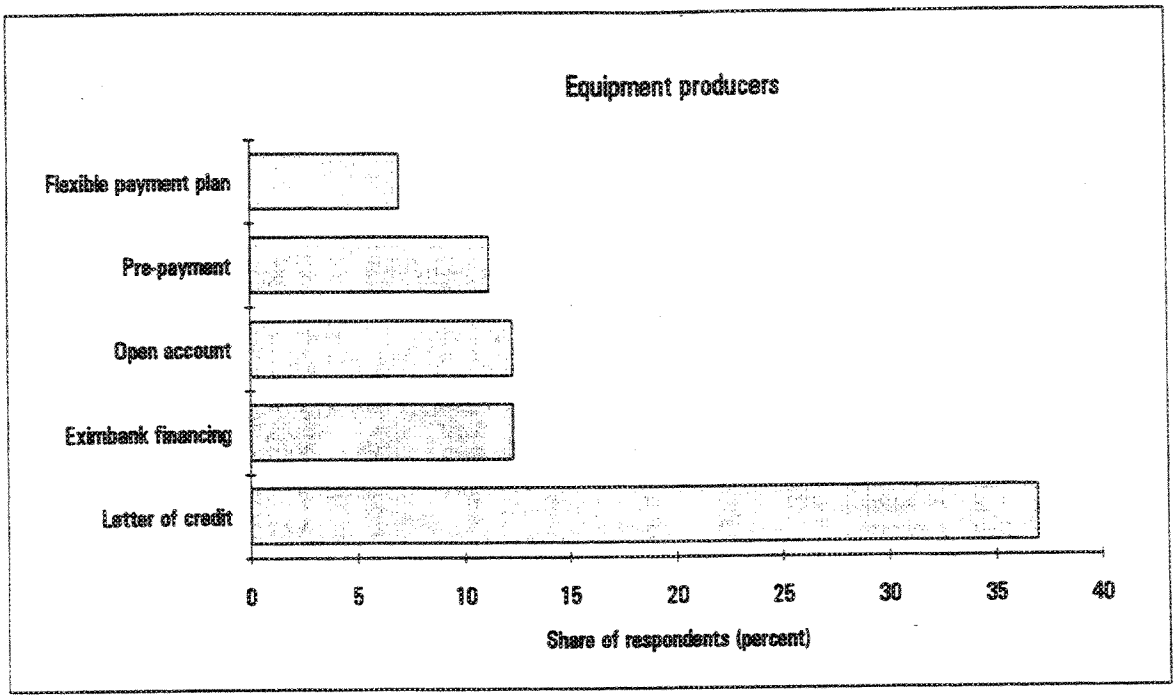
Neither form nor enforcement of environmental regulation was rated particularly high as a competitive factor in non-U.S. markets. However, enforcement was rated relatively high in the U.S. market. Also, rated surprisingly low in non-U.S. markets were such factors as technical standards, intellectual property protection, licensing, and lack of metrification in the United States; these factors are often raised as competitive factors by environmental technology producers.

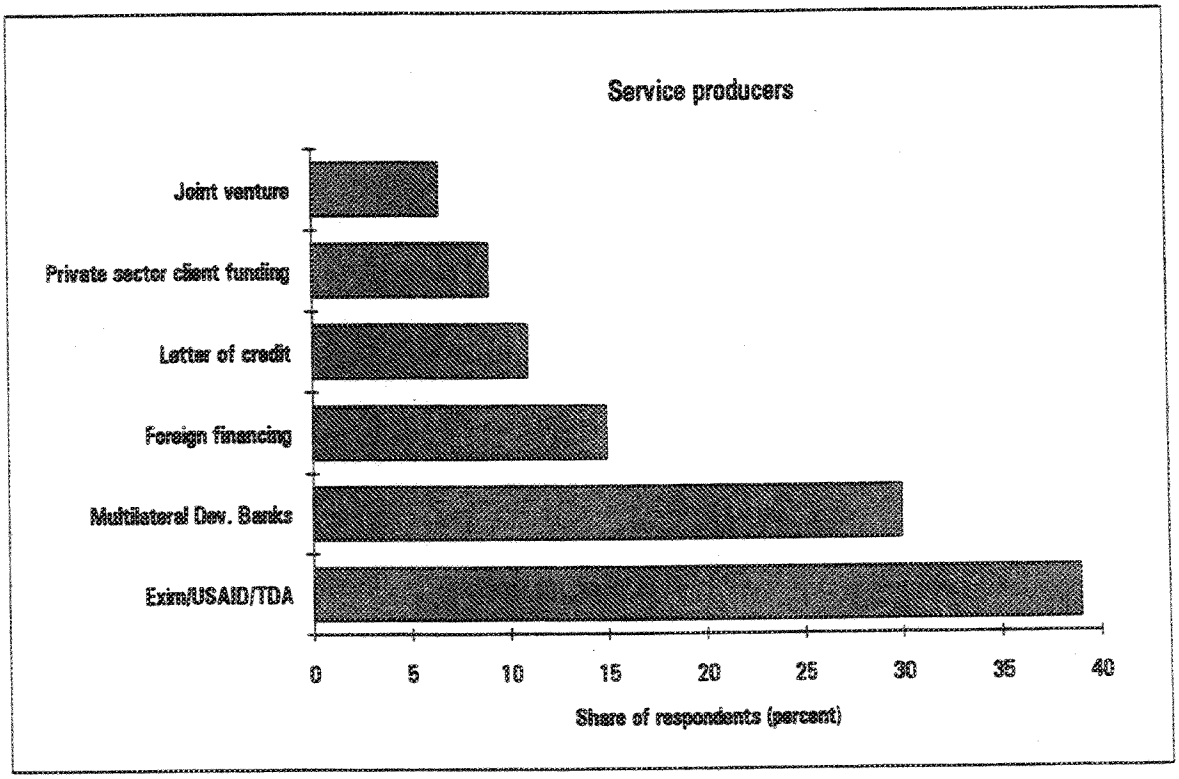
Table 6-9
Competitive factors in U.S. and non-U.S. markets

Description	Engineering		Construction		Instruments		Delivery		Process	
	Rating	Rank	Rating	Rank	Rating	Rank	Rating	Rank	Rating	Rank
Factors determining ability to compete in U.S. market:										
Price	4.03	3	4.69	1	4.20	1	3.90	1	4.38	1
Quality	4.26	1	4.23	2	4.14	2	3.88	2	4.21	2
Ability to meet specific needs	4.13	2	3.69	5	3.99	3	3.78	4	4.10	3
Company reputation	3.84	4	3.54	6	3.69	4	3.83	3	3.71	4
Enforcement of environmental regulation	3.67	5	3.23	9	3.43	5	3.15	8	3.38	5
Form of environmental regulation	3.22	9	2.89	11	3.27	7	2.98	10	3.13	10
Procurement practices of private sector	3.22	10	3.77	4	3.23	8	3.40	7	3.33	6
Procurement practices of public sector	3.57	6	3.51	7	3.37	6	3.65	5	3.02	11
Availability of project financing	3.27	8	3.37	8	3.20	9	3.48	6	3.17	9
Firm size and financial strength	3.30	7	3.89	3	2.89	13	2.85	13	3.02	12
Ability to offer complete package	3.06	11	3.17	10	3.08	10	2.98	11	3.29	7
Availability of market information	3.01	12	2.69	12	3.08	11	3.08	9	3.23	8
Ability to offer training	2.63	13	2.43	13	2.95	12	2.95	12	2.92	13
Factors determining ability to compete in non-U.S. markets:										
Price	4.07	2	3.82	3	4.17	3	3.91	1	4.17	2
Quality	3.64	11	3.00	14	4.08	14	3.68	6	4.22	1
Ability to meet specific needs	4.11	1	2.73	16	3.95	16	3.68	7	4.04	3
Company reputation	3.91	3	3.18	12	3.75	12	3.74	4	3.70	5
Enforcement of environmental regulations	3.73	7	2.45	19	3.33	19	2.91	21	3.37	14
Form of environmental regulation	3.38	15	2.45	20	3.25	20	2.85	22	3.17	18
Procurement practice of private sector	3.59	13	3.27	10	3.31	10	3.59	8	3.26	15
Procurement practice of public sector	3.66	10	3.27	9	3.42	9	3.88	2	3.22	16
Availability of project financing	3.75	6	3.82	4	3.34	4	3.21	15	3.54	7
Firm size and financial strength	3.59	12	3.45	7	3.17	7	3.09	17	3.17	17
Ability to offer complete package	3.75	5	3.45	5	3.39	5	3.24	13	3.50	8
Availability of market information	3.52	14	3.45	6	3.37	6	3.44	11	3.37	13
Ability to offer training	3.13	17	2.45	18	3.39	18	3.26	12	3.41	11
Availability of suitable partner	3.89	4	4.00	1	2.95	1	2.97	19	3.13	19
Existence of foreign sales office	3.68	9	3.18	11	3.85	11	3.47	10	3.78	4
Tariffs or duties	2.63	21	2.90	15	3.54	15	3.74	5	3.61	6
Risk of non-payment	3.71	8	3.82	2	3.32	2	3.47	9	3.46	10
Knowledge of exporting	3.21	16	3.27	8	3.49	8	3.79	3	3.48	9
Exchange rates	2.91	19	3.18	13	3.30	13	3.21	16	3.41	12
Technical standards	3.00	18	2.73	17	3.18	17	3.24	14	3.02	21
Licensing barriers	2.77	20	2.45	21	2.61	21	2.62	23	2.80	22
Availability of protection for intellectual property	2.48	22	2.18	22	2.92	22	2.97	20	3.13	20
Lack of metrification in the United States	2.05	23	2.18	23	2.51	23	3.03	18	2.48	23

Source: Questionnaire responses.

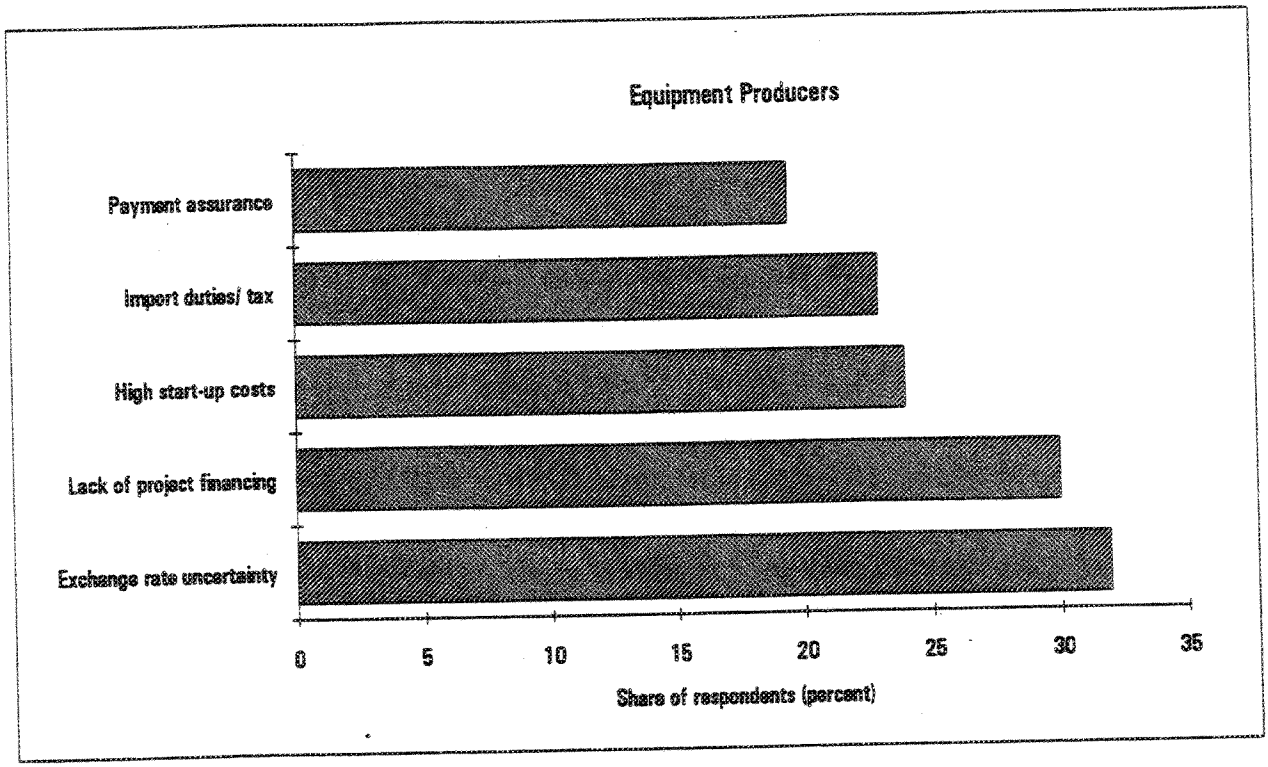
Figure 6-5
Financing mechanism used to win non-U.S. contracts

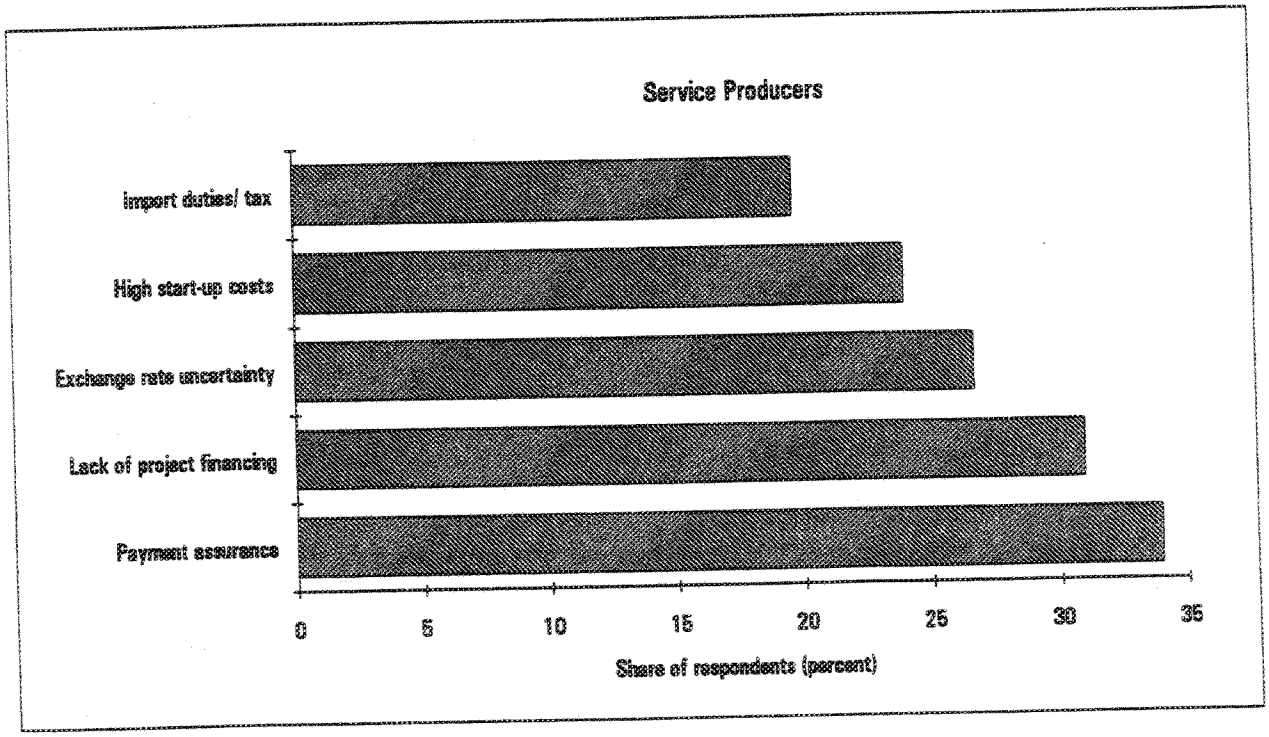




Source: Questionnaire responses.

Figure 6-6
Top five financial barriers to entry in non-U.S. markets





Source: Questionnaire responses.

Competitive Position

The global market is, of course, becoming more and more competitive. As shown in chapters 3 and 4, the domestic markets for the major competitors, except the recently reunified Germany, are mature like the United States, maybe even saturated. The industries in the United States and the other countries have excess capacity and are looking to export their goods and services.

France, Germany, Japan, and the United Kingdom have large and highly competitive industries, with firms more focused on the export markets. The large British and French firms have emerged as the leaders of most of the consortia that are obtaining the largest contracts, not just in the developing world, but even in developed countries like Australia.

Most U.S. firms tend to target the U.S. domestic market, where they face increasing competition from foreign capital, technology, and expertise. OTA noted that the U.S. market is not only attractive to foreign firms, but is one that provides opportunities for acquisitions, joint ventures, and licensing of technologies. The large foreign firms have increased their presence in the U.S. market, as with the Indianapolis operation and maintenance contract.

Some foreign customers perceive U.S. products as too sophisticated or expensive for their needs. U.S. firms may need to adapt their products to local needs and to become more concerned with service, training, and the provision of parts. W&WW, particularly on the municipal side, may call for less sophisticated approaches. This may occur less because of a different form or degree of environmental regulation and more because the lower cost of labor may undersell the cost of sophisticated systems with costly on-line analyzers and process controls.[4]

U.S. firms may or may not have less access to government support, including export financing, than their European and Japanese competitors. This often-made claim is hard to verify, particularly with respect to tied aid (see chapter 5). It is difficult to calculate levels of support for such items as research and development, export promotion, export finance, and foreign aid that go to support W&WW industries. Data are uneven and patchy.

U.S. regulatory and permitting procedures may hinder U.S. firms as they try to develop the technological innovations likely to become so important in the export market for environmental goods and services. One cannot say whether this kind of impediment may or may not apply as particularly to basic W&WW service as it may to other areas such as the handling of hazardous waste or site remediation, for instance, as with groundwater remediation. Some U.S. equipment firms have mentioned that they can sell innovative W&WW designs and systems overseas but not here in the U.S. market, owing to the permitting process.[5] The regulatory and permitting process may hinder the introduction of new technologies to the U.S. market more than it hinders competitiveness in foreign markets.

Outlook

To sum up, environmental regulation and project finance will probably affect the W&WW industries of the United States and major foreign competitors more than anything else does. These two variables will determine overall growth of the global market and the relative U.S. emphasis on domestic or foreign sales. It is difficult to predict how regulation will run its course in the United States and in both the developed and developing markets abroad. For example, regulation may or may not grant more flexibility in meeting water-quality requirements of both municipal and industrial users of W&WW treatment technology.

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[4]Questionnaire responses.
[5]Questionnaire responses.

Finally, the economic growth in the world economy, which is picking up in the United States, still lags in many other countries, and it may hold back investment in new or upgraded facilities. For example, financing is a potential problem in foreign markets for municipal W&WW projects, and possibly in some industrial projects. "Needs" appear by far to exceed effective "demands." Local government financing in the U.S. market for municipal W&WW facilities is also a potential problem that may lead to privatization of more municipal W&WW facilities. In this era of U.S. budget cutting, funds for substantial improvements or for growth in export promotion programs may not turn up to assist the domestic industry.

APPENDIX A

United States Senate

COMMITTEE ON FINANCE
WASHINGTON, DC 20510-6200

October 14, 1993

Dear Mr. Chairman:

As part of its policymaking process, the Senate Committee on Finance anticipates a need for impartial and detailed information on the competitiveness of environmental technology manufacturing and service industries in the United States. Recent reports prepared by the Office of Technology Assessment (OTA) at the request of the Committee have highlighted the emerging market opportunities for U.S. exporters of these goods and services. The OTA reports have also underscored the need for better data about the extent to which U.S. competitors are involved in export promotion of their environmental technology goods and services.

Accordingly, the Committee hereby requests, pursuant to section 332(g) of the Tariff Act of 1930 (19 U.S.C. 1332(g)), the Commission to collect and analyze information on the competitiveness of U.S. industries producing environmental goods and services. Specifically, the Committee requests that the Commission provide two reports. These should be comparative in nature, reviewing the export promotion/technical assistance policies of the United States' top competitors in the environmental technology field, including but not limited to Japan and Germany.

The first report should focus on the industry providing goods and services for municipal and industrial water supply and for municipal and industrial wastewater treatment and disposal. The second report should focus on the industry providing goods and services for air pollution prevention and abatement. The first report should be delivered within 12 months of the release of OTA's final report in its series on American Industry and the Environment, which is anticipated before the end of this year; the second report should be delivered not later than 12 months after delivery of the first report.

In defining the scope of its investigations, the Commission should focus on:

(1) those industries that provide such conventional environmental goods and services as pollution abatement, pollution prevention, or environmental remediation; or goods and services that have as a central component the reduction of energy or materials consumption or the reduction of environmental impact during use or upon disposal; and

(2) those industries that would benefit in foreign markets from greater coordination among export promotion and market development, environmental regulation, technology transfer, technical development assistance, economic development or other financial assistance, and intellectual property protection policies.

Thank you for your attention to this request.

Sincerely,

Daniel Patrick Moynihan
Chairman

The Honorable Don E. Newquist
Chairman
U.S. International Trade Commission
500 "E" Street, S.W.
Washington, D.C. 20436

APPENDIX B

APPENDIX B

USITC QUESTIONNAIRE

The USITC's questionnaires were sent to a total of 600 firms that were identified as providers of goods and services for municipal and industrial water and wastewater treatment facilities. The breakdown of the mailing list and response rates are shown on tables B1 and B2. For services, the questionnaire focused primarily on the engineering and construction firms, as discussions with industry experts led to the conclusion that these firms were the most likely to encounter competition with foreign companies. Thus, fewer questionnaires were sent to laboratory testing firms and to operation and maintenance firms. For equipment, the most questionnaires were sent to firms believed to be primarily involved in the production of what is termed process equipment, while smaller numbers were sent to producers of instruments and delivery equipment.

Services

The list of design/engineering firms selected to receive the questionnaire was derived primarily from the listing in the Engineering News Record (ENR) of the top 500 design/engineering firms and included only those firms listed as having billings in 1993 from water or sewer and waste.[1] The ENR listing categorizes these firms by revenues; those selected had 1993 total revenues greater than $6 million. The ENR's top 500 U.S. design firms had a combined total of $31.7 billion in billings in 1993, of which $26.0 billion were domestic and $5.8 billion were international. For these engineering firms, design billings for water projects accounted for $1.1 billion, while those for sewer and waste accounted for $2.0 billion.[2] The ENR does not provide a breakdown of the source (domestic or international) for the water and sewer and waste billings.

The responses to the Commission's questionnaire from the design/engineering firms accounted for 32 percent of total domestic and foreign billings, 30 percent of domestic billings, and 38 percent of foreign billings. The questionnaire responses accounted for 38 percent of the total water and sewer and waste billings.

The sample for the construction firms was taken from the ENR's list of the top 400 construction firms and included only those who were listed as having contracts in 1993 for water or sewer and waste. The ENR listing categorizes these firms by the value of new contracts; those selected each had new contracts in 1993 greater than $6 million. The ENR's top 400 U.S. contractors had a total of $217.8 billion in new contracts in 1993, of which $152.4 were domestic and $65.5 billion were international. Contracts for water projects accounted for $2.6 billion, while sewer and waste accounted for $5.7 billion.[3] The ENR does not provide a breakdown of the source (domestic or international) for the water and sewer and waste contracts.

For the construction firms, the responses accounted for less than 5 percent of total domestic and foreign contracts for 1993. The questionnaire responses accounted for about 10 percent of the total water and sewer and waste billings.

The firms providing operation and maintenance service selected were among the largest such firms in the country. Given the prior information that most of these firms operated only in the United States, a smaller set was selected to yield a picture of the size and scope of such firms. The list of laboratory services firms was derived from industry association membership lists, reports on the laboratory testing industry, and other industry sources.

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[1]Waste also includes solid waste. *ENR*, Apr. 4, 1994, pp. 43-65.
[2]Ibid., p. 35.
[3]*ENR*, May 23, 1994, p. 41.

Table B-1
Questionnaire recipients and response rates

Category of recipient	Mailed (*N*)	Responses (*N*)	Response rate (*Percent*)
Services firm	309	136	44
Engineering services	190	75	40
Construction services	78	35	45
Laboratory testing services	26	15	58
Operation and maintenance	15	11	73
Equipment firm	291	122	42
Process equipment	133	49	37
Instruments	67	36	54
Delivery equipment	91	37	41

Source: USITC Questionnaires.

Table B-2
Questionnaire response rates for U.S. and non-U.S. interests

Category of recipient	Number of respondents reporting		Share of respondents reporting	
	U.S. revenues	Non-U.S. revenues	U.S. revenues	Non-U.S. revenues
			(*Percent*)	
Gross revenues:				
Services	136	60	100	44
Engineering	75	47	100	63
Construction	35	5	100	14
Laboratory testing	15	6	100	40
Operation and maintenance	11	2	100	18
Equipment	121	106	99	87
Process	48	41	98	84
Instruments	36	33	100	92
Delivery	37	32	100	87
Water and wastewater related revenues:				
Services	136	34	100	25
Engineering	75	28	100	37
Construction	35	3	100	9
Laboratory testing	15	1	100	7
Operation and maintenance	11	2	100	18
Equipment	121	102	99	84
Process	48	40	98	82
Instruments	36	32	100	89
Delivery	37	30	100	81

Source: USITC Questionnaires.

Equipment

The list of equipment firms selected to receive the questionnaire was derived from the membership listings of trade associations and other organizations representing firms known to manufacture products used by water and wastewater facilities, from listings assembled by consultants, or from equipment directories. The various listings ranged in size from fewer than 100 equipment firms to more than 2000 equipment firms. Overall industry data are not available to permit assessment of the percentage of industry revenues and exports accounted for by the respondents.

APPENDIX C

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ABBREVIATIONS

ABCC	Association of British Chambers of Commerce
AKA	Ausführkredit-Gesellschaft
ATP	Aid and Trade Provision
BFCE	Banque Francaise du Commerce Extérieur
BNA	Bureau of National Affairs
BOTB	British Overseas Trade Board
CFCE	Centre Francais du Commerce Extérieur
CGE	Compagnie Générale des Eaux
COFACE	Compagnie Francaise D'Assurance pour le Commerce Extérieur
DOC	U.S. Department of Commerce
DREE	Direction des Relations Economiques Extérieures
EBI	Environmental Business International
EBJ	Environmental Business Journal
ECGD	Export Credit Guarantee Department
EGS	environmental goods and services
EID	Export Insurance Division
EPA	U.S. Environmental Protection Agency
ETDC2	Environmental Technologies Development Corporation
ETI	Environmental Training Institute
ETWG	Environmental Trade Working Group
EU	European Union
Ex-Im Bank	U.S. Export Import Bank
FWPCA	Federal Water Pollution Control Act
GATT	General Agreement on Tariffs and Trade
GAO	General Accounting Office
GDP	gross domestic product
JEA	Japan Environment Agency
JEXIM	Japan Export Import Bank
KfW	Kreditanstalt für Wiederaufbau
MITI	Ministry of Trade and Industry
NAFTA	North American Free Trade Agreement
NIST	National Institute of Standards and Technology
NRA	National Rivers Authority
ODA	official development assistance
OECD	Organisation for Economic Co-operation and Development
O&M	operation and maintenance
OPIC	Overseas Private Investment Corporation
OTA	U.S. Congressional Office of Technology Assessment
POTW	publicly owned treatment work
PSG	Professional Services Group, Inc.
SAUR	Société d'Aménagement Urbain et Rural
SIC	Standard Industrial Classification
TDA	U.S. Trade and Development Agency
TPCC	Trade Promotion Coordinating Committee
UNCED	United Nations Conference on Environment and Development
US-AEP	United States-Asia Environmental Partnership
USAID	U.S. Agency for International Development
U.S. ETI	U.S. Environmental Training Institute
U.S. TIES	U.S. Technology for International Environmental Solutions
US&FCS	U.S. and Foreign Commercial Service
USITC	United States International Trade Commission
WHO	World Health Organization
W&WW	water and wastewater