



**U.S. DEPARTMENT OF COMMERCE**  
**International Trade Administration**

A gray silhouette map of Vietnam is positioned on the left side of the page, partially overlapping the text. The background of the entire page is a light gray with a subtle pattern of concentric circles.

# VIETNAM ENVIRONMENTAL TECHNOLOGIES EXPORT MARKET



**U.S. DEPARTMENT OF COMMERCE  
International Trade Administration  
and  
United States-Asia Environmental Partnership  
Washington, D.C.: 2001**

## Library of Congress Cataloging-in-Publication Data

Vietnam environmental technologies export market plan/U.S. Department of Commerce, International Trade Administration, Office of Environmental Technologies Exports and United States-Asia Environmental Partnership.

p. cm.

1. Pollution control equipment industry—Vietnam. 2. Pollution control equipment industry—United States. 3. Export marketing—United States. 4. Imports—Vietnam.
5. Trading companies—Vietnam. 6. Pollution—Vietnam. 7. Market surveys—Vietnam.
- I. United States. Office of Environmental Technologies Exports. II. United States. Asia Environmental Partnership.

HD9718.V52 V53 2001  
382'.4568176—dc21

2001016892



Federal Recycling Program  
Printed on recycled paper.

Illustration on page vii courtesy of the Central Intelligence Agency.

The full text of this report is available on the International Trade Administration's Internet site at [www.environment.ita.doc.gov](http://www.environment.ita.doc.gov). Reprints in paper or microfiche are available for purchase from the National Technical Information Service, 5285 Port Royal Road, Springfield, VA 22161; [www.ntis.gov](http://www.ntis.gov).

This report was prepared under contract for the Office of Environmental Technologies Industries in the International Trade Administration of the U.S. Department of Commerce, with the supervision and assistance of the U.S.-Asia Environmental Partnership (US-AEP), by Mekong Research, Ltd., of Ho Chi Minh City.

# Preface

This study on the market for environmental technology in Vietnam was prepared under the supervision of the U.S. Department of Commerce's Office of Environmental Technologies Industries (ETI) within the International Trade Administration and the U.S.-Asia Environmental Partnership (US-AEP).

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755654AI (R02698) 3-01

# Abbreviations

ADB	Asian Development Bank	IFC	International Finance Corporation
AFD	Agence Française de Développement (France)	IP	industrial park
AusAID	Australian Agency for International Development	IZ	industrial zone
BADC	Belgium Administration for Development Cooperation	JBIC	Japan Bank for International Cooperation
BMZ	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (Germany)	JICA	Japan International Cooperation Agency
BOD	biochemical oxygen demand	kWp	peak kilowatt
BOT	build-operate-transfer	MARD	Ministry of Agriculture and Rural Development (Vietnam)
CIDA	Canadian International Development Agency	MOSTE	Ministry of Science, Technology, and Environment (Vietnam)
COD	chemical oxygen demand	MPI	Ministry of Planning and Investment (Vietnam)
DANIDA	Danish International Development Agency	NASDA	National Association of State Development Agencies
DFID	Department for International Development (United Kingdom)	NEA	National Environmental Agency
DDC	Department for Development Cooperation	NetGov	Government of the Netherlands
DOSTE	Department of Science, Technology, and Environment (Vietnam)	NORAD	Norway Agency for Development Cooperation
DPC	District Peoples Committee	ODA	overseas development assistance
EIA	environmental impact assessment	OECF	Overseas Economic Cooperation Fund (Japan)
EPZ	export processing zone	PV	photovoltaic
EU	European Union	SDC	Swiss Development Cooperation
EVN	Electricity of Vietnam	SIDA	Swedish International Development Cooperation Agency
FINNIDA	Finland International Development Agency	UNDP	United Nations Development Program
HCMC	Ho Chi Minh City	WFP	World Food Program (United Nations)
IE	industrial estate		
IFAD	International Fund for Agriculture Development		

Note: Dollar amounts given in the text are, unless otherwise noted, in U.S. dollars. Calculations from Vietnamese currency have been figured at 14,500 dong to the dollar.

# Executive Summary

- The market for environmental technologies is being driven by overseas development assistance (ODA). In general, the Vietnamese government and Vietnamese companies do not have the resources to finance pollution prevention or treatment equipment. ODA-financed projects represent the largest market for environmental technologies, equipment, and services.
- Foreign manufacturers and foreign-invested industrial zones represent a shrinking market opportunity. Vietnam's economy is growing at half the rate of the mid-1990s, and levels of foreign direct investment in Vietnam are down by over 60 percent from 1996. The market trend is defined by foreign companies leaving, not entering Vietnam.
- Vietnamese companies can be a promising market opportunity, but financing from the supplier, from bilateral aid grants, or from other ODA sources should be arranged. Securing bilateral grants to finance environment-related projects at large, state-owned companies has proven to be a successful approach to winning business.
- To bid successfully on contracts funded by Vietnamese companies, and even those funded by ODA, it is essential to develop strong relationships with the government ministries administering the tender, as well as with the end client (often a provincial or city government). In addition, demonstrating a willingness to be flexible and to work in a legal environment less secure than what exists in developed countries can be helpful in both establishing strong relationships and in securing contracts.
- Vietnam's most pressing environmental problems are providing clean water and reducing the population's exposure to polluted water. Less than 40 percent of the population has access to potable water. Most of Vietnam's largest companies dump untreated wastewater into canals, streams, and rivers. Over \$1 billion in ODA have been committed to the water resources sector.
- Increasingly, ODA funding is being directed toward urban-environment improvement projects. Five of the 14 largest ODA projects in the pipeline are in the urban planning and pollution control sector. These projects include rehabilitation or construction of water supply, drainage, and sewage networks. The drainage and sewage networks in Vietnam's urban centers are dual-purpose systems used for rainwater and wastewater (and often solid waste). Flooding of these systems occurs frequently, exposing the population to pollutants.
- Vietnam is just starting to tackle its air pollution and hazardous waste problems. The country's first comprehensive studies on the effects of these forms of pollution are underway or in the planning stage. The best opportunities in these sectors are for vendors of monitoring and analysis equipment, as well as for companies that can undertake air quality and hazardous waste studies.
- Major urban centers are unable to dispose of the volumes of solid waste being produced. Urban centers' main dumping grounds are approaching their capacities and have not been built to prevent leakage. ODA-backed projects are financing upgrades of garbage collection infrastructure and construction of new landfills.
- Vietnam's soil environment is most threatened by continued deforestation, rapid growth in agriculture productivity, and overuse of pesticides. While some ODA has been directed away from forestry management toward urban pollution problems in recent years, 74 percent of total planned ODA (in terms of dollar value) is directed toward natural resources management.
- The market for environmental services centers on consultant contracts for ODA-funded projects. The best opportunities for environmental services companies rest with preparation of feasibility studies, detailed designs, bidding documents, etc. on ODA-funded

projects. Project consultant and construction supervision contracts on ODA projects are, and will continue to be, market opportunities.

- U.S. companies trail those from Europe, Australia, and Japan in capturing contracts for environment-related projects in Vietnam. This is largely because bilateral financing from these countries, or co-financing on multilateral ODA projects, gives companies from the donor country the inside track for winning contracts. The U.S. position should improve with the introduction of U.S.-Asia Environmental Partnership initiatives, the signing of a bilateral trade agreement between the

United States and Vietnam, as well as with the entry of the Overseas Private Investment Corporation and the Export-Import Bank to the market.

- Opportunities exist for U.S. exporters of equipment related to water supply, purification, and treatment. The most commonly imported equipment used for water supply and treatment include industrial and household pumps, motors, filters, aerators, and water purification equipment/systems. U.S. brands are generally recognized in the local market for their quality and durability.

# Chapter 1

## Economic Overview

From the late 1980s until 1997 Vietnam enjoyed some of the highest growth rates in Asia after the government launched its *doi moi*, or renovation, program in 1986. Faced with a decline in Soviet aid and food shortages caused by failing agricultural cooperatives, Vietnam's leaders were forced to open the country's economy to foreign investors and trade.

Vietnam dismantled its collective farms, giving families the right to use land in the countryside, where 80 percent of Vietnam's population lives. Farmers were allowed to choose which crops to grow and to sell them at market prices to whomever they chose.

The results of these changes were dramatic. Vietnam's GDP growth averaged more than 8 percent from 1991 to 1997, making it the second fastest growing country in Asia, after China. Vietnam went from being an importer of rice to the world's third largest rice exporter. Poverty, as measured by the World Bank, dropped from 70 percent to 30 percent.

At its peak in 1996, Vietnam licensed foreign investment projects valued at more than \$8 billion. Foreign companies, mostly from Asia, rushed into a market of 77 million people, eager to profit from what would surely become the next "Asian Tiger."

In recent years, that optimism has faded. The slowing pace of reforms and lingering effects of the Asian economic crisis have taken their toll. After reaching \$8 billion in investment pledges in 1996, that number plunged to \$4.5 billion in 1997. In 1998, the amount dropped further, to \$1.8 billion. In 1999, Vietnam approved 274 new foreign investment projects worth \$1.48 billion. Donors estimate that actual inflows will total \$600 million in 1999, the lowest since 1992 (Table 1.1).

Recognizing the trend, the government has taken incremental steps toward improving the investment climate. It has made it easier for foreign companies to establish 100 percent foreign-owned enterprises instead of arranging forced marriages to local joint-venture partners. Foreign companies can now set employee salaries in Vietnamese dong. Previously, salaries were set in dollars, making Vietnam a less competitive labor market, especially after devaluations in Indonesia and Thailand.

**Table 1.1 Foreign Direct Investment in Vietnam, 1987–1999 (billions of dollars)**

	<i>Total</i>	
	<i>Commitments</i>	<i>Disbursements</i>
1987–1995	36.2	11.2
1995	6.6	1.8
1996	8.5	2.3
1997	4.5	2.4
1998	1.8	1.0
1999	1.0	0.6

Note: Figures do not include additional capital committed to existing projects.

Source: World Bank, Ministry of Planning and Investment, January 2000.

These steps have not been enough, however, and the economy has slowed over the past three years. For 1999, GDP growth was between 4 and 5 percent depending on the source. Generally, the World Bank's forecast is a bit lower than the Vietnamese government's. The industrial sector grew about 10.5 percent in 1999, despite falling demand. As has been the trend over the past five years, foreign-invested companies are growing fastest, recording a 19.4 percent growth rate, with state enterprises growing an estimated 4.9 percent, and local private businesses 8.5 percent.

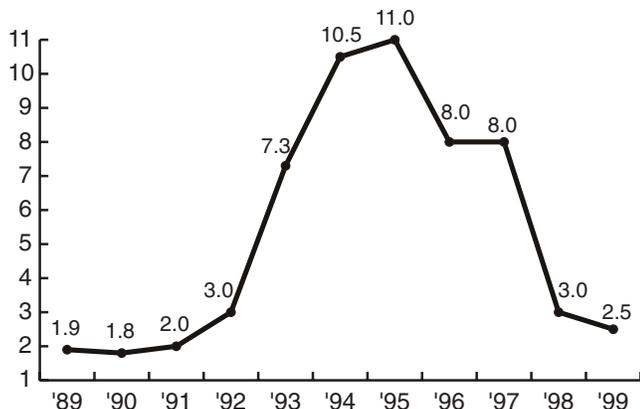
Inflation dropped precipitously in 1999, with Hanoi recording an inflation rate for the year at 0.1 percent year-on-year (Table 1.2). The figure for year-on-year inflation in 1998 was 9.2 percent. Falling rice prices, which account for 60 percent of Vietnam's consumer price

**Table 1.2 Year-on-Year Inflation in Vietnam, 1994–1999 (Percent)**

<i>1994</i>	<i>1995</i>	<i>1996</i>	<i>1997</i>	<i>1998</i>	<i>1999</i>
14.4	12.7	4.5	3.8	9.2	0.1

Source: World Bank, General Statistics Office, January 2000.

**Chart 1 Foreign Direct Investment in Vietnam (as Percent of GDP), 1989–1999**



index, are believed to be the cause of the lower than expected inflation rate.

Vietnam enjoyed a strong export performance in 1999, marking one of the economic highlights of the year. Exports rose to \$11.5 billion, up 23.1 percent compared with 1998 (Table 1.4). The trade gap for 1999 slimmed to an estimated \$113.0 million, from \$2.0 billion in 1998. Imports rose 0.9 percent to \$11.6 billion for the year.

**Table 1.3 Changes in Vietnamese Consumer Prices, 1998–1999**

	<i>Dec.</i> <i>1999</i>	<i>Nov.</i> <i>1999</i>	<i>Dec.</i> <i>1998</i>
Month-on-month change	0.5	0.4	0.8
Year-on-year change	0.1	0.4	9.2
Index*	100.1	99.6	109.2

\*Base 100 = previous December.

Source: World Bank, General Statistics Office, January 2000.

**Table 1.4 Vietnamese Balance of Trade 1995–1999 (Billions)**

	<i>1999</i>	<i>1998</i>	<i>1997</i>	<i>1996</i>	<i>1995</i>
Merchandise exports	\$11.5	\$9.4	\$8.9	\$7.1	\$5.1
Merchandise imports	\$11.6	\$11.4	\$11.2	\$11.1	\$7.5
Trade deficit	\$0.1	\$2.0	\$2.3	\$4.0	\$2.3

Note: Smuggled goods estimated to add \$1.5 billion to annual import totals.

Source: World Bank, Ministry of Trade, 2000.

Higher oil prices and Vietnam's continuing ability to capitalize on its strength in agricultural commodities, such as rice and coffee, helped boost the country's export performance in 1999. Meanwhile, imports have dropped as domestic economic growth has slowed, reducing demand for capital equipment.

The long-awaited bilateral trade agreement with the United States is expected to boost these figures tremendously. Indeed, the trade agreement is now the key factor that will determine Vietnam's economic health over the next three to four years.

With the final agreement in July 2000, Vietnam would win Normal Trading Relations (NTR; formerly Most Favored Nation status) with the United States. The lower taxes on Vietnamese goods, combined with Vietnam's low labor costs, would result in a new influx of investment to produce items such as garments, textiles, shoes, and furniture. In the first year of NTR alone, it is expected that Vietnam would earn an additional \$800 million in export sales. In the long term, the agreement would lead Vietnam to adopt market-opening measures that would benefit foreign investors and Vietnam's private sector.

# Chapter 2

## Overview of Market for Environmental Technologies

### 2.1 Current Trends

Since the beginning of Vietnam's "renovation" period, which started in 1986, the government's stated goal has been for Vietnam to become an industrialized and modernized country by 2020. To achieve this goal, the government adopted policies that encouraged foreign investment and simultaneously sought to increase output of domestic industries.

From 1991 to 1997, Vietnam achieved extraordinary growth. Annual GDP growth averaged 8 percent during that period, making Vietnam the second fastest growing economy in Asia, after China. At one point in 1996, Ho Chi Minh City (formerly Saigon) had the fastest growing economy in the world.

Along with the benefits of industrialization have come the costs, including degradation of the environment. Vietnam is particularly vulnerable to environmental problems for simple reasons. Vietnam's 20th century history was defined by war, primarily on its own soil. Successive conflicts destroyed much of the country's infrastructure, leaving an already poor, underdeveloped nation in even worse condition. Following the reunification of the country in 1975, the government's centrally planned economic policies, especially the establishment of agricultural cooperatives, drove the country further into poverty. Therefore, the government has had little or no funds to upgrade urban infrastructure such as sewerage, drainage, and water supply. Pollution abatement has been a luxury, not a priority. Much of the existing infrastructure in the country's two largest cities, Hanoi and Ho Chi Minh City, has remained unchanged since being built early in the last century.

The same can be said for many of Vietnam's industries. Loss-making state-owned enterprises have been fighting for their survival, so installing costly waste treatment and prevention equipment has been, and remains, a low priority. Many of these enterprises use outdated equipment or second-hand imports which generate higher levels of pollution. Wastewater goes untreated and is dumped into local waterways. Enforcement of environmental regulations at state-owned enterprises is weak. While firms may be inspected and fined on occasion, they

are rarely forced to close their doors. Company management, as well as inspection bodies, are aware that pollution is a problem, but both recognize that the SOEs do not have the funds to address the issue. Instead, companies try to keep the fines to a manageable amount, rather than pay for costly pollution-prevention equipment.

Air pollution is an acute problem, since many industries are located in densely populated areas. Vehicular emissions are the country's largest source of air pollution. If the government's decision to phase out leaded fuel by July 1, 2001, is implemented, this pollution source will at least become cleaner.

Some foreign manufacturers have also contributed to Vietnam's environmental degradation, capitalizing on the weak enforcement of the country's environmental regulations. In many cases, the fines imposed for violating standards is less than the cost of installing and operating waste treatment facilities. There have been some reported cases where waste treatment facilities have been installed but are not in use. No foreign manufacturer has been shut down because it violated environmental standards.

Over the past decade, urban migration has further strained an already overburdened urban infrastructure. Economic growth has been concentrated in Vietnam's largest cities, Hanoi and Ho Chi Minh City. In both cities, drainage and sewerage systems are combined, so when flooding occurs (as happens frequently) the population is exposed to highly polluted waters. Potable water supply in both urban and rural areas is inadequate, with large percentages of the population going without access to piped water or clean ground wells.

Solid waste collection and disposal is inefficient because of inadequate collection equipment. Landfills are reaching their capacity and many do not safeguard against contamination of surrounding areas. Medical and other hazardous waste are generally not treated separately from other solid waste.

### 2.2 Market Drivers

Faced with these overwhelming and worsening environmental conditions, the government passed a Law

on the Protection of the Environment in 1993. The law covers everything from requirements for environmental impact assessments to a list of prohibited activities and a system for addressing non-compliance with the law.

The government regulations opened a limited market for vendors of environmental services. Foreign investors and foreign-invested industrial zones, which (in theory) had to meet the regulations set by the law in order to receive investment licenses, became potential customers, especially during the early to mid-1990s, when investor interest in Vietnam was at its peak.

Since 1996, however, foreign investment commitments to Vietnam have dropped by over 60 percent. The difficulties of doing business in Vietnam, combined with the slow pace of policy reforms and the lingering effects of the Asian crisis, have deterred new investment. Accordingly, the number of new potential clients has dropped as well.

The market for environmental technologies in Vietnam today is being driven almost exclusively by overseas development assistance (ODA). Currently, there are more than 173 ongoing environment projects funded by 36 donors in Vietnam. The total financial commitment of these projects is over \$1.4 billion. Forty-eight of these projects are funded by multilateral donors, and 125 are funded by bilateral ODA. In the pipeline are 57 projects valued at over \$770 million. ODA commitments to the environment sector have increased six-fold since 1995.

## 2.3 Opportunities

Water supply, sewerage, and drainage projects will drive the market over the next two years. Limited access to potable water and exposure to raw sewage and polluted waters during flooding have become major health hazards to urban populations. Aid has been targeted accordingly.

For the past three years, donors and the government have channeled most urban-development ODA to rehabilitate infrastructure and water supply in Hanoi and other northern cities. Now, most attention is focused on Vietnam's largest city, Ho Chi Minh City. There are four major ODA-financed urban environment projects underway or in the planning stages. While the projects are focused on drainage and sewerage, some also contain air pollution and solid waste management components. These projects are financed by the World Bank, the Asian Development Bank, the Japan International Cooperation Agency (JICA), and the Belgian Administration for Development Cooperation (BADCO).

Because so much of the activity in the environment technologies sector is now centered on ODA-financed projects in Ho Chi Minh City, Table 2.1 (page 6) provides

a useful reference for ongoing and upcoming opportunities in the sector.

Local companies are becoming more viable sales prospects, but the market remains limited. Citizen pressure to reduce waste emissions at manufacturing plants and the government "black books" of environmental polluters have raised awareness at local companies of the need to reduce pollution. Approaching these companies directly with viable financing schemes, such as bilateral aid or grants, has proven to be a successful market entry strategy for environmental equipment suppliers.

## 2.4 Equipment

Contracts for ODA-funded projects make up the largest market for environmental technologies. Since technology needs vary from project to project, it is difficult to assess sales trends and opportunities for any given product. The descriptions of ongoing and upcoming ODA projects in the following chapters include examples of the types of technologies being imported.

What is clear is that the primary environmental technologies market is equipment for water treatment, water supply, and water purification. These products are imported on a regular basis for ODA projects, and also for local industries, businesses, and consumers. For instance, the market for pumps, valves, water meters, and spare parts has grown steadily over the past four years. Almost none of this equipment is produced domestically, and local consumers are familiar with the advantages of international brands.

Vietnam imports nearly all of the key equipment needed for waste treatment and pollution control. For wastewater treatment equipment, local environmental service companies and end users import pumps, control systems, motors, aerators, and filters. (For a list of popular brand names and product lines in the water-treatment sector, as well as market-size estimates, see Section 4.8.)

An interesting niche market for environmental technologies has been local environmental service companies and research institutions. These institutions are part state-owned enterprise, part academic institution, and part government ministry. They can be responsible for everything from issuing environmental impact assessments, to environmental monitoring, to selling pollution control equipment, to foreign enterprises. While sales volumes to these uniquely Vietnamese "conglomerates" may be less than those to ODA-funded projects, they have proven to be a consistent market.

In addition to purchasing imported pollution-control equipment, these institutions have been consistent buyers

of monitoring and analysis equipment. These institutions import equipment for taking and analyzing soil, water, and air samples, as well as laboratory equipment such as pH meters, spectrophotometers, and centrifugal machines. (For a list of the leading environmental service companies in Hanoi and Ho Chi Minh City, see Appendix C.)

## **2.5 Competitive Situation and U.S. Market Share**

As is the case in numerous industries in Vietnam, U.S. companies are playing “catch-up” in the environmental technologies and services markets in Vietnam. Over the past 15 years, Denmark, Finland, Holland, Japan, Sweden, Australia, and France have been the countries most active in financing bilateral aid projects to the environment sector or co-financing multilateral aid projects. Government grants from these countries are financing feasibility studies and “master plans” for environmental improvements and pollution prevention in Vietnam. Companies from these countries then win the design contracts and subsequent engineering and equipment contracts.

U.S. bilateral aid to the sector has been relatively slow in coming. This is largely because the focus of U.S.-Vietnam bilateral relations over the past five years has been on re-establishing diplomatic ties and normal trade relations. In general, U.S. policy on bilateral aid has shifted away from big project funding in recent years, so it is unlikely that U.S. grants to environmental projects in Vietnam will ever reach the levels provided by European countries.

Therefore, projects funded by multilaterals such as the World Bank, ADB, and UNDP offer significant opportunities for U.S. firms. Several American companies have

successfully bid for consulting contracts to ODA-funded projects, among them Parsons, Black and Veatch, and Camp Dresser McKee.

In addition, some American companies have won contracts to sell equipment to the primary contractor on environmental projects. For example, it is likely that key equipment needed for an air quality monitoring project in Ho Chi Minh City will be sourced from the United States, although the primary contractor is a Danish company.

U.S. participation in Vietnam’s environment sector is increasing via the participation of the United States-Asia Environmental Partnership (US-AEP), which established offices in Hanoi and Ho Chi Minh City in 1999.

The United States has not yet provided bilateral aid in the form of loans or grants to the environment sector. A new source of financing for U.S. companies is available via the Overseas Private Investment Corporation (OPIC). OPIC provided its first financial support to a U.S. investment project in Vietnam in December 1999. In late 2000, following the visit to Vietnam by President Clinton, OPIC extended a loan to the Ho Chi Minh City pharmaceutical company OPV, and announced a \$200 million loan facility for joint ventures with at least 25 percent U.S. ownership. The U.S. Export-Import Bank is operational in Vietnam, but to date it has not provided any funding.

U.S. products such as water pumps, water filtration and purification equipment, and control systems enjoy a strong reputation among local buyers. Products from the United States, Europe, Japan, and Australia are preferred over imports from other Asian countries because they are perceived to be of higher quality and durability. However, the significantly higher prices of U.S.-made products remains a barrier in a market that is extremely price sensitive.

**Table 2.1 Summary of Overseas Development Assistance (ODA) Environmental Projects in Ho Chi Minh City**

Donor Agency/Projects	Contributions <sup>a</sup>				Project Total <sup>c</sup>	Project Status <sup>b</sup>								
	UNDP		Other Donors			A	B	C	D	E	F	G	H	Duration
	UNDP	Other Donors	Total ODA	Government										
<b>U.N. Development Program (UNDP)</b>														
Environmental management	1.63	0.70	2.33	0.04	2.37					X			X	1998–2001
<b>World Bank (WB)</b>														
Irrigation	6.67		6.97	2.94	9.91	X	X	X	X	X	X			1995–2001
Environmental sanitation (prep)	1.00		1.00		1.00				X		X			1998–1999
Environmental sanitation	150.00		150.00	30.00	180.00	X	X							
Poverty analysis	0.10		0.10		0.10				X			X		1999–
City development strategy		0.05	0.05		0.05				X		X			1999–2000
Totals, World Bank projects	158.07	0.05	158.12	32.94	191.06									
<b>Asian Development Bank (ADB)</b>														
Water supply infrastructure strengthening	0.60		0.60		0.60					X			X	1993–1994
Water supply master plan	0.60		0.60		0.60				X				X	1993–1994
Water supply/sanitation	65.00		65.00		65.00				X	X	X		X	1993–2001
Environmental improvement (prep)	0.60		0.60		0.60				X				X	1993–1994
Environmental improvement	70.00	1.80	71.80	28.20	100.00				X		X			1999–2006
Totals, ADB projects	136.80	1.80	138.60	28.20	166.80									

**Table 2.1 Summary of Overseas Development Assistance (ODA) Environmental Projects in Ho Chi Minh City continued**

Donor Agency/Projects	Contributions <sup>a</sup>				Project Total <sup>b</sup>	Project Status <sup>b</sup>								
	JBIC	Other Donor	Total ODA	Government		A	B	C	D	E	F	G	H	Duration
<b>Japan Bank for International Cooperation (JBIC)</b>														
Tau Hu/Ben Nghe sewerage/drainage						X	X							1999–2001
Drainage sewerage	350.00		350.00		350.00	X								
<b>Japan International Cooperation Agency (JICA)</b>														
Drainage/sewerage master plans	2.50		2.50		2.50				X					1998–2000
<b>Belgium Administration for Development Cooperation (BADC)</b>														
Hospital waste	1.48		1.48	0.43	1.91	X	X	X	X	X				1998–2000
Canal upgrading/sanitation	5.60		5.60	5.42	11.02	X	X	X						1998–2001
Totals, BADC projects	7.08		7.08	5.85	12.93									
<b>France</b>														
Thu Duc water filter tanks	3.25		3.25	0.80	4.05	X	X	X	X	X	X	X		1995–2000
<b>Totals, all projects</b>			661.88	67.83	729.71									

a. Figures represent millions of U.S. dollars.

b. Legend:

A = studies/master plans E = final approvals/agreements

B = pre-feasibility study F = detailed design

C = feasibility study G = implemented

D = appraisal H = completed

Source: Overseas Development Assistance Partnership.

# Chapter 3

## Legal and Regulatory Overview

### 3.1 Institutional Structure

The Ministry of Science, Technology, and the Environment (MOSTE) is responsible for management of the environment throughout Vietnam. MOSTE coordinates environmental policies among ministries and between national and local governments and People’s Committees. Within MOSTE, the National Environmental Agency (NEA) implements regulations set by MOSTE.

At the provincial and city levels, the People’s Committees are responsible for implementing MOSTE’s regulations on environmental protection. Each local government has a department for monitoring environmental regulations—the Department of Science, Technology, and the Environment (DOSTE).

DOSTEs in each locality are responsible for pollution control activities, EIA appraisals, issuing import permits, inspections of projects and establishments, imposing penalties, and presiding over dispute resolutions, along

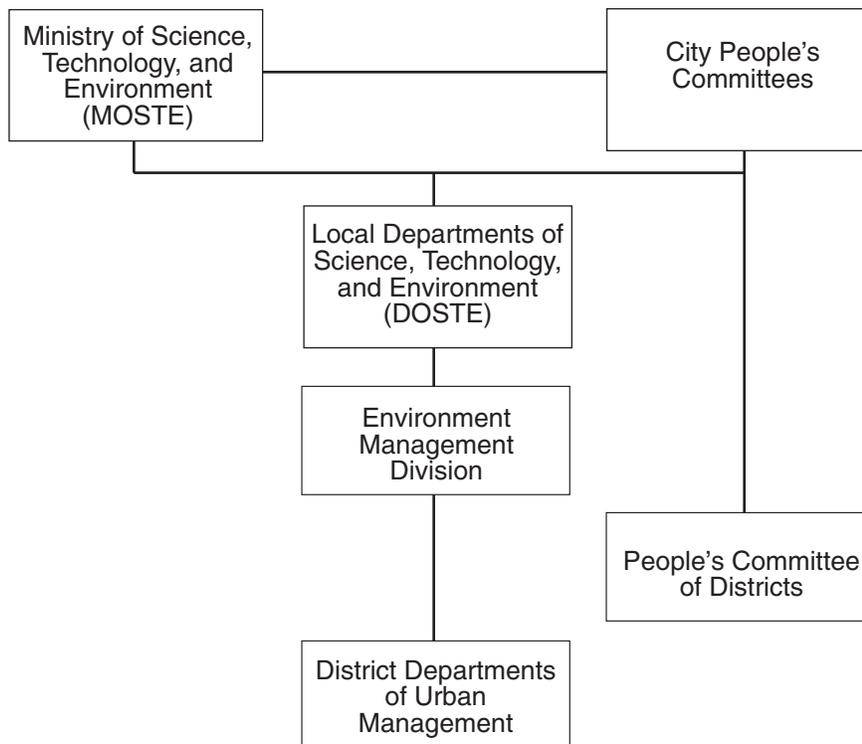
with the NEA, with regard to penalties for violating environmental regulations.

The People’s Committees are permitted to promulgate environmental legislation at the city and provincial levels. If a local People’s Committee sets its own environmental regulations that are stricter than those set by MOSTE, the local government’s rules must be followed.

While the Ministry of Planning and Investment (MPI) mainly presides over issuing investment licenses, it does have an environmental unit called the Department of Science, Education, and Environment. This department evaluates environmental impact assessments that are a part of the investment license application.

Various other ministries have ancillary roles in the protection of the environment or in the implementation of environment-related projects. For example, the Ministry of Transport is responsible for inspecting any form of transport to see that it complies with environmental standards. The Ministry of Finance is partly

**Figure 3.1 Institutional Structure of Environmental Regulation in Vietnam**



**Figure 3.2 Organization Chart of the Vietnamese Ministry of Science, Technology, and Environment**



responsible for setting the fees or charges for issuing and extending an environmental permit.

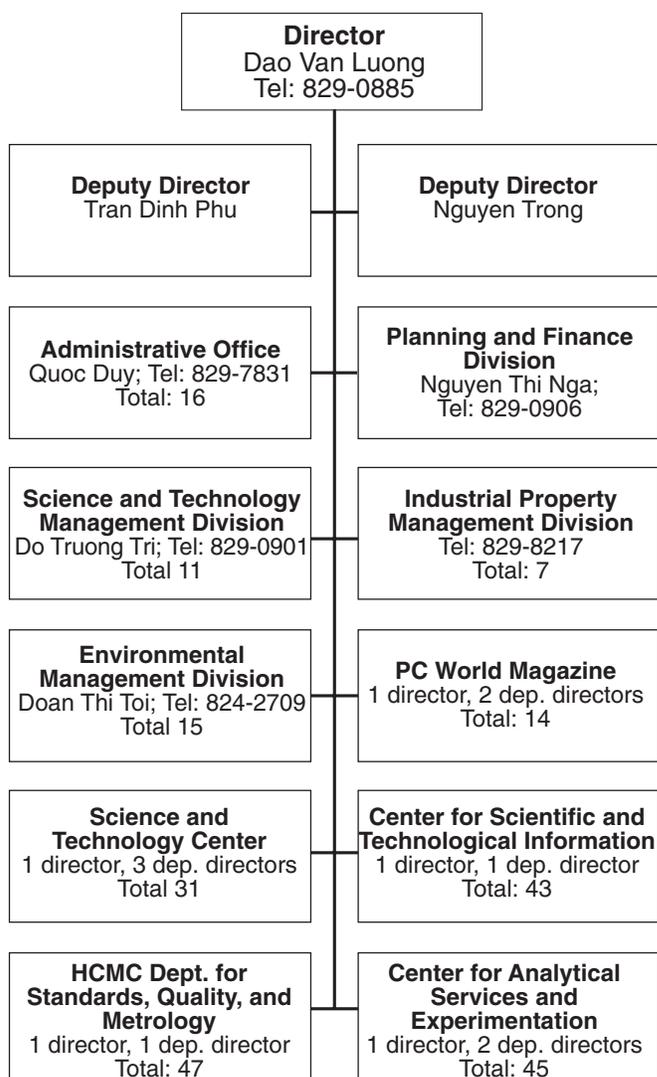
Apart from MOSTE, there are approximately 20 other central government ministries or institutions that have some role to play in environment protection. For example, general responsibility for the prevention of marine pollution lies with the National Maritime Bureau, but responsibility for dealing with the discharge of pollution from ships falls to the Ministry of Transport.

### 3.1.1 Key Agencies for Procurement and Implementation

In addition to MOSTE, the National Environment Agency, and local DOSTEs, other ministries and agencies are either directly responsible for approving environment-related projects and procurement decisions or play a vital role in making recommendations to final decision makers.

Because Vietnam relies on consensus rather than centralized decision making, it is important to secure approvals from any office that might have a say in the decision-making process. Getting an official to sign off on a project or procurement decision, no matter how detached from a project they may seem to be, can often mean the difference between winning or losing a contract in Vietnam. While approval from the agencies described below may not guarantee a project's implementation or

**Figure 3.3 Organization Chart of the Ho Chi Minh City Department of Science, Technology, and Environment**



a procurement contract, disapproval will likely halt a project or procurement decision in its tracks.

### City and District People's Committees

People's Committees are responsible for implementing all foreign-funded projects within their cities on behalf of the government of Vietnam.

Vietnam's larger cities are divided into districts. District People's Committees (DPCs) implement the administrative orders of the City People's Committee. DPCs may share responsibilities with city agencies for operating and maintaining infrastructure under their jurisdiction, such as canals, drains, and bridges.

Agencies within DPCs are responsible for refuse collection, drainage, sewerage, and environmental

protection within their jurisdiction. DPCs may also be responsible for appraising proposed small-scale (less than 2 billion dong) infrastructure projects in these areas. Once approved by the City People's Committee, the District People's Committees are then responsible for managing these projects.

### ***Departments of Planning and Investment***

The Ministry of Planning and Investment is responsible for disbursing central funds to all environmental projects. At a local level, Departments of Planning and Investment (DPIs) are key decision makers for preparing and budgeting development plans for cities, whether funded domestically or from external sources. One foreign sponsor of a major water-related project in Ho Chi Minh City said that a positive recommendation from the DPI for his project was essential to getting it approved by the Ho Chi Minh City People's Committee and the Ministry of Planning and Investment.

For projects valued under \$500,000, the DPI plays the largest role in granting approval. The Ministry of Planning and Investment grants approval for projects valued over \$500,000. However, even for these larger projects, the DPIs provide critical recommendations to the MPI as to the feasibility of proposed projects. All projects must be included in DPI plans before they are examined for appraisal by the MPI, City People's Committees, or national ministries. The DPI provides its recommendations on development needs, potential funding sources, and the addition or elimination of certain components to a project.

Because of the DPI's key role in approving and overseeing foreign-funded development projects, there is a plan to include the DPIs in project management units (PMUs). This would enable DPI officials to monitor overseas development assistance projects and ensure that PMUs fulfill donor requirements on bidding, work plans, and loan management.

### ***Departments of Finance***

The Ministry of Finance is involved in all decisions to allocate central funds to environment-related projects. At a local level, departments of finance provide input in appraising the contract rates for public services. Together with the DPI, the departments of finance prepare annual plans for fund utilization that are subject to approval by local People's Committees before being forwarded to the Ministry of Finance for approval. The local departments of finance serve as treasurer, disbursing funds and approving invoices submitted by public service companies.

### ***Departments of Transport and Public Works***

Local departments of transport and public works (DTPWs) are responsible for city infrastructure such as canals, drains, sewers, water supply, and solid waste management. While DOSTEs are responsible for monitoring and enforcing environmental standards, DTPWs are responsible for implementing environmental services through companies under their management. For example, urban drainage companies within DTPWs are responsible for drainage/sewerage implementation, including issuing permits to connect to city sewer networks. City environmental companies are responsible for collecting and transporting solid waste from collection points to transfer stations. Waste disposal companies are responsible for managing solid waste landfill sites. Water supply companies are responsible for distributing and maintaining pipe networks. These companies purchase environmental technologies (subject to DTPW approval) and have significant input on plans for the development of the cities' infrastructure.

### ***Ministry of Construction***

The Ministry of Construction (MoC) and its local affiliates, the departments of construction within individual cities, is responsible for construction quality and appraisal of civic and industrial projects using either domestic or foreign funding sources. In effect, the MoC has been given a broad mandate by the Vietnamese government to manage urban development in its cities.

The MoC has numerous companies under its management that are used as primary or sub-contractors on environmentally related infrastructure projects. The Vietnam Water Supply and Environmental Company (VIWASE) is the key company under the Ministry of Construction that participates in nearly all projects related to water-supply infrastructure. VIWASE often acts as a subcontractor on projects lead-managed by a foreign contractor. Two representatives from foreign companies that have bid successfully on water-related projects cited establishing good working relationships with VIWASE as helpful to their efforts to win contracts.

## **3.2 Legal Framework and Enforcement**

In the early 1990s, Vietnam's leaders became aware that the country's tremendous economic growth was causing serious pollution problems. On December 27, 1993, the National Assembly passed the Law on Protection of the Environment.

The law has seven chapters and 55 articles, and broadly covers everything from requirements for environmental

impact assessments to a list of prohibited activities and a system for addressing non-compliance. The most important article of the law is the Decree on Protection of the Environment.

The Decree on Protection of the Environment details: the duties of various government agencies and local organizations; the procedures for undertaking environmental impact assessments (EIAs); mechanisms such as standards and permits for preventing, combating, and rectifying environmental hazards, pollution, and degradation; the types of environmental standards; methods of financing activities to protect the environment; and establishing inspectorate and compliance systems.

In addition to passing the Law on Protection of the Environment, the government periodically issues incentives for companies investing in projects related to environmental protection. Most recently, the government issued Circular 1817 on October 21, 1999, that outlined tax benefits given to investment projects involving environmental protection, pollution treatment, and waste treatment and processing.

MOSTE has delegated to local DOSTEs the power to verify that projects continue to comply with environmental standards. MOSTE has the overall responsibility for organizing environmental inspections and ensuring that actual inspections are executed according to the relevant environmental standards. The inspectors themselves are drawn from agencies such as NEA, MOSTE, the State General Department of Inspection, the People's Committees, and customs bodies.

Commercial and manufacturing establishments are required to make financial contributions for environmental protection, pay compensation for any damage they cause by their activities, and rectify any environmental degradation they cause. To improve enforcement of this principle—in this instance, for the mining sector—the government in October 1999 issued Circular 68CP/Article 15. The circular requires companies engaged in mining exploration or exploitation to contribute funds to an environment rehabilitation fund. The funds are put in an escrow account, to be used if the company's operations require environmental clean-ups. MOSTE must present any cases of serious environmental hazards to the prime minister and submit proposals for rectification of these problems for his approval.

Besides the penalties imposed for violations of the Law on the Environment, the government attempts to create other disincentives for polluting industries. The government has compiled a list of the country's worst polluters and has entered them into a "black book" which is distributed to provincial offices responsible for

environmental protection. The government also uses the state-owned media to highlight environmental violations committed by these black book companies and foreign enterprises.

These efforts aside, overall enforcement of environmental guidelines remains weak, especially regarding domestic enterprises. One of the key problems with Vietnam's enforcement mechanism is that fines are so low that they do not provide an incentive for companies to invest in pollution-prevention technology. While the fines vary depending upon the degree to which standards have not been met, they usually fall in the range of 2 to 5 million dong (\$150 to \$400). These costs are minimal, when compared to the cost of installing primary and secondary waste treatment facilities.

According to an official at the DOSTE office in Ho Chi Minh City, domestic enterprises are generally aware that they cannot meet environmental standards set in the law. Lacking the financial ability to minimize or treat waste, companies simply try to keep their emissions as close to the standards as possible in order to keep the fines at a manageable level.

The administrative structure for managing inspections and levying fines complicates enforcement. In Ho Chi Minh City, for example, DOSTE used to have an autonomous division responsible for enforcing standards called ENCO. The division had its own "seal and signature," according to one DOSTE official, which gave it the mandate to inspect and impose fines. In 1999, however, this division was folded back into DOSTE, weakening its clout. The division now must go through the DOSTE bureaucracy before performing its role as enforcer.

In practice, organized, and sometimes heated, protests by local citizens are the strongest incentive for local companies to install waste treatment systems. Citizens who believe that a company is discharging harmful pollutants will take their complaints to the local company. For example, in the Xuan Truong area of Thu Duc district, a heavily industrialized area outside of Ho Chi Minh City, citizens have organized and brought complaints to polluting companies. If this does not produce results, complaints are lodged with local authorities, provincial authorities, and in some cases the National Assembly in Hanoi. There have been isolated cases of citizens taking action themselves, such as blocking discharge pipes.

Depending upon the success of the lobbying efforts, the district officials, People's Committee officials, etc. will then contact the company directly. According to some Vietnamese environmental experts, polluting companies will only take action once forced to do so by these government offices, not by DOSTE officials.

### 3.3 Environmental Impact Assessments

All projects implemented within Vietnam are subject to environmental standards issued by MOSTE, of which there are currently over 100.

MOSTE requires environmental impact assessments (EIAs) from two types of investment projects. Group I investment projects are those that can potentially cause wide-scale environmental pollution, easily cause environmental pollution, or are difficult to control and for which it is difficult to determine environmental standards. In practice, these are the only projects that require detailed EIAs.

Group II investment projects are all the remaining projects, and the applicant must prepare and analyze its own EIA reports in order to receive a certificate of “registration of satisfaction of environmental standards.” In practice, these assessments are very general and are not scrutinized by government agencies.

For companies located in industrial zones, the industrial zone authority submits the EIAs for tenants.

When applying to the Ministry of Planning and Investment for an investment license, the application must contain a summary of the potential environmental impact of the particular project. The application must include information about the proposed site, a summary of the production technology, any sources of pollution, all measures to minimize that pollution, the environmental supervision program, and all undertakings to satisfy environmental standards. At this point, MOSTE decides whether the project falls into Group I or Group II.

After the investment license has been issued and the project site determined, an application file containing environmental impact documentation must be submitted. (In the case of petroleum projects, the EIA report must also include plans for controlling oil spills.)

According to Circular 490, issued by the prime minister, Group I projects include some of the following:

- Projects situated within or close to environmentally sensitive areas, such as natural parks, tourist sites, cultural vestiges of international and national interest;
- Projects developing a master plan for (a) a whole region (b) a whole sector (c) a city (d) IP or export processing zone;

- Projects on oil and gas: (a) exploitation, (b) processing, (c) transportation, and (d) warehousing (greater than 20,000 cubic meters);
- Steel and metallurgy (greater than 100,000 tons per year);
- Tanneries (greater than 10,000 tons/year);
- Textiles (greater than 20 million meters/year);
- Paints (greater than 1000 tons/year);
- Rubber processing (greater than 10,000 tons/year);
- Sugar (greater than 10,000 tons of sugar cane/year);
- Food processing (greater than 1,000 tons/year);
- Ice and Freezing (greater than 1,000 tons/year);
- Thermo electricity (greater than 200 megawatts);
- Pulp and paper (greater than 40,000 tons of pulp/year);
- Cement (greater than 1 million tons/year);
- Tourism and entertainment zone (greater than 100 hectares);
- Airports;
- Ports (for vessels greater than 10,000DWT);
- Railways, highways, roadways longer than 50 km;
- Hydroelectric plants (with reservoir greater than 100 million cubic meters);
- Irrigation systems (servicing areas greater than 10,000 hectares);
- Ore exploitation (total ore, earth, stone volume greater than 100,000 cubic meters/year);
- Forestry (all kinds of wood exploitation);
- Aquaculture (areas greater than 200 hectares);
- Hazardous chemicals production and warehousing (all kinds);
- Nuclear reactors (all kinds).

A number of state agencies may judge the EIAs to determine whether the project will be approved. MOSTE, the local People’s Committee where the project is being undertaken, the local DOSTE, the National Environmental Agency, or the supervising ministry under which the project may fall can all theoretically approve, disapprove, or make recommendations concerning a project based on the EIA.

In practice, the effectiveness of EIAs is weak. Companies are able to submit plans for installing waste treatment facilities and receive an investment license, but then never follow up on installing the plant as promised. In some cases, companies have won investment licenses without submitting EIAs.

## Chapter 4

# Water Resources

Access to clean water is the largest environmental problem facing Vietnam. Polluted water is a leading cause of dysentery, which accounts for 25 percent of all childhood deaths in Vietnam. UNICEF estimates that nearly 40,000 children under the age of five die each year from this disease. Because of the direct health benefits of access to clean water, water-related projects have been prioritized by the government as well as by the donor community.

Bilateral and multilateral aid in the water resources sector will approach \$1 billion by 2001. Both the Asian Development Bank and the World Bank have signed major clean-water-related loans in the past six months, presenting opportunities for American consultants, contractors, and equipment suppliers (see Section 4.8).

There are currently over 50 water projects in 39 Vietnamese provinces, with a total investment of about \$900 million. Another 20 proposals have been submitted in hopes of luring either direct investment or ODA.

As urban migration continues unabated, demand for clean water is outpacing construction of new water networks. Water supply plants have been completed in Hanoi and Ho Chi Minh City, but the problem has been connecting households to the network and ensuring efficient distribution with minimal leakage and contamination. In rural areas, the challenge has been to lessen the reliance on polluted surface waters.

Vietnam's cities suffer from antiquated and inadequate sewerage and drainage infrastructure. Most drainage systems are for combined usage—mixing rainwater runoff with untreated wastewater and solid wastes—thereby creating heavily polluted drains, canals, and rivers in highly populated areas. Restricted flows cause flooding during the rainy season, further exposing the population to untreated wastewater. Donors to Vietnam are squarely focused on reducing these problems, especially in Ho Chi Minh City, where Vietnam's largest environment-related projects are now underway.

Vietnam passed a Water Resources Law in 1998, which effectively gave administrative responsibility for managing the country's water resources to the Ministry of Rural and Agricultural Development (MARD). The law also provides legislation for issuing permits as a

means of controlling point-source wastewater discharge into surface or ground water.

Among the projects being carried out by MARD is the National Program on Rural Clean Water and Environmental Sanitation. The government has designated the program as one of the country's seven most important development initiatives over the next 10 years.

By 2005, the government is hoping to supply 80 percent of the urban population with a daily supply of 80 to 150 liters of potable water per capita. The target also calls for 60 percent of the rural population to have their own systems of wells and purification equipment. MARD estimates that \$1.23 billion is needed for the rural component alone. In 1999, \$21 million in funding for water-related projects was disbursed from the national budget. The Ministry of Planning and Investment estimates that \$143 million will be needed to drill 1.2 million wells to supply water to rural areas.

### 4.1 Water Supply

Vietnam's ground water supply is generally pure at the source, but this is not the case for surface water, much of which is generated during monsoon season, exposing the water to contamination. Ground water feeds only 30 percent of urban water systems, while 70 percent is sourced from surface water.

Surface water from reservoirs and rivers is polluted by untreated industrial effluents from small towns or, in the case of coastal towns, by seawater intrusion. During the dry season, river volumes drop, allowing seawater to contaminate water sources, in some cases as far as 70 kilometers inland. Vietnam's urban population outside Hanoi and Ho Chi Minh City must depend primarily on surface water passing through a purification plant before being piped to customers.

Hanoi and Ho Chi Minh City have sizable ground aquifers. But the large number of private wells being built directly into these two large aquifers is causing problems. While some of the wells are dug with permission and planning by town authorities, many are drilled illegally. Some of these wells have penetrated septic tanks or

sewerage systems, contaminating the city's basic water supply.

A 1995 study conducted by the Hanoi Department of Science, Technology, and Environment showed that the unchecked exploitation of underground water in the city has increased its subsurface water absorption capacity from 40 percent to 80 percent over the last decade. A 1995 study of the underground water in Hanoi showed levels in the aquifer falling by approximately half a meter per year. The pumps for the city's 120 pumping stations were installed 25 meters below ground, but the 1995 study showed the water level had dropped to 27 meters below ground, thereby rendering the pumps useless.

For Ho Chi Minh City, unpolluted source water comes from the upper reaches of the Dong Nai and Saigon Rivers, as well as from the Be and La Nga Rivers. The density of organic matter and waste where treatment plants obtain water from these rivers remains low at a biochemical oxygen demand (BOD) of less than 3 mg/liter, well within clean standards set by the World Health Organization.

Current water treatment facilities in secondary cities cover only 30 percent of the clean water demand. Rural areas suffer the most because of their dependence on surface water. Seventy-five percent of the rural population get their water directly from natural sources, such as rivers, streams, and underground aquifers, all of which receive no treatment.

## 4.2 Urban Water Supply

Vietnam's urban population is approximately 15 million, but only 50 percent of urban residents nationwide are estimated to have access to piped water. In larger cities (Hanoi, Ho Chi Minh City, Haiphong), it is estimated that 60 percent to 70 percent of residents are end-users of piped water. In smaller cities it is estimated to be only 30 percent.

Those not using piped water receive their supplies from shallow wells, rainwater, rivers, and ponds. In some cases, urban residents obtain water from supplies transported by truck by municipal water companies or from public taps.

Most of Vietnam's 192 water supply plants date from the 1960s. The nation's total capacity for supplying water is estimated at 2.7 million cubic meters per day. The biggest supply plants in Vietnam are Ho Chi Minh City's Thu Duc Plant (750,000 m<sup>3</sup>/day), the Hanoi Yen Phu plant (80,000 m<sup>3</sup>/day), and the Haiphong An Duong plant (85,000 m<sup>3</sup>/day). Dozens of other urban plants have an average capacity from 10,000 to 30,000 m<sup>3</sup>/day and 500–5,000 m<sup>3</sup>/day for smaller town plants.

## Ho Chi Minh City

In 1999, the Binh An Water Treatment Plant, Vietnam's first water build-operate-transfer (BOT) project, began supplying water to Ho Chi Minh City (see Case Study 4.1, page 14). The HCMC Water Company now supplies 750,000 m<sup>3</sup> of water per day to the city. However, demand is estimated at 1.2 million m<sup>3</sup> per day, so that only about 50 percent of the population of HCMC have access to potable water.

Two other BOT projects are being negotiated. One is a \$100 million project backed by France's Lyonnaise des Eaux (LDE). The company has not yet signed a price agreement with the HCMC People's Committee, however. LDE is reportedly asking for a price of \$0.24 per m<sup>3</sup>, a price that would be locked in for seven years. The LDE plant would have a capacity of 300,000 m<sup>3</sup> per day. The other project is backed by Grand Imperial Water Company, a consortium of Malaysian companies. This plant also has a scheduled capacity of 300,000 m<sup>3</sup> per day.

### Case Study 4.1 Being First Isn't Easy

In August 1999, the Binh An Water Treatment plant began supplying 95,000 m<sup>3</sup> of treated water per day to the Thu Duc Reservoir. Binh An Water Co. is owned by a consortium of Malaysian companies, including Masscorp, the investment arm of the Malaysian government. The Binh An project is notable because it is the first-ever BOT project implemented in Vietnam. Achieving this feat was not easy.

According to executives familiar with the project, in order to win the license Binh An gave a 10 percent stake to a silent partner that had the connections in Hanoi to get the BOT approved by the prime minister. Binh An obtained the land for the \$35.8 million project from the Vietnamese military, a factor that delayed the start of operations by some 10 months as land transfer agreements took longer than expected to complete. The project is entirely financed by Binh An Water Co. Initially, the company sought financing from the International Finance Corporation (IFC). In the end, the IFC backed away from the deal because legal guarantees from the government were considered insufficient. The Asian financial crisis of the late 1990s also delayed construction, as financing dried up for two years.

Binh An Water sources water from the Dong Nai River and supplies it to one of Thu Duc's four reservoirs. Once the water leaves the property of Binh An Water, responsibility for its purity lies with the HCMC Water Co. The capacity of the treatment plant is 100,000 m<sup>3</sup> per day. HCMC Water Co. signed a take-or-pay contract for a minimum of 85,000 m<sup>3</sup> per day through the year 2000. Binh An Water is charging a fixed price of \$0.20 per m<sup>3</sup> and it has recently guaranteed the HCMC People's Committee that the price will not increase through the year 2000.

Despite the take-or-pay clause, there are still concerns about whether the investment is viable. At the moment, HCMC Water Co. is unable to use the capacity of water available to it because a pipe network doesn't yet exist to distribute it. Another concern is that the HCMC Water Company is paying more for its water than the government allows it to charge. Investors in Binh An are betting that the local infrastructure and pricing will increase before HCMC Water Co. goes under.

## Hanoi

The largest water supplier in the city, the Hanoi Water Company has eight water stations and other smaller plants. The company says it is able to supply between 340,000 to 350,000 m<sup>3</sup> of clean water per day. The company's system is supplied by over 125 artesian wells, some of which have less than 50 percent of their designed capacity left.

Capacity will increase when construction of two new water treatment plants is completed. The plants are part of the World Bank's \$97.8 million First Water Supply project, which is upgrading water resources in four key northern regions: Hanoi, Haiphong, Quang Ninh, and Danang. In addition to the World Bank loans, the Finnish government is providing \$1.96 million in co-financing for technical assistance and consultant contracts.

In early 1999, the World Bank awarded a \$33 million construction contract for the Hanoi component to a joint venture between Korea's Kolon Corporation (51 percent) and the Vietnam Construction and Import/Export Corporation (49 percent). The World Bank is providing 85 percent of the financing for the construction contract.

The joint venture is building two 30,000 m<sup>3</sup> per day water-supply stations. One plant is being built in Tu Liem district and the other in Tay Ho district. Four new wells will be drilled to supply water to the plants. The additional 60,000 m<sup>3</sup> per day will bring total capacity to 410,000 m<sup>3</sup> per day.

By 2010, authorities in Hanoi plan to install water treatment systems in Ba Dinh, Hai Ba Trung, Hoan Kiem, Dong Da, Tay Ho, Thanh Tri, and Tu Liem districts.

A U.S. firm, M-Power Corp., is developing plans to build a \$134 million build operate transfer (BOT) water supply network in Hanoi. The project is in the feasibility study phase and no BOT contract has been signed. The project calls for construction of a water purification plant with a capacity of 500,000 m<sup>3</sup> of clean water per day and rehabilitation of 56 kilometers of water drainage systems. The project aims to include construction of reservoirs and installation of water supply systems in Hanoi's suburbs, as well as steps to reduce water loss throughout Hanoi's distribution system.

## Haiphong

Construction has been completed on the Haiphong component of the World Bank's First Water Supply project. The project is rehabilitating the main water supply plant for Haiphong, the An Duong Water Plant. Capacity of the plant is being increased from 60,000 m<sup>3</sup> per day to 100,000 m<sup>3</sup> per day. The project also involves

rehabilitation of the distribution system, water intake, and pumping stations and will increase household connections to the water network. The project is scheduled to be complete by 2002.

The World Bank has signed a credit for \$24.4 million to finance these upgrades. The Chinese Metallurgy and Construction Corporation will supply and install equipment worth \$19.3 million over the next three and a half years.

## Quang Ninh

After a three-month delay, construction has started on the Quang Ninh component of the First Water Supply project. French contractor SAUR International won the main civil works contract, valued at approximately \$19 million.

By mid-2000, SAUR had started purchasing materials and equipment and had started construction of raw water lines. SAUR was also preparing the detailed design for rehabilitation of two water supply plants in Quang Ninh.

When completed, the Dong Ho Water Plant will have a capacity of 20,000 m<sup>3</sup> per day, and the Dien Vong plant will have a capacity of 60,000 m<sup>3</sup> per day.

## Danang

Danang is the fourth component of the First Water Supply project and has been the slowest in getting underway. Prequalification for bidding on the project has been completed, and bid documents for the civil works contract and construction supervision contracts were submitted on January 5, 2000. Five contractors have submitted bids. The consultant evaluating the bids, GHDK Co., is a joint venture between GHD of Australia and Kim Hien Co., a Vietnamese firm with offices in Hanoi and Danang.

## 4.3 Rural Water Supply

In mid-1999, the government completed a master plan for rural water supply. The study was conducted by the Ministry of Construction, the Ministry of Agriculture and Rural Development (MARD), and Danish International Development Assistance (DANIDA). DANIDA provided a \$2 million grant to complete the study.

The plan focuses on supplying clean water to rural households, building household sanitary facilities, and preventing diseases caused by polluted surface waters by the year 2020. The government and National Assembly

have designated the project as one of Vietnam's "seven most important" development programs.

By 2005, the government objective will provide 80 percent of the rural population with clean water and 50 percent of the rural population with adequate sanitation facilities. In order to achieve these rates of penetration, the plan's authors estimated an investment of \$132.3 million per year will be needed. In total, the master plan calls for \$2 billion to implement the project.

The majority of the financing for rural clean water and sanitation projects will come from overseas development assistance sources. Since the program started, MARD reports that 750,000 farming families have been able to access clean water supplies, bringing the total number of rural users nationwide with access to clean water to 19.7 million. This marks a penetration rate of 33 percent of the rural population.

The program is also designed to provide hygienic toilets to 50 percent of all rural families and to install wastewater treatment facilities for 30 percent of rural water users. The government has spent over \$5 million on the program since the beginning of the year. Approximately \$16.2 million in funds for the project are also being supplied by DANIDA, the World Bank, UNICEF, and the Asian Development Bank. Denmark is also financing a \$1.8 million water supply and sanitation project in the north-central province of Ha Tinh.

AusAID has provided \$45 million in financing for rural water supply projects in Bac Giang, Bac Ninh, Ha Tinh, Tra Vinh, and Vinh Long provinces.

Between 1990 and 1997, UNICEF dispersed \$14.8 million in funding as part of a rural water supply program to 20 million people, covering all of Vietnam's 61 provinces. The program has installed 180,000 clean water stations, including 500 small water plants. Half of the water installations have been set up in rural areas, with 15 percent in mountainous zones and 11 percent at kindergartens, schools, and local clinics. The remainder were set up for the families of war veterans.

#### 4.4 Distribution

While the quality of treated water in Vietnam usually meets World Health Organization standards, once it leaves the treatment plants, it is exposed almost immediately to contamination. Between 40 and 50 percent of the water pumped out of the country's treatment plants is lost on its way through Vietnam's 119 rusted and leaky distribution networks.

The majority of the 14,800 kilometers of water pipes in urban systems are either cast iron, concrete, or steel

#### Case Study 4.2 Relationships Count

Hong Kim Co. is a local Vietnamese company based in Ho Chi Minh City. For four years it served as an agent for a Canadian-American water purification company based in Nevada called Vector Corp. Vector sold water purification equipment under the brand name Diamond Rain. The equipment retailed for between \$30,000 and \$200,000, with the primary markets being hospitals, schools, and bottled water companies.

Last year, Vector Group left Vietnam to focus on other markets, but it licensed the trademark to Hong Kim Co. After four years serving as an agent, Hong Kim Co. knows the technology and provides sufficient after-sales service. The Diamond Rain trademark is established, and the system is considered durable and of high quality. Hoping to build on its success of distributing U.S.-made purification equipment, Hong Kim Co. executives have traveled to the United States to meet with other companies, such as Ametek and Universal Aqua.

The government's \$2 billion rural water supply program could turn out to be a gold mine for Hong Kim Co. The government is allocating overseas development assistance funds to most of Vietnam's provinces to implement the program. In one province, Australian aid has already funded construction of a 200,000 gallon/day purification system, and the province has funds from other sources, including the UNDP, to install another 60 purification systems.

In addition to having a solid product with a proven track record in Vietnam, Hong Kim Co. has a trump card: Several of its employees are directly related to the chairman of the province awarding the contract. While this may not necessarily win the deal for Hong Kim, this small distributor of American-built purification technology is now on the inside track to win several parts of this sizeable rural water supply initiative.

and are in extremely poor condition. With the unsealed pipes and low water pressure comes greater exposure to contaminants from outside the pipes.

Vietnam's water companies are extremely inefficient. Not only does a huge amount of leakage and waste occur, but the companies continually fail to earn enough income to offset operating costs or upgrade their distribution systems.

Because of unreliable piped water supplies, authorities have been unsuccessful in controlling the use of ground water sources. Well digging at the household, neighborhood, and industrial levels continues unregulated in many urban and rural areas. This is resulting in both contamination and depletion of ground water supplies in some urban areas.

Charging less than their operating costs, municipal water companies are losing money and have no funds to upgrade their infrastructure, creating the supply inefficiencies. After years of debate, the government finally agreed to raise water prices effective March 1, 2000, but prices remain below operating costs (Table 4.1).

The recently completed Binh An Water Treatment plant supplies the HCMC Water Company with 95,000 m<sup>3</sup> per day. The company pays a fixed price of \$0.20 per m<sup>3</sup> on a take-or-pay basis. Meanwhile, the company can charge residential customers a maximum of \$0.18 per m<sup>3</sup>.

A second problem is the lack of accurate water meters. Installation of water meters is usually included in ODA or bilateral/multilateral projects to the water sector. In Hanoi, for example, over 70 percent of households lack water meters. Because of the poor distribution network, the water pressure is so low that meters cannot measure accurately. Water supply companies therefore charge a flat fee, resulting in overuse by some consumers and continuing losses for water companies.

According to one estimate by the Hanoi Water Supply Company, households pay \$0.43–\$0.55 month, per person, for the equivalent of four cubic meters of water per person; \$0.107 cents per cubic meter of water is well below prices recommended by multilateral donors funding water-supply projects in Vietnam.

### Ho Chi Minh City

The water distribution network in Ho Chi Minh City (HCMC), much of it built during the French colonial period and not repaired since, is in desperate need of overhaul. Dilapidated pipe systems and weak water pressure have forced the HCMC Water Co. to use large water tanks to deliver clean water to many of HCMC's districts.

While BOT projects are lined up to supply HCMC with enough capacity to meet demand, the challenge will be efficiently distributing water to consumers. Therefore, if the two other BOT water-supply projects were to come on line, there would be no way to distribute the water,

**Table 4.1 Water Prices in Vietnam, per Cubic Meter**

	<i>Before</i> 03/01/00	<i>After</i> 03/01/00
Residential	\$0.09	\$0.12 (1–4 m <sup>3</sup> ) \$0.18 (4–6 m <sup>3</sup> )
Industrial	\$0.18	\$0.23
Luxury/Entertainment	\$0.29	\$0.36

Note: Prices are given in U.S. dollars.

Source: Ho Chi Minh City Water Company.

because HCMC's primary water distribution network is unable to handle large volumes of water. HCMC Water Co. is unable to distribute at capacity because higher volumes will cause the old piping networks to crack. Another problem is the small diameter of many of the pipes in five key districts in HCMC—Districts 1 through 5—pipe capacity needs to be expanded or rehabilitated so that the HCMC Water Co. can reach its customers.

### Hanoi

Hanoi's primary water distribution network is in better shape than Ho Chi Minh City's. Its main system is a 330-kilometer-long network built in 1985 with funding from the Finnish Development Agency. This network meets European health standards and delivers water to over half a million customers. Hanoi has a second main distribution network, which is 217 kilometers long. This network, however, was built in the early 1900s by the French and needs rehabilitation.

While HCMC's biggest problems are leakage and the need to rehabilitate existing pipelines, Hanoi Water Supply Co. suffers from administrative weakness.

**Table 4.2 Industrial Water Demand Estimates for Industrial Estates and Export Processing Zones**

<i>Location</i>	<i>Size (in hectares)</i>			<i>Annual Water Demand*</i>	<i>Percent of Total Demand</i>
	<i>Industrial Estates</i>	<i>Export Processing Zones</i>	<i>Total</i>		
Hanoi	1,700	760	2,460	0.492	8.4
Haiphong	800	100	900	0.180	3.1
Quang Ninh	200	100	300	0.060	1.0
Quang Nam-Danang	1,010	470	1,480	0.296	5.1
HCMC	22,800	360	23,160	4.632	79.5
Vung Tau	600	100	700	0.140	2.4
Can Tho		150	150	0.030	0.5
<b>Total</b>	<b>27,110</b>	<b>2,040</b>	<b>29,050</b>	<b>5.830</b>	<b>100.0</b>

\* Water demand is given in millions of cubic meters per year.

Source: World Bank, *Vietnam Water Resources Sector Review* (May 1996).

According to the Hanoi Water Supply Co., 65 percent of the water distributed is either lost in transmission or goes unpaid. Of this, 25 percent fails to reach customers because of leakage, 10 percent is siphoned off from illegal taps, and the remaining 30 percent reaches the customer but is not paid for.

As part of the World Bank's \$33 million First Water Supply project for Hanoi, Korea's Kolon will install a 407-kilometer pipe network. In addition, 30 network water meters and 75,000 household water meters will be fitted.

## 4.5—Market Opportunities and Competitive Situation

### Water Supply Equipment Market

The largest customers for imported water supply equipment are government-executed but foreign financed

water supply projects for major cities, provincial capitals, and rural areas. Hospitals, schools, and industrial zones are also large customers.

The market for pumps, filters, water meters, and valves has increased steadily over the past four years. Industrial and household pumps represent the largest market, and foreign companies supply the majority of the equipment. The market for industrial pumps has primarily been to ODA-financed water supply systems, sewerage and drainage, and irrigation projects. Other customers have been manufacturing plants, industrial zones, and real estate developments.

Foreign suppliers account for 85 to 90 percent of the market demand. Market leaders include:

- Grundfos (Denmark): submersible pumps
- Pleuger (Germany): submersible pumps
- Ebara (Japan): horizontal and submersible pumps
- Flygt (Sweden): submersible and vertical pumps
- Perollo, Matra (Italy): submersible and horizontal pumps

**Table 4.3 Sample Product Lines for Water Treatment Equipment**

<i>Brand</i>	<i>Product</i>	<i>Capacity</i>	<i>Cost*</i>
Osmonic (USA)	Water treatment systems (including filters, water softener, RO membrane, ozone purifier)	30 m <sup>3</sup> /day	\$21,450
Diamond Rain (USA)	Water treatment systems		
Meytoroy (USA)	Metering pump for wastewater treatment	1 m <sup>3</sup> /hour	\$3,000
G.A. (USA)	Valves	150 20 mm	\$3,000 \$500
Charlotte (USA)	Pipes	10 inches, 3 m	\$413
Ametek	Industrial filter STBC	25 m <sup>3</sup> /hour	\$1,300
Tsurumi (Japan)	Air blower	5 m <sup>3</sup> /minute	\$3,500–\$4,000
Alpha-Laval (Holland)	Mud pressing	10 m <sup>3</sup> /hour	\$30,000
Ebara (Italy)	Sewage pump	10 m <sup>3</sup> /hour	\$500
Caprari (Italy)	Sewage pump	20–60 m <sup>3</sup> /hour	\$1,000
Flygt (Sweden)	Sewage pump	20–80 m <sup>3</sup> /hour	\$1,000–\$1,200
Tsurami (Japan)	Sewage pump	20–80 m <sup>3</sup> /hour	\$750
Trominelc (Germany)	Tossing pump	20–120 liters/hour	\$300–\$2,000
Aldos (Germany)	Tossing pump	20–120 liters/hour	\$300–\$2,000
Dosatron (Italy)	Tossing pump	20–120 liters/hour	\$150–\$1,000
Kohn (Germany)	Flow meter	60 m <sup>3</sup> /hour	\$750
Flygt (Sweden)	Air diffuser		
Polymer (Singapore)	Mud treatment chemicals		\$8/kg

\* In U.S. dollars.

Source: Center for Environmental Technology (ECO), Ho Chi Minh City.

**Table 4.4 Sample Product Lines for Water Supply Equipment**

<i>Brand</i>	<i>Product</i>	<i>Capacity</i>	<i>Cost<sup>a</sup></i>
LG-Goldstar (S. Korea)	High-pressure pump	1.0 hp	\$111
LG-Goldstar	Lifting pump	2.5 hp	\$267
LG-Goldstar	Industrial pump	4.0 hp	\$342
Ebara CMA100 (Italy)	High-pressure pump	1.0 hp	\$125*
Pentax MB200 (Italy)	Lifting pump	2.2 hp	\$214*
Teco (Taiwan)	Industrial pump	4.0 hp	\$296*
Teco (Taiwan)	Industrial pump	5.0 hp	\$403*
Viking Johnson (USA)	Flexible couplings Flange adapters Tapping tee		
G.A. Industries	Valves		

a. In U.S. dollars.

\* Includes 5 percent of value-added-tax.

Source: Dai Viet Trading Co. (HCMC); Duc Quang Trading Co. (HCMC).

These firms supply the market via bids on ODA-finance projects or via distributors and trading companies with an established presence in Vietnam.

Household-sized pumps are used in urban and rural areas to increase water pressure supplied from a city's supply system or to source from drilled wells. The market for household pumps is dominated by Asian suppliers. Companies from Taiwan, such as Kutaz and Kikawa, and Korean companies, such as Goldstar, Hanil, and Shinil, control an estimated 60 percent of the market share. Chinese-made pumps own a 20 percent market share.

The filter and purifying system market is also supplied by imports. Along with foreign competitors such as Elga and Doulton from the U.K., several U.S. companies are active in this sector of the market. American products from Pura, Instapure Water, Diamond Rain, Osmonic, and Water Pur International are distributed locally and have gained a reputation for high-quality, durability, and reasonable price.

### **Mekong Delta Water Resources**

In August 1999, the World Bank and the government of Vietnam signed a \$101.8 million credit for the \$147 million Mekong Delta Water Resources project. The project will increase agricultural productivity, reduce pollution of surface water in the affected areas, and increase the clean water supply to over 280,000 people. It will provide domestic water supply through wells, pumps, and piped systems for remote communities and improve sanitation. Finally, it will strengthen water

resources management and planning at the provincial, communal, and farmer levels. The project is scheduled to be completed by 2005.

Civil works contracts will be awarded for canal dredging and excavation, and construction or repair of sluices, bridges, and canal-connected roads. Nearly 200 sluice gates will be repaired or built. Over 3,000 kilometers of irrigation/drainage canals, embankments, and structures will be upgraded. Works for the irrigation component (valued at \$2.3 million) and the rural water supply component (\$5.3 million) will be procured through local shopping procedures. Consulting services will be required to assist in engineering design, implementation supervision, and water management studies.

The Central Project Office at the Ministry of Agriculture and Rural Development (MARD) is implementing the project. The Vietnam National Mekong Committee will also supervise project implementation. Two subproject implementation offices, already established by MARD, will carry out all procurement for water resources infrastructure.

### **Second Provincial Towns Project**

The Asian Development Bank has committed \$69 million to improve public health in seven provincial capitals by increasing access to clean water supplies. The cities include: Tuyen Quang, Ninh Binh, Vinh, Dong Hoi, Dong Ha, Quy Nhon, and Ben Tre. The project has included investments to rehabilitate or build new

sewerage and drainage systems. The project was started in 1997 and is scheduled to be completed by 2002.

In December 1999, construction started on a \$12.9 million component of the project in Dong Ha, Quang Tri province. The project will include a treatment facility capable of supplying 15,000 m<sup>3</sup> per day, 63 kilometers of raw water piping, 11 kilometers of concrete sluices for the city's drainage system, and 11 wells. Once complete, the supply plant and distribution network will supply 85 to 90 percent of the population of Dong Ha with clean water.

### **Phuoc Hoa Multipurpose Water Resources**

The Asian Development Bank has identified the Phuoc Hoa Multipurpose Water Resources project in its firm loan pipeline for 2000. The \$140 million project will focus on developing a reservoir and associated infrastructure for irrigation and municipal and industrial water supply for Ho Chi Minh City and the Bien Hoa – Vung Tau economic triangle. A feasibility study has been completed and preliminary and detailed engineering designs are being developed. The project started in 1999 and is scheduled to be completed by 2005.

### **Red River Delta and Third Provincial Towns Projects**

The Asian Development Bank has identified the Second Red River Delta Water Resources project and the Third Provincial Towns Water Supply and Sanitation project for its 2001 loan pipeline. The bank estimates it will provide \$60 million for the Red River Delta Water Resources project and \$60 million for the Third Provincial Towns Water Supply project.

### **Second Water Supply Project**

According to a World Bank official in Hanoi, a Second Water Supply project is in the conceptual stages. Instead of targeting water supply/distribution projects for specific cities, the World Bank would establish a water supply fund. Qualifying water supply companies from each city or region would then apply to access funds for specific projects. This design would decentralize project planning and allow local governments to design water-resource projects based on local needs.

If such a fund is established, it will be essential for vendors and contractors to develop strong ties to municipal water supply companies, departments of planning and investment, and People's Committee officials. Opportunities may exist for foreign contractors to co-design projects directly with these local authorities and subsequently apply to the World Bank fund for financing.

World Bank officials estimate that if a Second Water Supply project along these lines is approved, it would not be implemented until 2002 or 2003 at the earliest.

### **Bilateral Aid Projects**

Numerous bilateral aid projects have financed water-supply improvements in both rural and urban areas. Finland has been among the most active supporters of such programs.

Finland's Development Agency (FINNIDA) has been instrumental in upgrading water supply and distribution facilities in northern Vietnam. In addition to the water distribution project it financed in 1985, FINNIDA has financed water supply projects in Haiphong since 1990. FINNIDA is providing co-financing for technical assistance and design studies for three World Bank-financed projects: Hanoi Water Supply (\$2.5 million grant), Haiphong Water Supply and Sanitation (\$6.1 million grant), and the Haiphong component of the Bank's Three Cities Sanitation project (\$1.3 million grant).

Denmark has also been an active player in the water-resources sector. Most recently, Danish Per Aarsleff A/S won a contract to supply equipment as part of Hanoi's water upgrade project. The purchases are being financed via a 12-year, \$6 million loan from ABN AMRO bank and the Ministry of Finance to the Hanoi Water Company. The Eksport Kredit Fonden is providing loan-enhancement measures. The Ministry of Foreign affairs is providing interest and insurance premium supports.

The Australian Agency for International Development (AusAID) has been active in financing water projects, especially as part of the Rural Water Supply project. To date, AusAID has provided \$45 million in financing for water supply projects in Bac Giang, Bac Ninh, Ha Tinh, Tra Vinh, and Vinh Long provinces.

**Table 4.5 Vietnam's Imports of Water Equipment by Exporting Country, 1998 (U.S. dollar value)**

<b>Water pumps for domestic use</b>			
<i>Country</i>	<i>Value</i>	<i>Country</i>	<i>Value</i>
India	2,597	United States	20,783
Belarus	92,400	Russia	107,574
Belgium	1,002	Japan	995,085
Taiwan	710,436	Australia	7,067
Denmark	10,968	France	17,469
Germany	212,987	Philippines	9,061
Netherlands	108	Singapore	449,941
South Korea	690,638	Spain	7,572
Hong Kong	75,900	Thailand	70,742
Indonesia	167,621	Sweden	237
Italy	680,810	China	1,010,618
Malaysia	540,680		
<b>Total: \$5,822,296</b>			
<b>Industrial pumps</b>			
<i>Country</i>	<i>Value</i>	<i>Country</i>	<i>Value</i>
India	364,832	United States	1,273,056
England	33,972	Norway	5,623
Austria	2,346	Russia	48,443
Belgium	11,142	Japan	4,186,714
Canada	70,209	Australia	256,081
Taiwan	346,799	Finland	11,090
Denmark	3,247	France	77,837
Germany	1,133,982	Philippines	8,730
Netherlands	42,199	Singapore	1,842,881
South Korea	1,004,449	Spain	12,294
Hong Kong	218,479	Thailand	909,580
Indonesia	89,200	Sweden	226,807
Iran	570	Switzerland	18,137
Italy	1,143,120	China	332,277
Malaysia	88,223	Ukraine	8,018
Mexico	194,353		
<b>Total: \$13,964,691</b>			
<b>Spare parts</b>			
<i>Country</i>	<i>Value</i>	<i>Country</i>	<i>Value</i>
India	112,463	Italy	106,740
England	1,123	Malaysia	11,099
Belarus	32,330	United States	38,480
Belgium	2,068	Russia	26,619
Canada	4,428	Japan	66,463
Taiwan	81,920	Australia	5,473
Denmark	4,528	France	51,761
Germany	14,278	Singapore	93,245
South Korea	524,565	Thailand	6,479
Honduras	46,893	Sweden	8,207
Hong Kong	18,815	China	73,586
Indonesia	25,916		
<b>Total: \$1,360,479</b>			

**Table 4.5 Vietnam's Imports of Water Equipment by Exporting Country, 1998 (U.S. dollar value) *Continued***

<b>Water filters</b>			
<i>Country</i>	<i>Value</i>	<i>Country</i>	<i>Value</i>
India	4,929	Malaysia	1,907
England	8,218	United States	282,231
Austria	5,118	Japan	21,245
Taiwan	113,983	Australia	896
South Korea	16,205	France	318,005
Hong Kong	1,618	Singapore	424,690
Indonesia	15,600	Spain	32,961
Italy	26,690	Thailand	258,592
Laos	3,950	China	782
<b>Total: \$1,540,620</b>			
<b>Valves</b>			
<i>Country</i>	<i>Value</i>	<i>Country</i>	<i>Value</i>
India	250	Japan	18,176
Canada	7,187	Singapore	22,999
Taiwan	94,656	Spain	3,492
Hong Kong	18,507	Thailand	197,355
Italy	42,332	China	60,399
Malaysia	3,064	Yemen	14,540
United States	780,506		
<b>Total: \$1,263,463</b>			
<b>Water meters</b>			
<i>Country</i>	<i>Value</i>	<i>Country</i>	<i>Value</i>
Taiwan	46,407	Malaysia	43,905
Denmark	274,447	Australia	78,490
Germany	625,003	Finland	95,930
Hong Kong	60,079	France	67,190
Indonesia	1,848,290	Thailand	151,411
Italy	299,177	China	413,538
<b>Total: \$4,003,867</b>			

Source: General Department of Statistics, Vietnam.

# Chapter 5

## Sewerage and Drainage

### 5.1 Current Trends

The Ministry of Agriculture and Rural Development and the Asian Development Bank estimate that only 16 percent of Vietnam’s urban population are served by sewerage systems. Many of these systems are dual-purpose sewers that carry rainwater runoff as well as wastewater. The pipe and canal networks are unable to handle volume flows, resulting in backups and flooding.

Some of the largest overseas development assistance (ODA)-funded projects over the next five years are directed toward rehabilitating sewerage and drainage systems in Vietnam’s major cities, most notably Hanoi and Ho Chi Minh City. While the projects in Hanoi are already underway, the four projects in Ho Chi Minh City are in the project preparation phase (Table 5.1).

#### Ho Chi Minh City

Ho Chi Minh City has nearly 1,000 kilometers of existing drainage—consisting of streams, canals, and closed sewers—that double as a conduit for rainwater and wastewater. Much of this system was built in the 1870s, with sporadic improvement projects conducted from the 1950s to 1975.

Most of the sewers are concrete, though some were built with brick and masonry. Settling has occurred since

initial construction. Some areas require frequent repairs, because they collapse during high-volume periods, such as monsoon rains.

The system is too small to meet current needs and requires widespread repairs. The network was designed for a population of 1.5 million, whereas HCMC’s population is expected to reach 7.6 million by 2020. The existing drainage network is estimated to handle 650,000 cubic meters of water per day. Therefore, certain sections of the city become flooded with polluted waters during the rainy season.

Most of the underground sewers drain into canals that eventually flow to the Saigon River. Over-development along the canals and the volume of solid waste restrict water flows, causing the canals and sewer systems to back up and flood.

#### Hanoi

Because of inadequate drainage and dual-purpose sewers, most of Hanoi’s lakes and rivers suffer from pollution from urban wastes. The center of Hanoi is bordered by the Red River on the east and the Nhue River on the west. The center is most prone to floods because of inadequate drainage and sewerage networks. During heavy rains, water flows backwards from the Nhue River

**Table 5.1 Pending Sanitation Projects in Ho Chi Minh City**

<i>Project</i>	<i>Donor</i>	<i>Amount*</i>	<i>Status</i>
HCMC Environmental Improvement	Asian Development Bank	\$100 million	Loan approved, feasibility study completed
HCMC Environmental Sanitation	World Bank	\$180 million	Feasibility study completed, detailed design underway
Sewerage and Drainage for Tau Hu–Ben Nghe Canal	Overseas Economic Cooperation Fund	\$350 million	Feasibility study completed
Tan Hoa–Lo Gom Canal Sanitation	Belgian Administration Development Cooperation	\$5 million	Feasibility and design studies underway

\* Values represent U.S. dollars.

Source: Mekong Research Ltd., 2000.

into the urban drainage facilities, causing widespread flooding of both rainwater and wastewater.

Hanoi's main drainage system is a network of 90 kilometers of inlet sluices. Much of this system servicing the "old city" was built before 1945 and services an area of 1,008 hectares.

A system servicing the "new city" covers an area of about 4,000 hectares for a population of 600,000 people. The system includes more than 60 kilometers of inlet sluice and nearly 40 kilometers of open sluice. The inlet sluices and canals are highly polluted. Some 120,000–130,000 cubic meters of mud accumulate there each year. Water-running speed at sluices and canals is very small, about 0.05–0.10 m/s. The combined-use network is for rain, domestic, and industrial wastewater.

To date, projects to improve drainage and sewerage in both the "old" and "new" cities have been financed by Japanese development aid. From 1994 to 1997, Japan's Bank for International Cooperation (JBIC) has provided loans worth 18.6 billion yen to the Hanoi Drainage and Environmental Improvement Project. The project is improving flood control and drainage facilities for a 77.5-square-kilometer area bordered by the Red River and the To Lich River.

The program has financed dredging and clearing of sludge in existing sewers and drainage channels. In addition, the program is constructing flood and control gates, improving river and drainage channels, and rehabilitating sewers. A pumping station is being built at Yen So in the Southeast section of the city to regulate drainage channels and a reservoir.

The main civil works and procurement of equipment were selected through international competitive-bidding methods. Contracts for drainage-channel rehabilitation, lake dredging, and sewer rehabilitation were awarded based on local competitive-bidding methods.

## **5.2 Market Opportunities and Competitive Situation**

The greatest opportunities in drainage and sewerage over the next two years will be in Ho Chi Minh City. This is largely because of the four major ODA projects that are underway or in the planning stages. These projects are tackling a number of environment-related problems in Ho Chi Minh City, but focus on improving the city's drainage and sewerage infrastructure.

## **HCMC Environmental Sanitation Project**

The World Bank recently completed a feasibility study for a \$180 million project to improve Ho Chi Minh City's sewerage and drainage systems. The project will rehabilitate the 33-square-kilometer Nhieu Loc–Thi Nghe catchment basin in the heart of Ho Chi Minh City, improving sanitary conditions for 1.2 million residents. According to current plans, the World Bank will finance \$150 million of the project. The Ho Chi Minh City People's Committee and the Department of Transport and Public Works are the local implementing agencies. The project is scheduled to start in 2000 and be completed by 2005.

American environmental consulting firm Camp Dresser McKee (CDM) won a \$958,000 contract to prepare the recently completed feasibility study for the project. The World Bank is in the final stages of extending this contract and selecting CDM as project consultant to prepare the detailed engineering design. Prequalification for bidding on the project's first contracts was scheduled for late 2000.

The project will improve the network of drainage and sewerage systems that empty into the Nhieu Loc–Thi Nghe canal, derisively referred to by local residents as "stink river." The nine-kilometer canal serves as the main drain for untreated wastewater from over a million residents and industries in the city center. The canal also serves as the main channel for rainwater drainage.

The project will create separate wastewater and rain water catchment systems leading to the canal. An interceptor pipeline will be installed two to three meters under the canal to separate wastewater and rain-water flows. A wastewater treatment station will eventually be built where the canal empties into the Saigon River, but funds are not currently available for its construction. For now, a pumping station only will be built at the end of the canal. Much of the project involves basic construction and piping installation, two areas where domestic enterprises have experience, equipment, and requisite skills. Domestic contractors will likely be in a strong position to win bids. Piping is also likely to be sourced domestically.

Some areas may provide opportunities for foreign equipment suppliers and contractors. The interceptor pipeline will include a series of combined sewer overflow structures or sluice gates that may be sourced from overseas. Pumps for the pumping station will also likely be purchased overseas, as few pumps are produced locally. Project managers may have to hire a foreign construction firm with experience in pipe jacking, as this is the most likely method to be used to install the two- to three-meter pipe underneath the canal.

## **HCMC Environment and Sanitation Improvement**

The Asian Development Bank has signed a \$70 million credit for the \$100 million Ho Chi Minh City Environmental Improvement project. The project will improve urban drainage/sewerage and solid waste management and will finance improvements to the water distribution network. The total cost of the urban drainage/sewerage component of the project is \$20.88 million.

The project will upgrade water drainage systems in districts 5, 6, and 11. The focus of the project will be on the Hang Bang canal area. The 380-hectare area is currently used as a catch basin, collecting waste and rain water from surrounding districts. Seventeen kilometers of new pipes, 7 kilometers of culverts, and 12 sluice gates will be built. The Ministry of Transport and Communications and MOSTE will administer the project, to begin in 2000 and reach completion in 2005.

## **Secondary Towns Environmental Improvement**

According to the Asian Development Bank, a follow-up to the Ho Chi Minh City Environmental Improvement project is planned for 2002 to 2005. The ADB is scheduled to approve a loan in 2001 to improve environmental conditions in some of Vietnam's larger secondary cities.

## **Three Cities Sanitation Project**

The World Bank is financing \$80.5 million of a \$119.5 million project to upgrade the drainage and sewerage infrastructure in Danang, Haiphong, and Quang Ninh (Halong City and Cam Pha). Prequalification for bidding on these projects has been completed. Consultants on the projects are Soil and Water Ltd. (Finland) in Haiphong, GHDK (Australia) in Danang, and Kampsax (Netherlands) in Halong.

The project will upgrade sewerage and wastewater treatment and drainage networks. The project also aims to foster administrative reform within the cities' sanitation and drainage companies.

Eight civil works contracts have been awarded. The primary equipment procured for the projects include waste compactors, vacuum trucks, solid waste trucks, and bulldozers. Three countries are providing co-financing for the project: Denmark's DANIDA is providing \$11.7 million, Finland's FINNIDA \$5.8 million, and Australia's AusAID \$1.24 million. The DANIDA and FINNIDA funds have financed most of the consulting services for the project.

Companies from each of these countries have won the consultant contracts for the projects. In Halong, the Danish firm Kampsax is the primary consultant. In Haiphong, Finland's Soil and Water is the consultant, and in Danang, a joint venture, between Australia's GHD and Vietnam's Kim Hien Co. (GHDK), is the primary consultant.

## **Urban Drainage and Sewerage System for HCMC**

In December 1999, Japan's Pacific Consultants International completed a draft master plan for rehabilitating Ho Chi Minh City's drainage and sewerage systems. The Japan International Cooperation Agency (JICA) funded the study. The study estimates that \$350 million is needed to complete priority upgrades of sewerage and drainage in the center of Ho Chi Minh City.

JBIC would finance rehabilitation of sewers, drainage networks, and canals in Districts 1, 5, and 6. This area is known as the Ben Nghe–Tau Hu Canal, which runs along the southern edge of the central business area. The canal is 12.2 kilometers long. It is contaminated with waste, garbage, direct inflow of domestic wastewater, and sludge. JICA has proposed dredging and building an interceptor along the length of the canal, which will parallel Ham Nghi and Tran Hung Dao roads. A treatment plant with a capacity of 512,000 m<sup>3</sup>/day at Nha Be has also been recommended.

## **Tan Hoa–Lo Gom Canal**

A fourth project to rehabilitate Ho Chi Minh City's drainage network is being undertaken by the Belgian Administration for Development and Cooperation (BADC). BADC is providing \$1.5 million in grants to improve solid-waste collection and recycling, cleaning and maintaining the Tan Hoa–Lo Gom Canal, and improving collection and treatment of household and industrial wastewater. A European consortium will be selected to complete the detailed design of the project, scheduled to be complete by 2003.

As an extension of this project, BADC is providing a \$5 million grant for rehabilitating a catchment basin covering 3,300 hectares in Districts 6, 8, 11, Tan Binh, and Binh Chanh. The government has agreed to provide \$4 million in funding and may provide an additional \$3 million to compensate relocated residents. The project feasibility study proposes a combined sewer system with an interceptor along the Tan Hoa–Lo Gom canal. In addition, a wastewater treatment plant with a capacity of 242,000 m<sup>3</sup>/day would be built in Binh Chanh district.

The larger of these projects is facing a three-year delay and is now scheduled to be completed in 2004 instead of in 2001 as was originally planned. Holding up implementation are administrative delays related to relocating existing residents and obtaining land permits to build a solid waste station and aerated lagoon. A Vietnamese company has been hired to complete the detailed designs for the project.

### **Second Provincial Towns Water Supply and Sanitation**

The Asian Development Bank has committed \$69 million to improve public health in seven provincial capitals by increasing access to clean water supplies. The project includes investments to rehabilitate or build new sewerage and drainage systems. The project was started in 1997 and is scheduled for completion in 2002.

# Chapter 6

## Wastewater Treatment

### 6.1 Current Trends

Vietnam is seriously deficient in the area of wastewater treatment. Enormous quantities of industrial wastewater are generated annually and discharged, untreated, into lakes, canals, rivers, and streams. Companies have insufficient funds to install water treatment facilities. The Vietnamese state-industrial sector remains the largest source of untreated wastewater. Many enterprises are hopelessly mired in debt with no real prospects of turnaround. Spending precious resources on pollution control equipment is rarely a priority.

Foreign-invested businesses, industrial parks, and export processing zones generally have built their own wastewater treatment plants to comply with the government's environmental regulations. According to anecdotal reports, some companies choose not to use the treatment facilities in order to save on operating costs.

In a report issued in May 1999, Professor Le Quy An, a deputy minister at MOSTE, estimated that Hanoi dumps 300,000 m<sup>3</sup> of untreated wastewater daily. The Viet Tri Industrial Zone outside Hanoi dumps nearly 170,000 m<sup>3</sup> of wastewater into the Red River and its tributaries. The Thuong Dinh industrial zone in Hanoi adds another 22,000 m<sup>3</sup> of daily waste. Professor Le also estimated that Ho Chi Minh City discharges 730,000 m<sup>3</sup> of wastewater per day. Ho Chi Minh City's infamous "black canals" are open dumping grounds for 700 large factories and 30,000 smaller industrial establishments. Water with biochemical oxygen demand (BOD) content larger than 13 mg/liter is considered contaminated. Some of the water tested in the HCMC canal system reaches BOD content of 50 to 200 mg/liter.

MOSTE estimates the following as the daily amount of pollutants discharged into the city's canals: 590 tons of solid wastes, 270 tons of BOD, 480 tons of chemical oxygen demand (COD), 50 tons of nitrogen, 14 tons of phosphorous, and 110 tons of organic oil.

The most industrialized parts of Vietnam are in provinces and cities to the north of Ho Chi Minh City. Dong Nai province and the city of Bien Hoa as well as Binh Duong province are some of the most economically successful regions of the country and are, in turn, the source of much of the country's pollution.

Bien Hoa Industrial Zone pours tens of thousands of cubic meters of wastewater into the Dong Nai River. Several kilometers away are the Bien Hoa and the Hoa An water plants, which supply usable water to Bien Hoa City and Ho Chi Minh City.

### 6.2 Market Opportunities and Competitive Situation

Nearly all of the key components used in wastewater treatment systems in Vietnam are imported. Local companies are winning contracts to design and install treatment facilities. Almost universally, they purchase parts from overseas and assemble the equipment domestically. Vietnam has little difficulty building or sourcing water tanks and the like. Parts such as fans, blowers, pumps, valves, and motors are imported from a variety of sources, including Italy, France, Switzerland, Japan, and Korea.

#### Foreign-Invested Enterprises and Joint Ventures

With the decline in foreign investment, fewer opportunities are available for supply of wastewater treatment equipment to foreign enterprises and joint ventures. Most of the foreign-invested manufacturing enterprises have at least some form of wastewater treatment facilities already in place.

Realistic market opportunities are for existing ventures that are building new facilities or expanding production. But here, too, market opportunities are limited, with many manufacturing enterprises facing stockpiles of goods. The market trend is not toward expanding capacity but in managing market gluts.

If a trade agreement with the United States can be finalized, the market should change shape rapidly. Textile producers will be the main beneficiaries of the trade agreement because of the lower import tariffs on Vietnamese textile goods that Normal Trade Relations will bring. With textile and garment firms installing new production lines and expanding output, the need for new

or larger-capacity wastewater treatment plants will increase.

### **Industrial Zones/Export Processing Zones**

Industrial zones and export processing zones represent an attractive market for wastewater treatment plants. Of the 60 industrial zones, parks, and export processing zones operating in Vietnam, only six have installed central wastewater treatment plants.

The reason there are so few installed plants is that many are operated by Vietnamese companies that are able to sidestep environmental regulations or that are unable to finance treatment plants. In addition, current market conditions for industrial parks and zones are abysmal. The lack of tenants led one official from the Dong Nai Department of Planning and Investment to remark, “Local industrial zones are suffering from remarkable emptiness.” As a result, few new parks will be built in the near future.

The country’s most successful export processing zone (EPZ), the foreign-invested Tan Thuan export processing zone, completed construction of a 10,000 m<sup>3</sup> per day wastewater treatment facility in 1999. In the same year, the Linh Trung EPZ completed construction of its wastewater treatment plant with a capacity of 6,000 m<sup>3</sup> per day.

The best opportunities in industrial zones/parks and EPZs in the near future are for individual tenants whose waste requires a separate treatment facility. According to anecdotal reports from Vietnamese suppliers of wastewater treatment equipment, business has been most active at industrial zones/EPZs in Ho Chi Minh City and surrounding provinces of Dong Nai and Binh Duong.

### **Local Companies**

To date, Vietnamese state-owned companies have not been realistic sales prospects, except in cases where they receive overseas development assistance to finance a project. According to local companies, such as the Ho Chi Minh City Center for Environmental Technology (ECO), the market for supplying equipment to Vietnamese companies is small but improving. Its business has gradually shifted from servicing foreign-owned companies and joint ventures to local companies. The company director estimates that in 1997, 65 percent of his business was generated by foreign invested enterprises (FIEs) or joint ventures (JVs). By 2000, about half his business was with local companies and half with foreign-invested firms.

### **Case Study 6.1 To Win a Tender, It Pays to Hire Well**

Belgian firm Seghers International recently completed construction of a waste treatment plant at the Bien Hoa II industrial zone in Dong Nai province, outside Ho Chi Minh City. This was a unique contract, because Bien Hoa II is Vietnamese-owned, and it paid for the waste treatment facility from its own financing, not from ODA. Bien Hoa II is flush with cash because it is the most successful Vietnamese-owned industrial park in Vietnam, enjoying 95 percent occupancy.

Because of Bien Hoa’s unusual financial situation, bidding for the project was extremely competitive. A good product, good relations with relevant ministries, and establishing a good working relationship with a critical government company won the Bien Hoa II contract for Seghers.

To win the project, no fewer than five agencies had to approve Seghers’ technology and bid: the Ministry of Construction, Ministry of Finance, Ministry of Planning and Investment, MOSTE, and SONADEZI, a state-owned company that operates three of the largest industrial parks in Vietnam, including Bien Hoa II.

To navigate this bureaucracy, Seghers had a key advantage. Four years earlier, when Seghers’ executives were on a fact-finding mission to Vietnam, their delegation was hosted by MOSTE officials. They were so impressed with one of these officials that they later hired him and eventually financed a two-year study trip for him to Belgium. This former MOSTE official not only knew the channels within the environment ministry, but also, through his own experience and through family friends, had connections with many other decision-making ministries.

Helping seal the Bien Hoa contract was Seghers’ ability to sign favorable terms with VIWASE, the local company partnering on the project. VIWASE (Vietnam Consultancy for Water Supply, Sanitation, and Environment) is the most powerful local company in water infrastructure projects, and nearly all foreign companies attempt to establish partnerships with the firm when bidding on water-related projects. (“They’re the only game in town,” says an executive at one foreign infrastructure company.)

According to one Seghers’ representative, the Belgian firm’s approach was to be more flexible in negotiating revenue-sharing terms instead of looking for legal guarantees at all points in the contract. It was better to “think of each other” when doing the deal, rather than seek legal exit strategies, because often in Vietnam “going to court is a waste of time,” the executive said.

Seghers also brought a world-class product to the table. Seghers’ two-hectare plant includes four reservoirs for biological, chemical, and physical treatment of liquid waste before it is conveyed to another reservoir for final treatment. The \$3.8 million facility has a daily capacity of 4,000 cubic meters although it can be expanded to 12,000 m<sup>3</sup> without adding any new civil works. Seghers’ engineers in Belgium can monitor operations at the plant via a remote control system using the Internet.

Two factors are driving this trend. First, there are fewer foreign companies establishing operations in Vietnam. Second, more complaints from local residents and awareness by polluting companies have increased the need to cut emissions.

**Table 6.1 Leading Industrial Parks (IPs) and Export Processing Zones (EPZs) in Vietnam**

<i>Name</i>	<i>Locality</i>	<i>Area<sup>a</sup></i> <i>(Millions of dollars)</i>	<i>Investor and Capital</i> <i>(Millions of dollars)</i>	<i>Number of foreign investment projects</i>	<i>Foreign investment capital projects<sup>b</sup></i>	<i>Environment protection facility</i>
Danang EPZ	Danang	63	Malaysia; \$12	3	\$15	
Amata IP	Dong Nai	100	Thailand; \$46	6	\$260	4,000 m <sup>3</sup> /day water treatment plant from U.S., supplied by Hydroteck (Thailand)
Nhon Trach 2 IP	Dong Nai	350	Vietnam; \$37	7	\$1,000	
Go Dau IP	Dong Nai	210	Vietnam; \$18	13	\$420	
Loteco	Dong Nai	100	Japan; \$41	6	\$70	
Bien Hoa 2 IP	Dong Nai	376	Vietnam; \$18	82	\$1,080	\$3 million water treatment plant (4,000 m <sup>3</sup> /day)
Ho Nai IP	Dong Nai	190	Vietnam; \$15	18	\$85	
Phu My 1 IP	Ba Ria-Vung Tau	954	Vietnam; \$76	3	\$105	
Viet-Sing IP	Binh Duong	100	Singapore; \$52	21	\$290	6,000 m <sup>3</sup> / day sewage treatment plant; piped water
Can Tho IP	Can Tho	300	Vietnam; \$14	11	\$120	
Noi Bai IP	Hanoi	100	Malaysia; \$30	9	\$64	
Daitu-Hanoi IP	Hanoi	40	Taiwan; \$12			
Sai Dong B IP	Hanoi	97	Vietnam; \$12	13	\$280	
Daewoo-Hanel IP	Hanoi	197	S.Korea; \$152			
Thang Long IP	Hanoi	128	Japan; \$53			Water supply (2,000 m <sup>3</sup> /day) Water treatment (15,000 m <sup>3</sup> /day)
Nomura-Haiphong IP	Hai Phong	153	Japan; \$164	8	\$58	
Dinh Vu	Hai Phong	164	US, Belgium, Thailand; \$80	1	\$15	
Haiphong 96 EPZ	Hai Phong	150	Hong Kong; \$75			\$3 million waste treatment plant supplied by China Eco Teck; 10,000 tons/day
Tan Thuan EPZ	HCMC	300	Taiwan; \$89	149	\$580	6,000 m <sup>3</sup> /day water treatment plant
Linh Trung EPZ	HCMC	60	China; \$14	23	\$69	

a. Area is in hectares.

b. Values are in U.S. dollars.

Source: Mekong Research.

## **Case Study 6.2 Overseas Development Assistance is Driving the Business**

Viet Thang Textile Co., one of Vietnam's largest textile companies, is listed in Ho Chi Minh City's "black book" of leading polluters for good reason. Many of its plants dump untreated wastewater into canals used by local residents. In November 1999, the company took a large step toward getting off that list when it installed its first waste treatment plant with help from an unlikely source.

Since 1992, Viet Thang had been doing business with Peja NV, a small Dutch trading company with a representative office in Ho Chi Minh City. Peja represented several European companies selling textile equipment to Viet Thang. Recognizing Viet Thang's need for pollution control equipment, Peja suggested installing a waste treatment facility using another company it represented, Stork Aqua NV. Stork Aqua specializes in waste treatment facilities for the textile and dairy industries.

Crucially, Peja and Stork were able to arrange financing so that Viet Thang only had to bear part of the plant's cost. The firms applied for, and won, a grant from the Dutch development aid agency to fund 75 percent of the plant's \$2.5 million cost. Viet Thang financed the rest, using loans from local banks.

Today the plant is one of the largest ever installed at a state-owned firm. The facility has a capacity of 5,000 cubic meters of wastewater per day. The plant reduces BOD to less than 20 mg/liter, COD to less than 50 mg/liter, and total suspended solids to less than 50 mg/liter.

Since the plant opened, Peja has received numerous calls from other state-owned companies seeking to reduce their emissions and wastewater discharges. Peja has also been active in contacting state-owned firms listed in the Ho Chi Minh City and Hanoi environmental black books to propose similar financing schemes. (See Appendixes K, L, and M for lists of black book firms.)

At the time of publication, numerous local and foreign suppliers of wastewater treatment equipment were preparing to bid on a project to supply the state-owned firm Vinamilk with a treatment plant. Vinamilk is often voted for Vietnam's most successful local company, so it is possible that Vinamilk will be able to finance installation of the plant from its own resources.

## **Hanoi Urban Infrastructure Project**

The Japan Bank for International Cooperation (JBIC, formerly OECF) has committed a loan of 11.4 billion yen toward the development of a new urban center in the Thang Long North Area, 20 kilometers north of Hanoi. Overcrowding in Hanoi's city center is straining its infrastructure. Under a master plan of Hanoi Urban Development prepared by Japanese consultants, the new urban area will be comprised of an industrial zone, a residential area, a commercial area, and a cargo distribution center.

Wastewater treatment plants, water supply systems, drainage and sewerage networks, power supply and a road

system are major additions to be built to improve the existing infrastructure. The JBIC loan will go toward civil works, equipment, and consulting services to the project.

## **HCMC Environmental Sanitation**

The World Bank–financed \$180 million HCMC Environmental Sanitation project will contain a wastewater treatment component in the future. The bank has suggested that by 2010, Ho Chi Minh City should build a biotech treatment plant for the Nhieu Loc Thi Nghe basin with an initial capacity of 400,000 m<sup>3</sup> per day.

A \$142 million treatment station will eventually be built where the canal empties into the Saigon River, but funds are not currently available for its construction. For now, project developers are following the maxim "the solution to pollution is dilution" and plan to only build a pumping station at the end of the canal.

## **Local Environmental Service Companies**

Because the key components used for wastewater treatment plants are almost exclusively imported, an active market exists for suppliers of pumps, motors, aerators, and filters. Some regular purchasers of these items are local environmental service companies. These firms are often small-scale treatment plants, offering primary wastewater treatment.

Local companies import equipment, then assemble the machinery and install the plant onsite. These companies service both local- and foreign-invested enterprises. For example, the Center for Environmental Technology (ECO) in Ho Chi Minh City has installed waste treatment facilities for some of the largest foreign investors in Vietnam, such as Cargill, Morning Star Cement, and Vietnam Brewery.

Another consistent importer of equipment for wastewater treatment systems in Ho Chi Minh City, is the Center for Environmental Technology and Management (CENTEMA). Like most other significant environmental organizations in Vietnam, CENTEMA doubles as a research institute and commercial enterprise. CENTEMA conducts environmental monitoring and provides engineering/consulting services. Its research has centered on pollution control at Vietnam's largest industrial zones, primarily in the Ho Chi Minh City-Bien Hoa-Vung Tau industrial triangle. Some of its largest clients for wastewater treatment systems have included the ProSun textile factory, Thanh An Seafood Processing Co., and VEDAN Co., one of Vietnam's largest food processing companies.

**Table 6.2 Sample Product Lines for Wastewater Treatment Equipment**

<i>Brand</i>	<i>Product</i>	<i>Capacity</i>	<i>Cost*</i>
Osmonic (USA)	Water treatment system, including filters, water softener, RO membrane, ozone purifier	30 m <sup>3</sup> /day	\$21,450
Tsurumi (Japan)	Air blower	5 m <sup>3</sup> /minute	\$3,500–4,000
Alpha-Laval (Holland)	Mud conditioner	10 m <sup>3</sup> /hour	\$30,000
Ebara (Italy)	Sewage pump	10 m <sup>3</sup> /hour	\$500
Caprari (Italy)	Sewage pump	2060 m <sup>3</sup> /hour	\$1,000
Flygt (Sweden)	Sewage pump	20–80 m <sup>3</sup> /hour	\$1,000–1,200
Tsurami	Sewage pump	20–80 m <sup>3</sup> /hour	\$750
Trominelec (Germany)	Tossing pump	20–120 liters/hour	\$300–2,000
Aldos (Germany)	Tossing pump	20–120 liters/hour	\$300–2,000
Dosatron (Italy)	Tossing pump	20–120 liters/hour	\$150–1,000
Kohn (Germany)	Flow meter	60 m <sup>3</sup> /hour	\$750
Flygt (Sweden)	Air diffuser	—	—
Polymer (Singapore)	Mud treatment chemicals	—	\$8/kg

\* Values in U.S. dollars. Subject to import tax rate of 10–20 percent.  
Source: Center for Environmental Technology, Ho Chi Minh City.

**Table 6.3 Sample Product Lines for Wastewater Treatment Equipment**

<i>Type of Product</i>	<i>Company</i>	<i>Model</i>	<i>Capacity</i>
Centrifugal Pump	EBARA, Japan	FS	5–150 m <sup>3</sup> /h
Centrifugal Pump	EBARA, Japan	S, 100SF	5–150 m <sup>3</sup> /h
Centrifugal Pump	EBARA, Japan	FSGD	5–150 m <sup>3</sup> /h
Chemical Dosing Pump	Prominent Sigma, Germany	SIBA	1.6–150 L/h
Submersible Pump	EBARA, Japan	Best	5–150 m <sup>3</sup> /h
Submersible Pump	Tsurumi Pump, Japan	KTZ, KTV, KRS	5–150 m <sup>3</sup> /h
Submersible Pump	J.S Pump, Taiwan	J.S, SV4	5–150 m <sup>3</sup> /h
Motor of mixer	GEAR Motor, USA		3/4–10 HP
Mixer	Neptune Mixer Company, Japan		3/4–10 HP
Electric facilities of electric control box	LG Industrial system, Korea, Mitsubishi		—
Aerator	Force 7.1 T, Force 7.2 T, Italy		—
Air blower	Taiwan, Japan		140–1,800 m <sup>3</sup> /h

Source: Center for Environmental Technology and Management.

# Chapter 7

## Solid Waste

### 7.1 Current Trends

Vietnam's National Environmental Agency (NEA) estimates that 19,315 tons of solid waste are created daily in the country's Vietnam's urban and industrial areas. NEA breaks down this waste as follows:

Industrial waste:	10,162 tons
Hospital waste:	212 tons
Municipal waste:	8,665 tons

Vietnam is only able to collect about 50 percent of the total waste. City-based companies are responsible for collection and management of solid waste. For example, in Ho Chi Minh City, the City Environmental Company (CITENCO) is responsible; in Hanoi, it is the Urban Environmental Company.

Hanoi is the only city that has a sizeable composting factory, but it accounts for only a small percentage of total waste generated. Ho Chi Minh City used to have composting facilities with equipment supplied by Denmark. The city discontinued its use of the factory in 1991 and now uses landfills. In general, most smaller cities have not built dump sites. Uncollected waste in cities tends to accumulate in drains, canals, and rivers, polluting the waterways, causing restricted flows and contributing to flooding during the rainy season.

Ho Chi Minh City produces the most solid waste in the country. Each day, some 4,000 tons of solid waste are generated. This amount is forecast to increase to 5,500 tons a day by 2005. Only 40 percent of the waste is thought to be collected and treated or disposed of properly. The city spends an estimated 40 billion dong (\$3 million) on solid waste collection and disposal annually.

Most solid waste is collected by handcarts and delivered to 380 collection points in the city. The waste is often stored at these collection points for a day or longer, presenting environmental hazards and foul odors around these sites. The waste is then transferred to two transfer stations. The station in District 11 has a capacity of 500 tons/day. The station in Go Vap district has a capacity of 700 tons/day.

Finally, the waste is disposed of by dumping at three primary fills. Forty-eight percent of the total waste goes to the Dong Thanh dumping ground at Hoc Mon, north of the city. The Ho Chi Minh City Waste Treatment Company estimates that 3,000 tons of solid waste each day are buried at this 25-hectare field. Approximately 20 percent of the waste is dumped at the Go Cat landfill west of the city, while 17 percent goes to a privately operated site at Vinh Loc.

Landfill management in Vietnam usually consists of digging a hole, dumping the garbage, and covering the pit with a layer of clay. Water penetrates the clay layers, however, and both leachate water and rain water enter landfills before they are covered. This system causes both ground water pollution and soil pollution.

Most of the sites are open to scavengers that pick their way through the mounds of rubbish. During the dry season, the clay layers tend to burst open at the surface because of pressures from biogas generated in the covered landfills. Five-foot high flames are occasionally seen erupting from the surface of the landfills.

Most landfills have no wastewater treatment systems, although some of the larger ones have installed primary systems to treat effluent waters. In urban areas, residents living near these landfills source their water from wells that are likely contaminated by water leaking from the dumping sites.

In Hanoi, the waste collecting and disposal systems are believed to remove only 60 to 65 percent of the city's daily solid waste. The government made some progress on this front in May 1999, when it upgraded one of its dumping sites in Nam Son commune, Soc Son District, outside Hanoi. The upgrade included a 3.3 kilometer access road and construction of four dumping zones on the 13-hectare site. The Nam Son dumping ground now handles an estimated one third of Hanoi's daily waste.

Hanoi's only solid waste treatment plant is in Cau Dien, which processes waste into micro-biological fertilizer. The UNDP-funded plant is capable of converting 30,000 tons of solid waste a year, which is only 5 percent of Hanoi's annual total. The rest is buried in landfills.

In 1999, the government approved a project to upgrade Cau Dien Waste Treatment plant with Spanish assistance. The \$400,000 investment will raise the capacity of the plant to 50,000 tons of waste annually. Another \$17 million waste treatment plant, with a capacity of 250,000 tons and producing 66,300 tons of fertilizer a year, is scheduled to be built in Soc Son district over the next two years.

## **7.2 Biomass Projects**

Several proposals for building biomass power plants or waste conversion plants have been submitted to the government. Most recently, an American-British consortium of Premier International Trading & Consulting (U.S.), Enviro-Control Ltd. (U.K.), and AS-C Materials Handling Ltd (U.K.) have proposed building a \$106 million build-operate-transfer (BOT) power plant fueled by waste generated in Ho Chi Minh City. The plant would process waste at \$2.00–\$2.50 per ton to fire a 12 megawatt power plant. The project sponsors would sell electricity to Electricity of Vietnam at \$0.06 per kilowatt hour. The plant would also produce 300,000 tons of fertilizer per year.

Since 1996, Ho Chi Minh City authorities have been considering a biomass project proposed by Canada-based Pourslo Systems, Inc. Pourslo has made little progress since it made its initial proposal to use waste at the Hoc Mon dumping ground to fire a 100 megawatt power plant. The \$175 million BOT project would burn 1,500 tons of waste per day at a cost of \$1.50 per ton. Pourslo would then sell electricity to Electricity of Vietnam at a rate of \$0.045 per kilowatt hour. The project is still pending approval from the Ho Chi Minh City People's Committee.

## **7.3 Market Opportunities and Competitive Situation**

Hampering the development of solid waste treatment is the Vietnamese government's reluctance to introduce or raise waste collection and disposal fees. Without official charges for these services, foreign invested projects are not commercially viable. In addition, BOT projects have proven extremely difficult to implement in Vietnam because of a weak legal infrastructure.

Vermeer Group of the Netherlands is in the advanced stages of negotiating an agreement to build a landfill at Go Cat, near Ho Chi Minh City. The project would be

financed by a grant from the Dutch government. The agreement has not yet been signed, in part, because the Netherlands is requesting that waste collection/disposal fees be introduced as part of the project.

Foreign investors, including several U.S. firms, are watching the deal closely for the precedent it may set if the central government agrees to the service charges. Negotiations for the \$106 million Premier waste-treatment BOT, for example, will likely regain momentum if the Vermeer deal is completed successfully.

## **HCMC Environment and Sanitation Improvement**

The Asian Development Bank's Ho Chi Minh City Environment and Sanitation Improvement project includes a solid waste component. The total cost for the solid waste portion of the project is estimated at \$63.6 million. The project focuses on improving the efficiency of primary collection by supplying garbage bins and carts, garbage trucks, compactors, and containers and by building new transfer stations. The project will also finance construction of a new landfill on a 130-hectare site next to the existing Dong Thanh site. The new site would be capable of handling disposal needs at Dong Thanh for at least 10 years.

## **Three Cities Sanitation Project**

The World Bank is financing \$80.5 million of a \$119.5 million project to upgrade the drainage and sewerage infrastructure in Danang, Haiphong, and Quang Ninh (Halong City and Cam Pha). Although prequalification for bidding on these projects has been completed, opportunities may exist for suppliers to the project's contractors.

The project will upgrade sewerage and sewage treatment, drainage, and foster administrative reform within the cities' sanitation and drainage companies. There are solid waste components to each project, with special emphasis placed on administrative reform of Danang's solid waste management.

## **Bilateral Aid Projects**

The Netherlands is involved in two solid waste projects in Ho Chi Minh City. The Go Cat Landfill Project in Hoc Mon District is being implemented by the Dutch firm Vermeer Contractors Group and the Ho Chi Minh City Waste Disposal Company.

### **Case Study 7.1 Tapping State Resources**

Several U.S. firms are exploring opportunities to build landfills in northern provinces. The companies—Envirotech and equipment supplier Red River, Inc.—have worked with a marketing office for the state of Oklahoma’s trade office in Vietnam. Oklahoma is one of the few states to have opened trade offices in Vietnam. It did so largely to focus on opportunities in the oil and gas industries. Pacific Ventures, Inc. is the marketing office assisting the Oklahoma companies with market entry.

Envirotech and Red River representatives first came to Vietnam on a trade delegation in January 1999. The firms later won a \$25,000 grant from the National Association of State Development Agencies (NASDA), to return in March 1999. On this trip, the two firms held seminars and conferences on solid waste disposal and landfill technologies. Following the conference, officials from Hai Duong and Bac Giang provinces approached the companies and asked them to prepare proposals. The NASDA grant also financed the feasibility studies carried out in the two provinces.

Current solid waste disposal in these provinces consists of digging a hole and burying the garbage. The landfills do not use any layering techniques or measures to prevent against leakage. As a result, contamination of ground water and foul odors are degrading the environment in the surrounding areas. Envirotech has proposed building landfills using layering and containment technologies. Envirotech specializes in consulting and design, while Red River leases associated equipment, so it is likely the two will team together for the projects. The contracts, estimated to be worth between \$500,000 and \$1 million, have not yet been signed but are said to be “on the desks of the provincial chairmen” and ready for signing.

In January 2000, Pacific Ventures hosted a delegation from the Southern States Energy Board, which was visiting Vietnam to explore opportunities in clean energy and renewable energy production.

A final agreement on participation by Vermeer is pending. The project would develop a new 25-hectare site at Go Cat with a capacity of 4 million tons of solid waste and be able to handle all of the city’s waste from 2001 to 2003. Land for the project has been acquired and preliminary designs are completed.

The new site at Go Cat would include bottom, side, and top layers of polyethylene, a drainage system, vacuum welding, a wastewater treatment plant, and gas wells for extracting biogas. The gas will later be used for power generation. Vermeer has already contacted potential equipment suppliers for the project, including some from the United States.

A solid waste management project in District 10 has been proposed by the Dutch firms, Peja Export BV and ARA NV. The Ho Chi Minh City Environmental Company is the local implementing agency. The final grant agreement for the project is still being prepared.

# Chapter 8

## Hazardous and Toxic Wastes

### 8.1 Current Trends

According to the Law on Protection of the Environment, any establishment that produces solid, liquid, or gaseous “waste” must ensure that such waste is treated prior to being disposed of, and that the disposal process conforms to environmental standards.

The law states, vaguely, that toxic wastes must be disposed of in dumps other than those used for “normal” refuse. However, there is no national, provincial, or local system for effectively disposing of hazardous wastes. Some industrial zones have designated certain disposal facilities for solid waste, but these do not identify the wastes, nor do they have proper coverage or containment facilities for holding hazardous wastes.

In general, there is little detailed knowledge of the amount or kind of hazardous wastes produced in Vietnam. According to an Asian Development Bank report prepared for the Ho Chi Minh City Environmental Improvement project, Vietnam has no existing database that details levels of hazardous waste production and disposal.

Medical waste is one area of hazardous waste disposal where the government and overseas donors have focused their attention. The Ministry of Health estimates that 240 tons of medical waste are dumped daily throughout the country. Furthermore, only 10 percent of Vietnam’s hospitals have adequate disposal equipment. At present, up to 90 percent of the hospitals nationwide do not have a wastewater treatment system. All wastewater—some of which contains toxic pollutants and bacteria—are discharged directly into the environment.

Hanoi has 36 hospitals, which together discharge between 11 and 20 tons of solid waste per day. Hospitals in Ho Chi Minh City are estimated to dump 50 tons of garbage and 6.5 tons of medical waste daily. Much of this waste goes untreated or is treated improperly before it is disposed. The ratio of “dangerous waste” in hospital garbage collected by Hanoi’s Urban Environment Co. is believed to be between 12 and 25 percent. Some hospitals use old furnaces to dispose of medical waste, spreading air pollution into the vicinity of the hospitals. Others dump wastewater into old reservoirs, contaminating the ground water.

### 8.2 Market Opportunities and Competitive Situation

As part of the Ho Chi Minh City Environmental Improvement project, the Asian Development Bank will undertake a detailed master plan for managing toxic wastes in regions surrounding Ho Chi Minh City—the most heavily industrialized part of Vietnam. The study will focus on toxic waste production in Ho Chi Minh City, Dong Nai, Ba Ria-Vung Tau, and Binh Duong province.

The master plan will be used both to identify leading toxic pollution sources and to begin design of a hazardous waste disposal facility for the region. The Norwegian Agency for Development Cooperation (NORAD) has expressed interest in financing the master plan and studies associated with building the disposal facility.

The Vietnamese government has allocated some funds to remedy the medical waste problem. For the period August 1999 to August 2000, the government allocated 5 billion dong (\$1.03 million) from the state budget to improve waste treatment facilities at hospitals. Thirty hospitals were supposed to have received funds for improvements, but because of a lack of funds, only 10 hospitals will be selected. According to Nguyen Minh Tuan of the Ministry of Health, these hospitals have yet to be selected.

While the Ministry of Health has garnered some funds, the largest opportunities in medical-waste disposal remain with bilateral aid-funded projects. In November 1999, the Austrian government penned an agreement to provide \$5.3 million in financing for installation of medical-waste furnaces at 25 provincial hospitals. Austrian firm Vamed Engineering Co. is reported to be the lead supplier for the project. Vamed has proposed installing furnaces with a capacity of 1,400 kilograms of waste per day at an average cost of \$0.06 per kilogram.

Belgian development aid is financing construction of an incinerator in Ho Chi Minh City to dispose of medical waste. The Urban Environment Company in Ho Chi Minh City is now building a plant in Binh Chanh district. Belgian aid is financing \$1.5 million of the \$1.9 million project. The incinerator will be capable of treating seven to eight tons of waste per day.

# Chapter 9

## Air Pollution

### 9.1 Current Trends

Vietnam has set a number of guidelines on emissions (Table 9.1), but the uncontrolled growth of poorly maintained, lead-fueled vehicles has led to deteriorating air quality in Vietnam's major cities. Vietnam has an estimated 400,000 cars/minibuses and over 5 million motorbikes swarming its streets. If drivers and transport companies even know about the emissions regulations, they are widely disregarded. Vehicle emissions have a direct impact on public health, causing respiratory infections, particularly among young children. High blood pressure and heart problems are also health concerns associated with lead-fueled vehicle emissions.

According to regulations issued in 1995 by the Ministry of Science, Technology, and Environment (MOSTE), "all means of transportation within cities must have a smoke emission level of less than sixty hartridge units and must not discharge any polluting agents into the environment." For those vehicles with operation permits issued prior to the issuance of the Law on Protection of the Environment, the owners "must apply technical measures to limit the maximum emission level of smoke and toxic waste into the environment."

Lead concentrations in the air are well above permissible levels in both Hanoi and Ho Chi Minh City. This is largely because all vehicles in use in Vietnam use leaded gas. Virtually none of the old trucks, buses, and

three-wheeled vehicles on Vietnam's streets use any pollution controls. The main pollutants emitted by these vehicles are lead, lead additives, carbon monoxide, hydrocarbons, nitrogen oxides, sulphur dioxide, and particulate matter.

In 1995, the government initiated a proposal to phase out the use of leaded fuel in Vietnam. The proposal was never carried out. In December 1999, the Ministry of Transport, the U.S.-Asia Environmental Partnership, and the World Bank sponsored a workshop on phasing out leaded gasoline, and again an action plan was drawn up. Eliminating leaded fuel is considered economically feasible in Vietnam because the country imports all of its petroleum products, removing the need for costly upgrades to existing refineries. In addition, most of the vehicles on Vietnam's roads can use either leaded or unleaded fuel. Finally, Vietnam stands to save money if it switches to unleaded fuel, because it is less expensive on world markets than leaded fuel.

In Hanoi, carbon monoxide levels are 1.7 to 1.9 times higher than permissible levels; nitrogen dioxide is 2.5 to 3.0 times higher; settled particulates are 50 to 60 times higher; and suspended particulates are 8 to 10 times higher. In some areas of Ho Chi Minh City, sulfur dioxide and dust levels are four times higher than standards set by MOSTE.

In addition to motor vehicles, leading sources of air pollution include power plants, cement mills, chemical plants, steel mills, and industrial manufacturing. Because of poor urban planning and overcrowding in cities, industrial manufacturing is located in heavily populated urban areas. Many of these industries use antiquated machinery and are high polluters. The Ministry of Industry estimates that most manufacturing equipment is 50 to 100 years out of date. A survey of 42 factories found that 70 percent of newly imported equipment dated back to the 1950s and 1960s. Some of the equipment was built as early as the 1920s.

The government also blames the importation of second-hand equipment for increasing air pollution. More than half the machinery imports are second-hand, mainly from Singapore, Thailand, South Korea, and China.

**Table 9.1 Vietnamese Air Emissions Standards (milligrams per cubic meter)**

Pollutant	Average Emissions		
	in 1 hour	in 8 hours	in 24 hours
CO	40.0	10.0	5.000
NO <sub>2</sub>	0.4	—	0.100
SO <sub>2</sub>	0.5	—	0.300
Pb	—	—	0.005
O <sub>3</sub>	0.2	—	0.060
Dust	0.3	—	0.200

Source: Ministry of Science, Technology, and Environment.

The main industrial air pollutant is smoke from fuel oil and coal. Most plants use fuel oil for energy. Gas exhausts from steel plants and dust particulates from cement plants are other leading causes of air pollution.

The Center for Environmental Science and Technology (CEFINEA) is a leading air pollution research institution in Ho Chi Minh City and also sells air treatment equipment to domestic companies. CEFINEA has installed air treatment facilities at major steel manufacturing plants, such as POSVINA (Ho Chi Minh City) and Phuong Nam Steel Plate Co. (in Bien Hoa I industrial zone).

CEFINEA has conducted studies of air pollution, primarily in the industrialized south. It found that most plants use old equipment without any air treatment systems. Those that use treatment systems tend to use wet-filter systems supplied locally. Some local firms, such as the Bien Hoa and Thu Duc Steel factories, have installed treatment systems from abroad which use dust filtering and carbon monoxide treatment systems.

While new cement plants, or those built with foreign investment have installed modern air treatment systems (capable of filtering more than 90 percent of dust volumes), numerous local plants in the south (Ha Tien, Binh Dien, and Quan Khu 7 Cement companies) have not yet installed dust-filtration systems.

CEFINEA has found that leading chemical and detergent producers (Thu Duc Chemicals, Tan Binh Chemicals, Bien Hoa Chemicals, Daso Detergent, Tico Detergent) are primary sources of gas exhausts (SO<sub>2</sub>, Cl, HCL). With the exception of some foreign-built plants (CP Group, Cargill), few food processing and animal feed companies have installed modern dust treatment lines.

Instead of requiring firms to install pollution-abatement equipment, the government's primary solution to air pollution in urban areas appears to be moving companies from urban to less-populated areas or industrial parks. In June 1998, the Hanoi People's Committee issued Instruction 36/CT-TW, allowing city authorities to force polluters to move from population centers. Sixty companies were targeted for relocation immediately, and 67 others were told to move by 2020. None of the companies have moved, and the bureaucracy and cost involved with shifting companies from one location to another has delayed the plans indefinitely.

## 9.2 Market Opportunities and Competitive Situation

There have been few major initiatives to reduce air pollution overall. In general, it is only the large foreign-invested enterprises that have invested in modern

pollution-control equipment, such as filters and scrubbers for cement mills. Some domestic enterprises may be fitted with filters or, less frequently, scrubbers, but these systems tend to be old and inefficient for reducing dust particulates.

To date, there has been limited ODA funding for air pollution abatement efforts. Most of the ODA efforts have been directed toward building air-monitoring stations as a first step toward reducing air pollution. Current methods of checking air pollution levels are uncoordinated. In Ho Chi Minh City, for example, four different local companies have been contracted to measure air quality at different locations using mobile stations. Each company uses different, incompatible equipment, so an accurate and consistent data base has yet to be compiled.

The Asian Development Bank's Ho Chi Minh City Environment Improvement project includes an air-quality monitoring component. The bank intends to identify key air pollution sources and develop an air pollution tracking database. The results of the studies will be used to develop air quality legislation and action plans for reducing air emissions.

The Norwegian Agency for Development Cooperation (NORAD) will provide co-financing of \$1.8 million for equipment and training of local personnel. Six air monitoring stations are to be introduced:

- Urban background station for the Ho Chi Minh City area (one station)
- Urban background stations in new residential areas (two stations)
- Roadside stations to monitor the results of traffic management (two stations); and
- Mobile station (one station)

The United Nations Development Program (UNDP) initiated the first air-quality monitoring project in Ho Chi Minh City as part of its \$2.3 million environmental management project (VIE/96/023). The project will measure ambient air, urban background, and residential and industrial air pollution levels.

The project includes co-financing from Denmark, valued at \$700,000, for the installation of four air-monitoring systems. Instrumatics A/S of Denmark won the tender for supplying the monitoring stations, which will be capable of monitoring:

- meteorological data;
- particulates;
- nitrogen oxides;
- sulfur dioxide;
- ozone;
- carbon monoxide;

- non-methane hydrocarbons;
- methane;
- benzene, toluene, xylene;
- noise, vibration; and
- toxic gases

Although the contract was awarded to a Danish company, American companies may also benefit. Instrumatics has proposed buying some key equipment

for the stations from a U.S. firm. At the time of publication, project sponsors were considering the Instrumatics proposal. The first monitoring station was scheduled to be operating by March 2000.

The ADB air-monitoring program will expand upon the UNDP initiative. Significantly, the Asian Development Bank has agreed to use equipment that is compatible with equipment currently being procured by the UNDP.

# Chapter 10

## Renewable Energy

### 10.1 Current Trends

Vietnam's national power company, Electricity of Vietnam (EVN), has a mandate to supply electricity to 80 percent of Vietnam's households by the year 2010. Currently, less than 50 percent of rural households have electricity. Rural electrification via extensions of the centralized power grid is prohibitively expensive given the costs of new infrastructure and the economic status of rural residents.

The government's efforts to increase rural electrification have focused on promoting the use of renewable energy. The World Bank agrees with this strategy and has provided \$95,000 to help local authorities implement renewable energy projects. Local companies now manufacture family and small community micro-hydro-units, solar heaters, solar photo voltaic, family wind turbines, and family and community biogas digester systems.

### 10.2 Micro-Hydro

Vietnam has long used micro-hydro for energy needs at the family and small community level in rural areas. Since 1955, the government has funded research and implementation of small-scale hydro power to electrify rural and mountainous areas. Over 400 small hydro stations are now in place with a total installed capacity of 30 megawatts. The stations supply electricity to over 1 million people in 20 mountainous and remote provinces.

On a smaller scale, it is believed that over 100,000 micro- and family-hydropower generators are now in use. Local, state-owned facilities such as the Ho Chi Minh City-based Research Center for Thermal Equipment and Renewable Energy (RECTARE) and the Hanoi-based Hydro Power Center produce units ranging in capacity from 100 watts to 1,000 kilowatts. However, systems imported from China that retail for roughly \$20 per unit have the majority of the market share, especially in northern mountainous regions.

Some private companies are becoming active in the micro-hydro market. Danish development aid has

financed one such company, focused on building mini-hydro electric dams. Privately owned Viet Phong Co. teamed with Den Elec to consult on renewable energy projects. The companies are helping Lam Dong Province to construct a small hydroelectric plant. The firms also provide consulting services on thermal electricity, wind energy, hydro energy, solar energy, and improving efficiency of electricity transmission and distribution.

### 10.3 Solar

Solar Lab, at the Institute of Technology in Ho Chi Minh City, and the Institute of Energy in Hanoi are the leading institutions focused on research and development of solar-powered generation systems.

Vietnam has over 110 monitoring stations throughout the country to track data on solar energy resources. On a countrywide basis, average total annual insolation ranges from 4 to 5 kilowatt hours per square meter per day.

There are currently five large-scale solar photovoltaic power systems in Vietnam. These include a hybrid system of solar photovoltaic (PV) and micro-hydro power generation in Gia Lai province that has a capacity of 125 kilowatts (PV has 100 peak kilowatts). Ninety percent of the financing for the project came from Japan's New Energy and Industrial Technology Development Organization (NEDO).

The government has financed construction of 100 solar home systems and 200 solar community systems for inhabitants of islands off the northeast coast. Total capacity of these systems is 25 peak kilowatts. Four hundred solar home systems were built for communities in Tien Giang and Tra Vinh provinces with a total capacity of 14 kWp.

According to the Institute of Energy, three large PV projects to be built over the next two to four years are now in the planning stages. Ten hybrid systems (PV and diesel), with a capacity of 10 kilowatts each, are being built with funding from the German government and EVN. Tohoku of Japan is considering funding a hybrid system of PV and wind-power generation in Dak Lak

province. The system would also have a capacity of 10 kilowatts.

Electricité de France and the French Ministry of Foreign Affairs have pledged \$1.5 million to finance solar power programs in three southern provinces (Gia Lai, Quang Nam, and Binh Phuoc) from 1999–2002. The Vietnamese partners to the project are MOSTE, Electricity of Vietnam, the Committee for Ethnic Minorities, and Solarlab.

## 10.4 Wind

The Research Center for Thermal Equipment and Renewal Energy (RECTARE) is the primary organization developing and promoting wind-energy technologies. The center is under the Ho Chi Minh City Technical University and has been granted permission by the Ministry of Planning and Investment to build and sell renewable energy products.

To date, RECTARE has installed over 800 wind generators in over 40 provinces and towns throughout Vietnam. The largest number of these units have been installed near Nha Trang, in Khanh Hoa province on the south central coast, where 135 units are in use. Nha Trang is also home to one of only two wind villages in Vietnam. The village was financed by MOSTE and by the Swiss-Vietnam Association. The second wind village is located on Can Gio island near Ho Chi Minh City, where 50 units have been installed through the support of the French aid agency Agence de Coopération Culturelle et Technique (ACCT).

Nearly all of the units are for small-scale, household use only. The generators in Nha Trang, for example, are capable of charging one or two 100-ampere-per-hour batteries per day. Each unit costs about 5 million dong (\$353) to build and install, according to RECTARE. RECTARE has built all of the generators producing 200 watts or less of electricity. Units producing 500 watts to 90 kilowatts of electricity are manufactured in Vietnam but use some imported parts.

RECTARE officials have expressed interest in purchasing higher-grade, small-scale wind turbines and generator technology from foreign suppliers. These purchases would be for 300 watt, 500 watt, or 1 kilowatt units.

A second group responsible for developing wind-energy technologies is the Institute of Energy in Hanoi. However, the Institute has neither the technology nor the equipment to produce units on their own and must be supplied with equipment by RECTARE in Ho Chi Minh City.

The Institute of Energy is preparing feasibility studies for larger-scale wind farms. One is a 20 megawatt wind farm in Khanh Hoa province. EVN and Germany's VENTIS are in discussions to build the farm under a build-operate-transfer (BOT) contract. A second wind farm with a capacity of 30 megawatts is proposed for Binh Dinh province. The project would be funded by Japanese aid. EVN plans to fund a third wind farm, also in Khanh Hoa province, with a capacity of 20 megawatts.

## 10.5 Biomass

Biomass and wood fuel account for about 57 percent of primary energy consumption in Vietnam. Besides wood, agricultural residues and agro-industrial residues are the main biomass fuel sources. Most of these fuel sources are used on a household level.

Rice growers create about 45 million tons of paddy straw annually, accounting for over 90 percent of the waste. It is used as fuel and as livestock feed. It is also used as a bio-fertilizer via field burning. Roughly 3 million tons of sugar cane trash, coconut shells and leaves, and cassava stems are produced annually, accounting for about 6 percent of the combined waste. This waste is used primarily as fuel or fertilizer at the household level.

Foreign investors have prepared feasibility studies on the use of urban biowastes for power generation, although no major commercial biomass plants are yet in operation. There is an Australian-funded project in the works for Long An province. It will burn rice husks and produce 50 kilowatt hours of electricity.

The government is still considering the \$106 million BOT plant in Ho Chi Minh City backed by American and British investors. The proposed project would include construction of a waste plant capable of treating 1,500 to 3,000 tons of waste per day, generating 15 megawatts of power, and up to 480,000 tons of NPK per year. The project is in discussion stages with the Ho Chi Minh City Department of Urban Planning and Transportation.

The central problem for these co-generation/waste projects has been price. The cost to produce a kilowatt hour of power from solid waste is expensive (around 10 to 12 cents per kilowatt hour). However, EVN can only charge its customers half that amount, so it is willing to buy power at no more than 6 cents per kilowatt hour. Until price reform takes place, bio-waste projects (and other types of renewable—and usually expensive—power generation) may simply be too expensive.

# Chapter 11

## Soil and Forestry

### 11.1 Current Trends

Protection of soil quality has focused on better management of Vietnam's forest resources and on overuse of pesticides and fertilizers. Awareness of the need to protect forests in preventing soil erosion and related flooding was highlighted in November and December 1999, when the central region of Vietnam was devastated by the largest flooding to hit the country this century. Deforestation of surrounding hills and mountainous areas in the central region were partly blamed for the massive scale of the floods.

Since the early 1990s, the government has stepped up its efforts to prevent deforestation, but has had limited success. An estimated 19 million hectares of Vietnam's total land area of 33 million hectares are classified as forest. Of those 19 million hectares, however, only an estimated 9.3 million hectares are still covered by trees and are considered natural forests. Deforestation has been the result of years of warfare, uncontrolled industrial logging, and unsustainable logging by rural populations.

The Vietnamese Ministry of Agriculture and Rural Development noted in 1997 that the country's green coverage was less than 30 percent. In some highland and mountain areas, such as Lai Chau and Son La (the Northern mountain areas noted in the table above), the

forest coverage has fallen to as low as 8 to 10 percent. The General Department of Statistics estimates that up to 100,000 hectares of forests are destroyed every year.

Table 11.1, based upon a World Bank report published in 1994, gives an indication of the rate of deforestation in Vietnam since 1943. Before 1993, wood-product industries sourced all their raw materials from domestic forests. As timber demand grew during the economic boom of the mid-1990s, high-quality timber resources diminished. In an attempt to stem deforestation, the government placed a number of bans on the export of products using domestically-sourced timber. In 1997, the prime minister called for a moratorium on logging in Vietnam's natural forests and instructed the Ministry of Agriculture and Rural Development (the ministry responsible for managing the country's forest resources) to convert the remaining forest area into protected reserves.

Both plans succeeded in reducing the amount of timber exploited. Vietnam harvested 350,000 cubic meters of timber in 1998, according to official estimates, down from levels in the early 1990s of 1 million cubic meters per year. To bridge the shortfall of raw supplies, domestic wood processing industries began to source raw materials from illegal imports from Cambodia and Myanmar, as well as by legal imports, primarily from Indonesia.

**Table 11.1 Forest Cover and Barren Land in Vietnam**

<i>Region</i>	<i>Land area (thousands of hectares)</i>	<i>Forest cover (percent of land area)</i>		<i>Barren area (percent of land area)</i>	
		<i>1943</i>	<i>1991</i>	<i>1943</i>	<i>1993</i>
Northern mountains	7,645	95	17	60	65
Northern midlands	3,982	55	29	27	33
Red River delta	1,030	3	3	5	14
North central coast	4,002	66	35	40	44
South central coast	4,582	62	32	42	49
Central highlands	5,557	93	60	25	32
Northeast Mekong	2,348	54	24	23	34
Mekong delta	3,957	23	9	12	21
<b>Totals</b>	<b>33,104</b>	<b>57</b>	<b>29</b>	<b>35</b>	<b>42</b>

Source: World Bank, *Environmental Program and Policy Priorities* (1994).

Deforestation continues, however. Slash-and-burn agriculture is still practiced in many areas, with harvesting cycles too short for forests to be replenished. Land designated for protection is still used by rural farmers for grazing livestock. State-owned forestry enterprises have been allowed to continue operations, because officials are concerned about increasing unemployment in the already poor rural areas.

The government has initiated several action plans to try to readdress the problem. The 10th National Assembly approved an forestation plan covering 5 million hectares. Two million hectares will be protected forest, and 3 million hectares will be used for industrial purposes. The government’s goal is to have 14.3 million hectares of total forest area by 2010, an increase from the current 9.3 million. Total funding needed for the project is estimated at \$2.5 billion.

There are concerns that this plan will be as unsuccessful as the plans implemented earlier in the decade, such as the “Greening the Barren Hills” plan of 1992. According to the World Bank, this plan failed because the day-to-day concerns of local populations were not considered. Incentives to protect or manage the resources in a sustainable manner did not outweigh the immediate need for income, shelter, and fuel. As a result, natural forests areas have continued to decline.

Liberating Vietnam’s agricultural sector and dismantling its rural cooperatives have led to tremendous growth in farming. Since beginning its renovation process in 1986, Vietnam has moved from a net importer of rice to the world’s third largest exporter. Regions that once only grew one crop of rice a year now can harvest two or three crops. This productivity growth has been accomplished through the use (and overuse) of fertilizers and pesticides (Table 11.2).

Anecdotal evidence from farmers in the Mekong Delta point to declining fish stocks due to the overuse of pesticides. The Ministry of Agriculture has conducted surveys of farming families in the north, south, and central regions of the country. Use of pesticides in all of

these regions has increased by 80 percent to 90 percent since 1986.

Studies conducted in the Mekong delta and in the Red River delta show that pesticide levels in the water, soil, air, and produce, are higher than standards set by the National Environmental Agency. In a survey of vegetable growing areas in Khanh Hoa province on the south central coast, 25 percent of the vegetables sampled had pesticide levels 2 to 6 times higher than standards. Thirty-nine percent of 423 soil samples taken showed levels 2 to 40 times higher than standards.

**11.2 Market Opportunities and Competitive Situation**

The forestry sector has received a substantial portion of overseas development assistance (ODA) commitments over the past five years. Many of the largest projects in the sector were developed in the mid-1990s, with implementation in 1997 and 1998. Table 11.3 shows some of the largest forestry ODA projects to date.

While attention is still focused on improved management of Vietnam’s natural resources, ODA and government funding trends are moving away from forestry toward urban pollution problems (water supply, drainage/ sewerage, wastewater treatment, etc.).

**Coastal Wetlands Protection**

A \$65.6 million coastal wetlands protection and development project is expected to help restore the Mekong delta’s depleted coastal mangrove swamps. The six-year project will develop sustainable resource use in six provinces, including Ca Mau, Bac Lieu, Soc Trang, and Tra Vinh provinces. About 60 percent of the mangrove coverage in these provinces have been lost since 1984 because of logging and uncontrolled shrimp-farm development. Project financing will come from a \$31.8 million loan from the World Bank, \$11.3 million loan from Danish International Development Assistance (DANIDA), and \$22.5 million loan from the Vietnamese government. The project is scheduled to be carried out between 2000 and 2006.

**Table 11.2 Pesticide Use in Vietnam, 1980–1999 (tons per year)**

<i>Year</i>	<i>Volume</i>
1984	10,000
1992	21,400
1995	30,000
1999	130,000

Source: Ministry of Agriculture and Rural Development.

**Table 11.3 Five Largest Ongoing Overseas Development Assistance Projects in the Vietnamese Forestry Sector**

<i>Donor</i>	<i>Amount (millions of U.S. dollars)</i>	<i>Duration</i>	<i>Executing Title</i>	<i>Agency</i>	<i>Project Objective</i>
Asian Development Bank	\$33.0	1997–2003	Forestry Sector Project	MARD	To restore vegetative cover of mountainous areas and to raise productivity of country's forestry resources.
World Bank	\$32.3	1998–2003	Forest Protection	MARD	To protect and manage natural forests and reduce dependency on forests for subsistence and cash.
BMZ	\$19.6	1997–2002	Vietnam Forestation	KfW	To establish social forestry programs.
European Union	\$19.3	1997–2003	Resources Conservation in Nghe An Province	MARD	To reduce destruction and degradation of forest resources in Pu Mat Nature Reserve through sustainable resources management.
World Food Program	\$15.6	1997–2001	Smallholder Forestry Development	MARD	To increase village-level incomes through village tree nurseries and by planting fruit and cash-tree species.

MARD = Ministry of Agriculture and Rural Development

KfW = KfW Bank (German Development Bank)

BMZ = Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung

Source: Mekong Research, Ltd.

# Chapter 12

## Environmental Services

### 12.1 Current Trends

The market for environmental services is driven by technical assistance and consulting contracts to projects funded with overseas development assistance. Such projects require numerous feasibility studies, project preparation studies, and preparation of bidding documents (terms of reference).

Larger contracts for detailed project design and supervising implementation represent the largest value contracts available in Vietnam for environmental services companies. In 1999, for example, U.S.-based Camp Dresser McKee was awarded a \$958,000 contract to prepare a feasibility study for rehabilitation of a polluted canal in Ho Chi Minh City as part of a \$180 million World Bank sanitation project in that city. Camp Dresser McKee is also likely to win the contract for detailed design and preparation of bid documents, valued at approximately \$6 million.

A number of the large overseas development assistance projects source co-financing from bilateral aid agencies

for consulting and technical assistance components of projects. These grants then go to companies from the bilateral donor's host country. For example, the Finnish development agency is financing design/technical assistance contracts to three major World Bank environment projects: Hanoi Water Supply, Haiphong Water Supply and Sanitation, and the Haiphong component of the Bank's Three Cities Sanitation project. These service contracts were awarded to Finnish companies (YME Group, Plancenter Ltd., and Soil and Water of Finland, Ltd.).

### 12.2 Market Opportunities and Competitive Situation

Demand for monitoring services is increasing, and numerous ODA projects have provided funding in this area. Comprehensive studies and measurements of pollution levels in Vietnam are now underway.

#### Case Study 12.1 U.S. Success Story

U.S. engineering firm Black and Veatch has been one of the more successful American companies tapping the environmental services market in Vietnam. Black and Veatch has targeted large-scale ODA projects funded by the Asian Development Bank (ADB) and the World Bank.

Black and Veatch first established itself in Vietnam by opening a representative office shortly after the U.S. trade embargo was lifted in 1994. It has since capitalized on its reputation as a world leader in engineering and project management to win consultancy contracts on major civil works projects.

Its first project in Vietnam was a \$1.2 million contract for the ADB-financed Second Provincial Towns Water Supply project. Black and Veatch served as the construction supervisor for water works projects in the northern cities of Tuyet Quang, Ninh Binh and Vinh. It won a second consultant contract with the ADB, valued at \$1.7 million, for the Phuoc Hoa Multipurpose Water project in Binh Duong Province, outside Ho Chi Minh City. The project is developing infrastructure for water supply, irrigation, and salinity control.

Capitalizing on its reputation and established track record in Vietnam, Black and Veatch won a World Bank consulting contract for a small water resources project in the Mekong delta. While

this project is relatively small compared to the ADB projects, it could be a key stepping stone to much larger contracts to be awarded for the World Bank's \$147 million Mekong delta water resources project, which is beginning implementation in 2000.

Black and Veatch is also targeting the ADB's Ho Chi Minh City Environmental Improvement Project, the Danang component of the World Bank's Three Cities Sanitation project, and the World Bank's Ho Chi Minh City Environment and Sanitation project.

One of Black and Veatch's keys to success has been demonstrating to ministries awarding the contracts (in this case, the Ministry of Construction and the Ministry of Transport) their engineering capabilities and their capacity to solve problems. Implementing large-scale civil works projects in Vietnam inevitably means tackling unexpected difficulties. The client's vision of the project often differs from that of the project designers.

Being able to mesh the needs and demands of the local People's Committee where the project is being built with those of the project designers is a key factor in winning tenders, according to one Black and Veatch executive. "You have to show that you will be able to solve the conflicts between local interests and project interests."

One example is air-quality monitoring. There is no consistent database available on air pollution levels on a national, regional, or local level. The Asian Development Bank, United Nations Development Program (UNDP), the Norwegian Agency for Development Cooperation (NORAD), and DANIDA are funding projects in Ho Chi Minh City to establish accurate measuring systems and monitoring equipment. The U.S.-Asia Environmental Partnership is also providing assistance to this project. Contract awards include a technical assistance and training component to build the capacity of local staff.

Investment projects need to complete an environmental impact assessment (EIA) before they are licensed by the Ministry of Planning and Investment. For most companies, completing the assessment is straightforward and does not require the use of international consultants. As a result, local Vietnamese companies dominate the market for EIAs. Local companies also perform audits and monitoring of facilities to determine whether waste output is within standards set by the Law on the Environment. Only major polluting industries, such as the oil, gas, steel, and cement industries, have required services of international consulting companies to complete the EIAs. In general, the market for environmental services is moving away from providing EIAs to providing clean production consulting or waste-auditing services. According to directors at the Center for Environmental Technology (ECO) in Ho Chi Minh City, one of the country's largest environmental services companies, the center has shifted away from providing EIAs to providing "clean production" studies for local

companies. ECO also advises companies on waste-treatment solutions.

As a state-owned company, ECO uses government networking as an effective marketing tool. The government occasionally sponsors training sessions and seminars on waste reduction. Directors at ECO speak at these events, providing a valuable opportunity to meet potential clients. ECO is well known among local DOSTEs, so when polluting companies ask DOSTE for advice on waste reduction or other environmental services, DOSTE refers them to the center.

In the past year and a half, ISO 14000 has been introduced to Vietnam, though only a handful of companies have been certified. Several American companies, such as Ford, Nike, and Indochina Building Supplies, have been ISO 14000 certified. ISO 14000 certification is in its infancy in Vietnam. While it is being promoted to a limited degree, the market for such certifications will be negligible for the near future. The government has not provided any specific incentives to companies that meet ISO 14000 standards.

One of the larger certification companies in Vietnam, Société Générale de Surveillance (SGS), has looked at the market for environmental services but has not made it one of its core businesses in Vietnam. Its environment-related business in Vietnam has been centered on the forestry industry. Furniture buyers in the European Union, for example, restrict imports of furniture that have used illegally logged timber for raw materials. SGS Vietnam monitors about 50 furniture factories in Vietnam to determine their source of origin for hardwood timber.

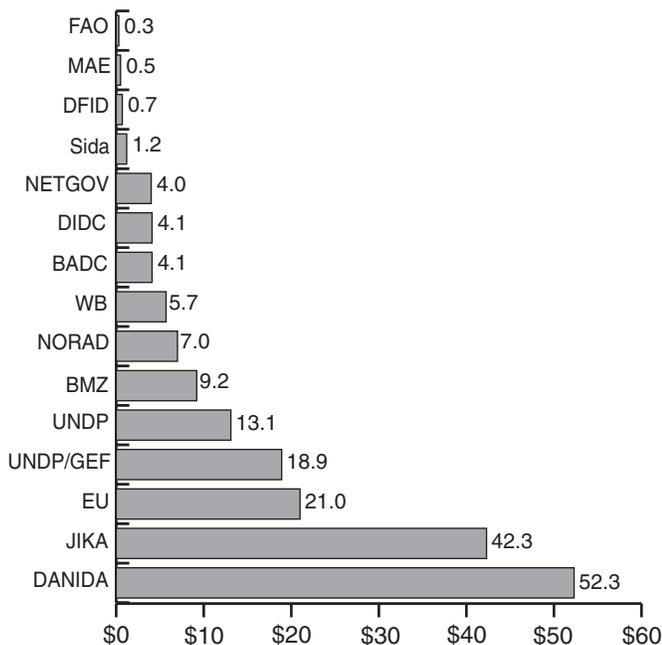
# Chapter13

## Sources of Financing

Overseas development assistance from multilateral institutions, such as the World Bank and the Asian Development Bank, remains the largest source of financing for environmental initiatives in Vietnam (Tables 13.1 and 13.3). While loans for environment-improvement projects have been approved and signed, implementing the projects and disbursing funds rarely proceed on schedule.

Vietnam has had a particularly poor track record of aid absorption for numerous reasons, including an entangled bureaucracy and extremely slow decision-making procedures. Local managers responsible for implementing projects must get approval for the smallest decisions along an entire chain of command. Major spending or disbursement decisions often must be approved by the local People's Committee, numerous agencies affiliated with the project, parent ministries in Hanoi, and, occasionally, the prime minister.

**Chart 13.1 Pipeline Commitments in Vietnam, by Main Grant Donors (millions of dollars)**



Note: Full names of donor organizations are given in the abbreviation list on page viii. Dollar figures have been rounded.  
Source: U.N. Development Program.

The government has issued an inter-ministry decision (Decree 87/CP) on speeding up ODA disbursements and on decentralizing decision making. Implementation of this decree is a work in progress, however. Bidders on projects should expect delays in procurement schedules.

### 13.1 U.S. Funding Sources

The United States has not yet provided bilateral aid in the form of loans or grants to the environment sector. However, the Overseas Private Investment Corporation (OPIC) provided its first financial support to a U.S. investment project in Vietnam in December 1999, a \$2.3 million loan to V-Trac Infrastructure Company, the sole authorized dealer of Caterpillar equipment in Vietnam. OPIC is a federal agency that provides investment services to small and medium-sized companies in overseas markets.

### 13.2 Key Sources of Overseas Development Assistance in Vietnam

#### Asian Development Bank

23 Phan Chu Trinh  
Hanoi  
Tel: +84 (4) 733-0923  
Fax: +84 (4) 733-0925  
Web: [www.adb.org](http://www.adb.org)  
E-mail: [adbhanoi@netnam.org.vn](mailto:adbhanoi@netnam.org.vn)  
Project officer: Mr. Le Dinh Thang

#### United Nations Development Program

27-29 Phan Boi Chau  
Hanoi  
Tel: +84 (4) 942-1495  
Fax: +84 (4) 825-9267  
Resident representative: Edouard Wattez

**World Bank**

63 Ly Thai To  
Hanoi  
Tel: +84 (4) 934-6600  
Fax: +84 (4) 934-6597  
E-Mail: [nthanh@worldbank.org](mailto:nthanh@worldbank.org)  
Web: [www.worldbank.org.vn](http://www.worldbank.org.vn)  
Project officer: Mr. Cong Thanh

**Overseas Development Assistance Partnership**

32 Le Thanh Ton St.  
Ho Chi Minh City  
Tel: +84 (8) 823-8988  
Fax: +84 (8) 822-4009  
E-Mail: [odap@hcm.vnn.vn](mailto:odap@hcm.vnn.vn)  
Program Coordinator: Ms. Le Dieu Anh

**13.3 Select Bilateral Aid Agencies****Australian Agency for International Development**

Australian Embassy  
8 Dao Tan St.  
Hanoi  
Tel: +84 (4) 831-7754  
Fax: +84 (4) 831-7706  
E-mail: [ausaid@fpt.vn](mailto:ausaid@fpt.vn)  
Web: [www.ausinvn.com](http://www.ausinvn.com)

**Belgian Administration for Development and Cooperation**

216 Nguyen Dinh Chieu  
Ho Chi Minh City  
Tel: +84 (8) 930-0407  
Fax: +84 (8) 930-0211  
Project Manager: Mr. Benoit Legrand

**Finland International Development Agency (FINNIDA)**

Embassy of Finland  
31 Hai Ba Trung St.  
Central Building  
Hanoi  
Tel: +84 (4) 826-6788  
Fax: +84 (4) 826-6766  
E-mail: [finnemb@netnam.org.vn](mailto:finnemb@netnam.org.vn)  
Web: [www.global.finland.fi](http://www.global.finland.fi)  
Program Officer: Le Quoc Hung

**Japan Bank for International Cooperation (JBIC)**

63 Ly Thai To St.  
Hanoi  
Fax: +84 (4) 824-8937  
E-mail: [jbic@hn.vnn.vn](mailto:jbic@hn.vnn.vn)  
Web: [www.jbic.go.jp](http://www.jbic.go.jp)  
Chief Representative: Koki Hirota

**Dutch Development Aid Agency**

Royal Netherlands Embassy  
Daeha Office Tower  
6th Floor, 360 Kim Ma St.  
Hanoi  
Tel: +84 (4) 831-5650  
Fax: +84 (4) 831-5655  
E-mail: [nlgovhan@netnam.org.vn](mailto:nlgovhan@netnam.org.vn)  
Commercial officer: Mr. Geoffrey van Leeuwen

**Japan International Cooperation Agency (JICA)**

Daeha Business Center  
11th Floor, 360 Kim Ma  
Hanoi  
Tel: +84 (4) 831-5005  
Fax: +84 (4) 831-5009  
E-mail: [jicvietnam@fpt.vn](mailto:jicvietnam@fpt.vn)  
Chief representative: Jibiki Takanori

**Danish International Development Agency (DANIDA)**

19 Dien Bien Phu St.  
Hanoi  
Tel: +84 (4) 823-1888  
Fax: +84 (4) 747-0167  
E-mail: [ambadane@hn.vnn.vn](mailto:ambadane@hn.vnn.vn)  
Chief representative: Toiben Bellers

**Swedish International Development Agency (SIDA)**

2 Nui Truc St.  
Hanoi  
Tel: +84 (4) 845-4824  
Fax: +84 (4) 823-2195  
E-mail: [per.lundell@sida.se](mailto:per.lundell@sida.se)  
Consular for Development Cooperation: Per Lundell

**Norway Agency for International Development (NORAD)**

56 Ly Thai To  
Hanoi  
Tel: +84 (4) 826-2111  
Fax: +84 (4) 826-0222  
E-mail: [noramb@hn.vnn.vn](mailto:noramb@hn.vnn.vn)  
[ambassade-hanoi@ud.dep.telemax.no](mailto:ambassade-hanoi@ud.dep.telemax.no)  
First Secretary: Svein Damsgaard

**Table 13.1 Largest Ongoing Development Projects in Vietnam, 2000**

<i>Sector</i>	<i>Donor</i>	<i>Project Title</i>	<i>Duration</i>	<i>Executing Agency</i>	<i>Annual Average Budget*</i>	<i>Total Budget*</i>
Energy Efficiency	World Bank	Transmission, Distribution and Disaster Rehabilitation Project	1998–2002	Electricity of Vietnam	49,750	199,000
Energy Efficiency	World Bank	Power Sector Rehabilitation and Expansion Project	1997–2000	Electricity of Vietnam	55,000	165,000
Urban Planning	Overseas Economic Cooperation Fund (Japan)	Hanoi Urban Infrastructure Development Project	1997–2002	PC Hanoi	21,400	107,000
Urban Planning	World Bank/IDA	Three Cities Sanitation Project (Ha Long, Danang and Hai Phong)	1999–2004	PCs in three cities	16,100	80,500
Disaster Management	Asian Development Bank	Irrigation and Flood Protection Rehabilitation Project	1994–2000	MARD	12,750	76,500
Urban Planning	Asian Development Bank	Second Provincial Towns Water Supply and Sanitation	1997–2002	MOC	13,800	69,000
Urban Planning	Overseas Economic Cooperation Fund (Japan)	Hanoi Drainage Project for Environment Improvement	1995–2002	PC Hanoi	9,764	68,349
Watershed	Asian Development Bank	Red River delta Water Resources Sector Project	1995–2000	MARD	12,000	60,000
Fisheries	Asian Development Bank	Fisheries Infrastructure Improvement Project	1996–2002	MOFish	9,500	57,000
Forestry	Asian Development Bank	Forestry Sector Project	1997–2003	MARD	5,500	33,000
Forestry	World Bank	Forest Protection and Rural Development Project	1998–2003	MARD	6,458	32,290
Disaster Management	World Food Program (United Nations)	Rehabilitation and Upgrading of Sea Dikes in Northern Vietnam	1996–2000	MARD	6,657	26,631
Rural Development	European Union	Cao Bang/Bac Can Rural Development Project	1999–2004	MARD	4,295	21,476
Rural Development	European Union	Son La/Lai Chau Rural Development Project	1999–2004	MARD	4,000	20,000
Forestry	BMZ	Vietnam Forestation	1997–2002	KfW	3,920	19,600
Forestry	European Union	Social Forestry and Natural Resources Conservation in Nghe An Province	1997–2003	MARD	3,212	19,273
Institutional Strengthening	International Fund for Agriculture Development	Strengthening Tuyen Quang Province to Implement Participatory Resource Management	1996–1999	PC Tuyen Quang	6,000	18,000
		<b>Total, all projects</b>				<b>\$1,072,619</b>

\* Thousands of U.S. dollars.  
Source: U.N. Development Program

**Table 13.2 Largest Pipeline Projects in Vietnam 2000**

<i>Sector</i>	<i>Donor</i>	<i>Project Title</i>	<i>Duration</i>	<i>Executing Agency</i>	<i>Annual Average Budget*</i>	<i>Total Budget*</i>
Energy Efficiency	World Bank	Rural Energy Project	2000–2004	EVN	37,500	150,000
Rural Development	World Bank	Northern Mountains Poverty Reduction	2001–2006	MPI	20,000	100,000
Urban Planning and Pollution Control	Asian Development Bank	Phuoc Hoa Multipurpose Water Resources	2000–TBA	TBA	—	80,000
Urban Planning and Pollution Control	Asian Development Bank	HCMC Environmental Improvement	1999–2001	PC HCMC	34,000	68,000
Protection of Mangroves and Wetlands	World Bank	Coastal Wetlands Protection and Development Project	1999–2006	MARD	9,314	65,200
Watershed	Asian Development Bank	Second Red River Water Resources	2001–TBA	TBA	—	60,000
Urban Planning and Pollution Control	Asian Development Bank	Third Provincial Towns Water Supply and Sanitation	2001–TBA	TBA	—	60,000
Fisheries	DANIDA	Fisheries Sector Program Support	1999–2004	MOFish	7,367	36,838
Urban Planning and Pollution Control	European Union	Urban Environmental Planning Program	1999–TBA	TBA	—	20,480
Marine Protection	UNDP/GEF	Prevention and Management of Marine Pollution in the East-Asian Seas, Phase 2	1999–TBA	IMO	—	16,289
Protection of Mangroves and Wetlands	JICA	Reforestation of the Coastal Sandy Soil Areas in Quang Nam, Quang Ngai, Phu Yen and Khanh Hoa Provinces	2000–2004	MARD	3,939	15,758
Disaster Management and Preparedness	JICA	Upgrade of Typhoon Operation of the Hydro-meteorological Services	2000–2003	HMS	5,202	15,608
Urban Planning, Pollution Control, and Health Issues	JICA	Urgent Equipment Supply for Waste Management in Hanoi	2000–2002	PC Hanoi	5,466	10,933
Protection of Mangroves and Wetlands	DANIDA	Coastal Wetlands Protection and Development Project	1999–2006	WB	1,505	10,541
		<b>Total, all projects</b>				<b>\$ 709,647</b>

\* Thousands of U.S. dollars.

Source: U.N. Development Program.

**Table 13.3 The 15 Largest Donors for Ongoing Projects in Vietnam, 2000**

<i>Rank</i>	<i>Donor</i>	<i>Number of Projects</i>	<i>Total Budget*</i>	<i>Average Length (years)</i>	<i>Average Annual Budget*</i>
1	World Bank	7	482,820	3.6	134,116
2	Asian Development Bank	7	298,182	4.4	54,932
3	Japan Bank for International Cooperation	2	175,349	6.0	31,164
4	European Union	18	67,544	3.2	13,947
5	World Food Program (United Nations)	2	42,496	4.0	10,624
6	Bundesministerium für Wirtschaftliche Zusammenarbeit und Entwicklung (Germany)	5	38,985	4.4	10,723
7	Swedish International Development Cooperation Agency	11	38,312	2.5	12,598
8	Japan International Cooperation Agency	6	32,654	1.8	18,195
9	International Fund for Agriculture Development	2	30,800	3.5	9,200
10	Government of the Netherlands	13	29,405	3.0	7,595
11	Swiss Development Cooperation	8	25,072	3.4	7,327
12	Agence Française de Développement (France)	2	24,900	6.0	4,150
13	United Nations Development Program	14	18,722	2.8	6,930
14	Danish International Development Assistance	6	11,752	3.7	3,690
15	Canadian International Development Agency	7	10,695	4.7	2,269
	<b>Total</b>	<b>110</b>	<b>1,327,688</b>	—	—

\* Thousands of U.S. dollars.

Source: U.N. Development Program.

# Chapter 14

## Market Entry Strategies

### 14.1 Getting Started

It is highly recommended that companies build a local presence in Vietnam by establishing a representative office to understand the dynamics of the market. Successful business in Vietnam means establishing relationships with key industry leaders and government officials and this can be accomplished locally. A foreign company with a representative office is allowed to negotiate and sign contracts with local firms or apply for an investment license from the government. However, a representative office cannot conduct commercial activities and earn revenue. Its sole purpose is to allow a company to research and prepare for a more formal investment project. The Ministry of Trade issues representative office licenses that are usually valid for five years. The current fee is just 1 million dong (approximately \$71).

### 14.2 ODA-Funded Projects

In the foreseeable future, the best opportunities for environmental equipment and services will be projects financed with overseas development assistance (ODA). Therefore, it is essential to maintain contact with ODA sources to remain abreast of project opportunities and status.

Tracking ODA projects includes establishing relationships with implementing ministries, agencies, and offices that will be responsible for project management on a local level. Successful bidding on ODA projects depends upon meeting the detailed qualifications set out in bidding documents and establishing relationships with key local decision makers.

ODA projects funded by the World Bank and the Asian Development Bank usually require that foreign contractors partner with local companies to promote transfer of technology/expertise. For example, in the case of large water supply, sewerage, and drainage projects, foreign companies often try to partner with the Vietnam Consultancy for Water Supply, Sanitation and Environ-

ment (VIWASE). VIWASE is owned by the Ministry of Construction.

### 14.3 Imports

All imported equipment must be through a company with an import/export license. Every shipment of goods must have an import permit from the Ministry of Trade.

In general, government authorities frown upon imports of used or outdated equipment, even when such equipment may be more appropriate for Vietnam's low level of infrastructure development.

Industrial water pumps, water filters, liquid filters, and air or gas purifying machinery is exempt from import duties. Equipment imported for use at a foreign-invested company and in ODA projects may also be imported duty free. However, local customs officials are occasionally unaware of national import policies. In the past, imports of equipment for ODA projects have been delayed until these policies could be clarified for local officials.

Household pumps and filters are subject to a 20 percent import tax. Import duties change often, especially since the introduction of the value added tax in Vietnam in January 1999, so rates should be checked before contracts are signed.

Vietnam tends to grant import licenses only to large, state-owned firms. If one is distributing product via a smaller local agent that does not have import rights, this company then signs an import contract with the firm that owns an import license. The larger trader then earns a commission, ranging from 1 to 2 percent of the contract value.

### 14.4 Distribution

Vietnam does not grant distribution rights to foreign companies. They are only allowed to manage distribution legally if they enter into a joint manufacturing venture with a local firm.

Distribution of environment-related equipment—such as pumps, filters, valves, motors, etc.—tends to be managed through local companies, both state-owned and private. Again, vendors should confirm that the agent either has an import license or a relationship with a licensed trading company.

Common distribution channels for vendors include:

- Local companies that import products for their own use. These may be environmental service companies which sell pollution prevention or treatment equipment but that need to import parts.
- Manufacturers that import under consignment.
- Import-export companies that import on behalf of other agents or to serve as an agent themselves.

Local companies provide marketing and promotion services and can be more effective in navigating distribution channels than would a foreign company establishing a new presence in the market. They can be invaluable for their contacts and relationships with equipment buyers, such as provincial, municipal, and district government officials.

It is important to provide local agents/distributors with adequate training so that they are able to provide after-sales services to buyers.

## 14.5 Payment

The Vietnamese dong is not a convertible currency. Moreover the state bank imposes strict controls on

foreign-exchange transactions. While some foreign-invested firms may have convertibility rights, it does not mean that the needed foreign currency will be available, as the market may fluctuate wildly. Convertibility rights are generally issued to import substitution manufacturers and other “important” industries.

Letters of credit are the most common method of payment for importing goods. Vietcombank, Vietnam’s largest state-owned bank, is the most active bank in issuing letters of credit. However, it is often reluctant to allow confirmation of its letters of credit by overseas banks. Also, Vietnamese banks do not always accept that a letter of credit constitutes a commitment on their part to meet obligations, and some banks have walked away, claiming that the importer is unable or unwilling to pay.

It is advisable for foreign exporters to open a letter of credit with a foreign bank branch in Vietnam. There are more than 20 foreign banks with branches in either Hanoi or Ho Chi Minh City. It is fairly standard for foreign companies that do not have a legal presence in Vietnam, such as a representative office, to import and sell goods through a state-owned enterprise that has import licenses and convertibility rights.

Consignment sales are not recommended unless the distributor’s performance and reliability can be verified. Once a proven track record is established, distributors often ask for payment terms of 30 to 180 days.

# Appendix A

## Ministries and State Agencies

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Ministry of Science, Technology and Environment (MOSTE)**

Minister: Chu Tuan Nha  
39 Tran Hung Dao  
Hanoi  
Tel: +84 (4) 825-2731/2722  
Fax: +84 (4) 825-2733

### **Ministry of Planning and Investment (MPI)**

Minister: Tran Xuan Gia  
2 Hoang Van Thu  
Hanoi  
Tel: +84 (4) 845-5298  
Fax: +84 (4) 823-4453

### **Ministry of Industry (MOI)**

Minister: Dang Vu Chu  
54 Hai Ba Trung  
Hanoi  
Tel: +84 (4) 825-3831/8311  
Fax: +84 (4) 826-5303

### **Ministry of Agriculture and Rural Development (MARD)**

Minister: Le Huy Ngo  
2 Ngoc Ha  
Hanoi  
Tel: +84 (4) 846-8160  
Fax: +84 (4) 845-4319

### **Ministry of Construction (MOC)**

Minister: Nguyen Manh Kiem  
37 Le Dai Hanh  
Hanoi  
Tel: +84 (4) 976-0271  
Fax: +84 (4) 976-2153

### **Ministry of Health (MOH)**

Minister: Do Nguyen Phuong  
138 A Giang Vo  
Hanoi  
Tel: +84 (4) 846-4416  
Fax: +84 (4) 846-2195

### **Water Supply and Environment Committee**

Director: Chu Tan Nha, MOSTE minister  
37 Le Dai Hanh  
Hanoi  
Tel: +84 (4) 821-5097  
Fax: +84 (4) 821-6339

### **Foreign Economic Relations Department (Ministry of Planning and Investment)**

Deputy Director: Nguyen Van Phuc  
2 Hoang Van Thu  
Hanoi  
Tel: +84 (4) 804-4408  
Fax: +84 (4) 823-4716

### **Management Board of Water Supply and Sanitation Projects (Ministry of Construction)**

Director: Nguyen Quy Don  
37 Le Dai Hanh  
Hanoi  
Tel: +84 (4) 976-0271  
Fax: +84 (4) 976-2153

### **Mekong Delta Water Resources Project (Ministry of Agriculture and Rural Development)**

Project Manager: Le Van Hien  
23 Hang Tre  
Hanoi  
Tel: +84 (4) 824-2363  
Fax: +84 (4) 824-2372

### **National Environment Agency**

Director: Nguyen Ngoc Sinh  
67 Nguyen Du  
Hanoi  
Tel: +84 (4) 822-3194  
Fax: +84 (4) 822-3189

Organizes and manages environmental protection activities on a national level; formulates policies on environmental protection; reviews environmental impact assessments; implements monitoring systems and pollution controls.

**Department of Science, Technology and Environment (DOSTE) of Ho Chi Minh City**

Director: Dao Van Luong  
244 Dien Bien Phu  
District 3  
Ho Chi Minh City  
Tel: +84 (8) 829-7831/ 824-2709  
Fax: +84 (8) 824-2584/ 2711

DOSTEs are city-level offices responsible for implementing regulations set by MOSTE and the NEA, as well as for environmental management at a local level.

**Department of Science, Technology and Environment (DOSTE) of Hanoi**

Director: Tran Lam  
2 Phan Chu Trinh  
Hanoi  
Tel: +84 (4) 825-6877/ 826-6672  
Fax: +84 (4) 825-1894

**DOSTE of Binh Duong Province**

Director: Nguyen Trong Dung  
Huynh Van Nghe, Phu Loi, Phu Hoa  
Thu Dau Mot  
Binh Duong Province  
Tel: +84 (650) 822-924/824-421

**DOSTE of Da Nang City**

Director: Le Khac Thanh  
15 Quang Trung  
Danang  
Tel: +84 (511) 821-466/822-864

**DOSTE of Dong Nai Province**

Director: Huynh Van Tam  
260, 15 Highway  
Bien Hoa City  
Dong Nai  
Tel: +84 (61) 822-297/ 825-585

**DOSTE of Hai Phong City**

Director: Dao Viet Tac  
1 Pham Ngu Lao  
Hai Phong  
Tel: +84 (31) 846-444  
Fax: +84 (31) 845-183

**DOSTE of Quang Ninh Province**

Director: Vu Van Thanh  
Km 8, Nguyen Van Cu  
Ha Long City  
Tel: +84 (33) 835-958  
Fax: +84 (33) 835-471

**HCMC Department of Transportation and Public Works (DTPW)**

Deputy Director: Nguyen Thi Dung  
63 Ly Tu Trong  
Ho Chi Minh City  
Tel: +84 (8) 829-0451  
Fax: +84 (8) 829-0458

Involves in several municipal environment projects (sewage, drainage, water supply, solid waste.)

**Hanoi Department of Transportation and Public Works (DTPW)**

Director: Pham Quoc Truong  
12-14 Phan Dinh Phung  
Hanoi  
Tel: +84 (4) 845-2471  
Fax: +84 (4) 845-6333

**HCMC Department of Planning and Investment (DPI)**

Deputy Director: Phan Xuan Hoa  
32 Le Thanh Ton  
Ho Chi Minh City  
Tel: +84 (8) 829-7831  
Fax: +84 (8) 824-2584

Department is responsible for approving investment proposals in HCMC and for making key recommendations to the HCMC People's Committee.

**Hanoi Department of Planning and Investment (DPI)**

Director: Nguyen Thanh Binh  
17 Tran Nguyen Han  
Hanoi  
Tel: +84 (4) 825-5275  
Fax: +84 (4) 825-1733

Responsible for approving investment proposals in Hanoi and for making key recommendations to the Hanoi's People Committee.

**HCMC Department of Science, Technology, Environment (DOSTE)**

**Environment Management Office**  
Manager: Doan Thi Toi  
244 Dien Bien Phu  
**Tel: +84 (8) 824-2709**  
Fax: +84 (8) 824-2711

**Hanoi Department of Science, Technology,  
Environment (DOSTE)**

Environment Management Office

Director: Tran Lam

204 Tran Quang Khai

Hanoi

Tel: +84 (4) 826-6672

Fax: +84 (4) 934-3184

**Department of Medical Equipment Project  
(Ministry of Health)**

Environment expert: Nguyen Minh Tuan

138A Giang Vo

Hanoi

Tel: +84 (4) 823-0795

Fax: +84 (4) 846-0843

**HCMC People's Committee**

Vice Chairman: Vu Hung Viet

Environment Expert: Dao Thi Bich Thu

Tel: +84 (8) 829-7067

Fax: +84 (8) 829-5049

## Appendix B

# International Organizations

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Birdlife International**

Program Coordinator: Jonathan C. Eames  
17M13 Lang Trung  
Dong Da District  
Hanoi  
Tel: +84 (4) 851-7217  
Fax: +84 (4) 835-2562  
E-mail: *birdlife@netnam.org.vn*

### **Fauna and Flora International**

Cuc Phuong National Park  
Ninh Binh  
Tel: +84 (30) 866-085  
Fax: +84 (30) 866-174  
E-mail: *FFI@netnam.org.vn*

### **International Union for Conservation of Nature and Natural Resources (IUCN)**

Representative: Le Minh Thong  
13 Tran Hung Dao  
Hanoi  
Tel: +84 (4) 933-0012  
Fax: +84 (4) 933-0013  
E-mail: *iucnvne@bdvn.vnmailvnd.net*

### **Society for Environmental Exploration**

Program manager: Richard Sopey  
P7 / A 4 Bach Khoa  
Hai Ba Trung District  
Hanoi  
Tel: +84 (4) 869-1541/ 933-0013  
C/O BP +84 (4) 826-6156  
E-mail: *SEEE@netnam.org.vn*

### **World Wide Fund for Nature (WWF)**

Representative: Eric Coull  
116 Yet Kieu  
Hanoi  
Tel: +84 (4) 822-0640/ 822-0641  
Fax: +84 (4) 822-0642  
E-mail: *wwfvne@netnam.org.vn*

# Appendix C

## Leading Environmental Service, Research, and Technology Companies

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Center for Applied Hydrology and Environmental Engineering (Hanoi Water Resources University)**

Director: Ngo Dinh Tuan  
299 Tay Son  
Dong Da District  
Hanoi  
Tel: +84 (4) 852-2027  
Fax: +84 (4) 853-4198

Conducts research and development; provides commercial applications for water resources projects; conducts EIAs for projects related to water resources; engaged in planning, design, and construction of flood control and dyke protection infrastructure.

### **Center for Environmental and Chemical Engineering (Vietnam Chemicals Corporation)**

Director: Dang Xuan Toan  
21A Cat Linh  
Hanoi  
Tel: +84 (4) 823-5335  
Fax: +84 (4) 823-2325

Applied research institute specializing in environment protection for the chemical industry. Conducts EIAs.

### **Center for Environmental Engineering of Towns and Industrial Areas (CEETIA) (Hanoi University of Civil Engineering)**

Director: Pham Ngoc Dang  
5 Giai Phong  
Hai Ba Trung District  
Hanoi  
Tel: +84 (4) 869-3405/ 869-1604  
Fax: +84 (4) 869-3714

Conducts EIAs and applied research focused on water and air pollution in urban areas and industrial zones.

### **Center for Environmental Science and Technology (Hanoi University of Technology)**

Director: Dinh Van Sam  
1 Dai Co Viet Road, C10  
Hanoi University of Technology  
Hanoi  
Tel: +84 (4) 869-1466  
Fax: +84 (4) 869-3551

Engages in research and development of environmental technologies, conducts investigations and audits, and provides EIAs for industrial parks and zones.

### **Center of Environmental Chemistry (University of Natural Science/Hanoi National University)**

Director: Pham Hung Viet  
T 3 Building, National University of Hanoi  
90 Nguyen Trai  
Dong Da District  
Hanoi  
Tel: +84 (4) 858-7964  
Fax: +84 (4) 858-8152

Research and development of environmental treatment technologies; pollution controls. Performs EIAs and consultancy services.

### **Center for Research and Application of Environmental Technology (RAENTEC)**

Director: Nguyen Duc Canh  
60 Nguyen Du  
District 1  
Ho Chi Minh City  
Tel: +84 (8) 822-5106  
Fax: +84 (8) 822-5068

Specializes in waste treatment technologies: site implementation, training, and environment-research software.

**Center of Environmental Technology (ECO)**

Director: Tran Ung Long  
18 A Cong Hoa St  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 842-5760  
Fax: +84 (8) 842-5763

Research and application of environmental technology;  
environmental impact assessment and waste auditing.

**Environment Protection Center (EPC)**

Director: Tran Minh Chi  
56 Truong Quoc Dung  
Ho Chi Minh City  
Tel: +84 (8) 844-7975/ 845-2354  
Fax: +84 (8) 844-7976  
E-mail: *BTTEP@Netnam2.org.vn*

Leading research and commercial enterprise conducting EIAs and installing wastewater, air emission, and solid waste treatment technologies. Provides training, consultancy services, and cooperation with international agencies in environmental protection.

**Center for Environmental Technology and Management (CENTEMA)**

Director: Nguyen Trung Viet  
C4/5-6 Dinh Bo Linh St  
Binh Thanh District  
Ho Chi Minh City  
Tel: +84 (8) 898-1504/ 1502  
Fax: +84 (8) 898-1505  
E-mail: *centema@Netnam2.org.vn*

Leading research institute and commercial enterprise providing waste audits, clean production studies, and studies of wastes produced at industrial zones.

**Center for Environmental Science and Technology (CEFINEA)**

Director: Nguyen Dinh Tuan  
268 Ky Thuong Kiet  
District 10  
Ho Chi Minh City  
Tel: +84 (8) 865-1132/ 863-7044  
Fax: +84 (8) 865-5670  
E-mail: *chidhl@mailser.ut-hcmc.edu.vn*

Research institute and commercial enterprise specializing in air pollution control and installation of air treatment technologies.

## Appendix D

# Major Environmental Companies in Hanoi

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Center for Rural Water Supply and Environmental Sanitation**

Director: Le Van Can  
C10 Nam Thanh Cong  
Ba Dinh District  
Hanoi  
Tel: +84 (4) 835-5821/ 5964  
Fax: +84 (4) 835-5964

Provides systems for clean water supply; wastewater treatment, and safe use of pesticide and fertilizer. Performs EIAs and conducts research and development.

### **Center of Environmental Technology (CET)**

Director: Truong Xuan Tung  
37 Lang Ha  
Hanoi  
Tel: +84 (4) 856-2382  
Fax: +84 (4) 856-2401

Conducts consulting, research and development, production, and commercial application of environmental technologies.

### **Center of Safety and Environment**

Director: Do Thanh Bai  
2 Pham Ngu Lao  
Hanoi  
Tel: +84 (4) 824-9231  
Fax: +84 (4) 826-5633

Specializes in conducting EIAs and applying clean production techniques to the chemicals industry.

### **Research Center for Water Resources and Environmental Engineering**

Director: Nguyen Quang Trung  
299 Tay Son  
Dong Da District  
Hanoi  
Tel: +84 (4) 853-3893  
Fax: +84 (4) 853-6290

Conducts research on water pollution control, wastewater treatment, and effects of water works on the ecology.

### **Scientific Technological Center for Water Supply and Sanitation Consultative Company for Water Supply and Environment**

Director: Dinh Viet Duong  
5 Duong Thanh  
Hanoi  
Tel: +84 (4) 824-4328  
Fax: +84 (4) 823-2760

Advises and supplies water supply and drainage solutions. Cooperates with Nisso Koe to provide drainage solutions for Hanoi. Upgrades Thu Duc Water Plant (HCM City), consultant for Ho Da Den, Nhon Thach water projects in Ba Ria-Vung Tau.

### **Vietnam Consultancy for Water Supply, Sanitation and Environment (VIWASE)**

Director: Nguyen Nhu Ha  
5 Duong Thanh  
Hanoi  
Tel: +84 (4) 896-6780  
Fax: +84 (4) 896-0713

Key construction and engineering company owned by the Ministry of Construction responsible for evaluating water-related construction projects. VIWASE is often selected as the local partner by foreign civil works contractors/consultants participating in ODA-funded water projects.

**Hanoi Water Supply Development Project**

Director: Hoang Quoc Loc  
44 Yen Phu  
Hanoi  
Tel: +84 (4) 829-4393

Develops water supply projects, primarily the Hanoi component of the World Bank First Water Supply project.

**Hanoi Drainage Development Project**

Director: Nguyen Quoc Don  
37 Le Dai Hanh  
Hanoi  
Tel: +84 (4) 821-5586

Manages the JBIC Hanoi drainage development project.

**Water Resources Development Consulting Joint Venture**

Director: Phung Van Luyen  
299 Tay Son  
Hanoi  
Tel: +84 (4) 853-5110  
Fax: +84 (4) 863-9417

Consultants on water resources projects.

**Hanoi Drainage Company**

Director: Le Minh Chau  
95 Van Ho 3  
Hanoi  
Tel: +84 (4) 976-2245  
Fax: +84 (4) 976-2663

Owned by Hanoi Department of Communication and Public Works. Manages drainage and water treatment systems. Supervises drainage projects in Hanoi.

**Hanoi Urban Environment Company**

Director: Chu Van Chung  
18 Cao Ba Quat  
Hanoi  
Tel: +84 (4) 845-4807  
Fax: +84 (4) 823-2566

Owned by Hanoi Department of Communication and Public Works. Responsible for collecting and disposing of solid wastes. Supervises solid waste treatment projects in Hanoi, including procurement.

**Hanoi Water Business Co.**

Director: Bui Van Mat  
44 Yen Phu  
Hanoi  
Tel : +84 (4) 829-4315  
Fax: +84 (4) 829-4069

Implementing agency for the World Bank First Water Supply project in Hanoi.

**Red River Engineering and Trading Company**

Director: Pham Minh Tuan  
32 Thai Thinh 2  
Dong Da District  
Hanoi  
Tel: +84 (4) 856-3579  
Fax: +84 (4) 856-3580

Supplier of water supply and water treatment equipment, pumps, air compressors and construction equipment.

**High-Tech Development Center**

Director: Nguyen Hoai Chau  
21/6 Lang Ha  
Hanoi  
Tel: +84 (4) 856-0858  
Fax: +84 (4) 756-1352

Supplies equipment for water treatment; installs filter stations, wastewater treatment units.

# Appendix E

## Major Environmental Companies in Ho Chi Minh City

Note: See page viii for abbreviations and acronyms used in this appendix.

### **New Technology Transfer Center Viet-NGA Tropical Center**

Director: Vu Van Tieu  
3 Road 3/2  
District 10  
Ho Chi Minh City  
Tel: +84 (8) 833-4564  
Fax: +84 (8) 832-6353

Research and application of technologies and equipment for water supply and wastewater treatment plants. Transfers new technology, helping health centers to completely burn disposed syringes and needles.

### **Science and Technique Center (STC)**

Director: Nguyen Dang Hung  
273 Dien Bien Phu  
District 3  
Ho Chi Minh City  
Tel: +84 (8) 824-4902  
Fax: +84 (8) 823-1650

Research and environmental monitoring.

### **Ho Chi Minh City Water Supply Company**

Director: Vo Quang Chau  
1 Cong Truong Quoc Te  
District 3  
Ho Chi Minh City  
Tel: +84 (8) 823-1090/ 829-1777  
Fax: +84 (8) 824-1644  
Contact: Dao Trong

Water supply company for Ho Chi Minh City.

### **Ho Chi Minh Drainage Company**

Director: Vo Quang Ke  
88 Bis Pham Ngoc Thach  
District 3  
Ho Chi Minh City  
Tel: +84 (8) 823-0800  
Fax: +84 (8) 910-0498

Supervises drainage network for Ho Chi Minh City.

### **Water and Sewage Construction Company (WASECO)**

Director: Phan Hong Son  
10 Pho Quang Str.  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 847-5166  
Fax: +84 (8) 847-5161

Responsible for sewage and waste treatment in Ho Chi Minh City. Designs and develops water supply and wastewater treatment systems. Has developed wastewater treatment systems at Tan Thuan EPZ in Ho Chi Minh City, Hyundai Shipbuilding Plant in Khanh Hoa; and in Daklak provinces (40,000 m<sup>3</sup>/day). Waseco has also built water supply systems at Cao Lanh, Dong Thap (Holland-funded, 25,000 m<sup>3</sup>/day), at Hoc Mon, HCMC (50,000 m<sup>3</sup>/day).

### **Water Construction Company (WACO)**

Director : Pham Tra  
54/5 Au Co Str.  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 865-3425  
Fax: +84 (8) 865-5952

General contractor and supplier of water-electric equipment and wastewater treatment equipment.

### **Trans-Tech Saigon**

Director: Vo Anh Tuan  
76 Cao Van Lau  
District 6  
Ho Chi Minh City  
Tel and Fax: +84 (8) 853-6096

Equipment supplier for environment-related projects.

**Waste Disposal Company (HOWADICO)**

Director: Le Dinh Mai  
Huong Lo 16, Hiep Thanh Ward  
District 12  
Ho Chi Minh City  
Tel: +84 (8) 891-6586  
Fax: +84 (8) 891-0801

Provides waste treatment services for Ho Chi Minh City. Manages dumping field in Hoc Mon commune.

**HCMC Urban Environment Company**

Director: Nguyen Van Mon  
42-44 Vo Thi Sau  
District 1  
Ho Chi Minh City  
Tel: +84 (8) 829-1975  
Fax: +84 (8) 829-6680

Responsible for collecting and transporting municipal solid waste to dumping sites

**DAMIFA Co. Ltd.**

Director: Le Quy Son  
V10Bis Huong Giang  
Cu Xa Bac Hai  
District 10  
Ho Chi Minh City  
Tel: +84 (8) 865-4179  
Fax: +84 (8) 865-2245  
E-mail: *Ka3@hcm.vnn.vn*

Designs and develops water and industrial wastewater treatment systems (Phu My power plant in Ba Ria-Vung Tau, Espace Bourbon Cora supermarket, Vedan glutamate plant in Dong Nai, Tan Thuan container port, Kotobuki pastry factory in HCMC).

**Saigon Engineering Co., Ltd.**

Director: Ton That Canh Hung  
90 Nguyen Thi Minh Khai  
District 3  
Tel: +84 (8) 829-9161/ 9116/ 822-6696  
Fax: +84 (8) 822-5865

Designs and installs equipment for air ventilation and water drainage systems. Manufactures air ducts, grills, and diffusers. Distributes Honeywell (U.S.) air cleaners.

## **Appendix F**

# **Major Environmental Companies in Hai Phong**

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Hai Phong Consultation and Technical Support on Environment Center (ENCEN)**

Director: Hoang Ngoc Tuan  
1 Pham Ngu Lao  
Ngo Quyen District  
Hai Phong  
Tel: +84 (31) 849-476  
Fax: +84 (31) 840-691

Conducts EIA studies, research and application of pollution control technologies.

### **Haiphong Sewerage and Drainage Co.**

Director: Nguyen Ba Can  
1 Ly Tu Trong  
Hai Phong  
Tel: +84 (31) 842-810  
Fax: +84 (31) 841-072

### **Haiphong Water Supply Co.**

Director: Dam Xuan Luy  
54 Dinh Tien Hoang  
Hai Phong  
Tel: +84 (31) 829-4315  
Fax: +84 (31) 829-4069

## Appendix G

# Major Environmental Companies in Danang

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Da Nang Environment Technology Center**

Director: Huynh Ngoc Thach  
46 Tran Hung Dao  
Danang  
Tel: +84 (511) 824-402  
Fax: +84 (511) 824-120

Conducts EIAs, manufactures and installs equipment for air emissions and wastewater treatment.

### **Danang Urban Environment Co.**

Director: Nguyen Tan Lien  
53 Nui Thanh  
Danang  
Tel : +84 (511) 625-299  
Fax: +84 (511) 615-912

Responsible for solid waste collection and disposal.

### **Danang Water Supply Co.**

Director: Ho But  
25 Pasteur  
Danang  
Tel : +84 (511) 822-222  
Fax: +84 (511) 827-633

Water supply company for Danang.

## Appendix H

# Major Environmental Companies in Quang Ninh

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Quang Ninh Environment Co.**

Director: Nguyen Manh Ha

Cao Xanh

Quang Ninh

Tel: +84 (33) 826-501

Fax: +84 (33) 829-569

### **Quang Ninh Water Supply Co.**

Director: Le Minh

375 Nguyen Van Cu

Quang Ninh

Tel: +84 (33) 835-733

Fax: +84 (33) 835-796

# Appendix I

## Leading Distributors/Wholesalers of Water Supply/Treatment Equipment

Note: See page viii for abbreviations and acronyms used in this appendix.

**Dai Viet Trading Co.**  
70 De La Thanh  
Hanoi  
Tel: +84 (4) 851-7219  
Fax: +84 (4) 851-3842

**HCMC**  
Tel: +84 (8) 811-5715  
Fax: +84 (8) 811-5714

**Schmidt Vietnam  
Schmidt Tower**  
Cau Giay, Tu Liem  
Hanoi  
Tel: +84 (4) 834-6186  
Fax: +84 (4) 834-6188

**HCMC**  
Tel: +84 (8) 822-8228  
Fax: +84 (8) 823-0239

**D and B Engineering Co.**  
479 Hoang Van Thu  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 845-2544  
Fax: +84 (8) 845-2544

**Dai Dong Nguyen Co.**  
4G Bui Minh Truc St.  
District 8  
Ho Chi Minh City  
Tel: +84 (8) 850-4005  
Fax: +84 (8) 850-4006

**Viet-Tech Co.**  
5 Lieu Giai St.  
Hanoi  
Tel: +84 (4) 823-5975  
Fax: +84 (4) 843-8852

## Appendix J

# Leading Distributors with Import Licenses

Note: See page viii for abbreviations and acronyms used in this appendix.

### **Contrexim**

39 Nguyen Dinh Chieu St.  
Hanoi  
Tel: +84 (4) 826-5836  
Fax: +84 (4) 826-2701

### **Artex Thang Long**

164A Ton Duc Thang St.  
Hanoi  
Tel: +84 (4) 823-7814  
Fax: +84 (4) 845-6731

### **Savimex**

4A Giai Phong Rd.  
Hanoi  
Tel: +84 (4) 869-4171  
Fax: +84 (4) 869-4168

### **Technoimport**

16 Trang Thi St.  
Hanoi  
Tel: +84 (4) 825-6821  
Fax: +84 (4) 825-4059

### **Machinoimport**

8 Trang Thi St.  
Hanoi  
Tel: +84 (4) 826-0344

### **Bavico Ltd.**

97a Ly Tu Trong  
District 1  
Ho Chi Minh City  
Tel: +84 (8) 824-3046  
Fax: +84 (8) 822-3582

### **Gia Khuong Co. Ltd.**

244 Pasteur  
District 3  
Ho Chi Minh City  
Tel: +84 (8) 820-4944/ 45  
Fax: +84 (8) 820-4908  
E-mail:

### **Vinh Phu Co. Ltd.**

129/4 Km03 National Road 13  
Vinh Phu Ward  
Thuan An District  
Binh Duong Province  
Tel: +84 (650) 853-702  
Fax: +84 (650) 853-701

## Appendix K

# “Black Book” Companies in Ho Chi Minh City, List 1

Note: See page viii for abbreviations and acronyms used in this appendix.

Source: Ho Chi Minh City, Department of Science, Technology, and Environment.

Cty Det Viet Thang  
Viet Thang Textile Co.-VICOTEX  
Linh Trung Ward  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-9337/ 9319/ 9543  
Fax: +84 (8) 896-9319  
E-mail: *vietthang@hcm.vnn.vn*  
General Director: Mr. Le Quang Thu

Cty Det Thang Loi  
Thang Loi Textile Company  
2 National Road No. 1  
Ward 15, Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 849-5961/ 5977  
Fax: +84 (8) 849-6076  
E-mail: *dethangloi@hcm.vnn.vn*  
Director: Mr. Duong Ba Chien

Cty Det Phuoc Long  
Phuoc Long Textile Company (FULTEX)  
Phuoc Long B Ward  
District 9  
Ho Chi Minh City  
Tel: +84 (8) 896-1100  
Fax: +84 (8) 896-4715  
Director: Mr. Trinh Van Son

Cty Det Chan A  
CHAN A Textile Company  
40 Huong Lo 14  
Ward 20  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 855-6905

Cty Det Phong Phu  
Phong Phu Textile Company  
Phong Phu, Tang Nhon Phu B  
District 9  
Ho Chi Minh City  
Tel: +84 (8) 896-3533/ 34/ 35  
Fax: +84 (8) 896-6088  
Director: Ms. Tran Thi Duong

Cty Det Quyet Thang  
Quyet Thang Textile Co. Ltd. (QUYTEXCO)  
304 Quang Trung  
Go Vap District  
Ho Chi Minh City  
Tel: +84 (8) 894-4546/ 6158  
Fax: +84 (8) 894-0339  
Director: Mr. Nguyen Van Thanh

Cty Det Thanh Cong  
Thanh Cong Textile Company (T.C.TEX)  
8 National Road 1  
Ward 15, Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 891-0926/ 849-5962  
Fax: +84 (8) 849-5932/ 891-0920  
E-mail: *tctex@hcm.vnn.vn*  
Director: Mr. Dinh Cong Hung

Cty Det Gia Dinh  
Gia Dinh Textile-Garment Company (GIDITEXCO)  
189 Phan Van Tri Binh Thanh District  
Ho Chi Minh City  
Tel: +84 (8) 894-0509/ 2145  
Fax: +84 (8) 894-0291  
Director: Mr. Nguyen Van Than

Xi Nghiep Giay Vinh Hue  
Vinh Hue Paper Company (VIHIMEX)  
66/5 National Road No. 1  
Linh Xuan Ward, Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-0006/ 3916  
Fax: +84 (8) 896-2092  
Director: Mr. Nguyen Hoa

Xi Nghiep Giay Xuan Duc  
Xuan Duc Paper Company  
54B Nam Hoa  
Phuoc Long A, District 9  
Ho Chi Minh City  
Tel: +84 (8) 896-0114  
Fax: +84 (8) 896-5540  
Director: Mr. Duong Van Cao

Xi Nghiep Giay Liksin  
LIK SIN Plate-making Factory  
709/6 Hung Vuong  
District 6  
Ho Chi Minh City  
Tel: +84 (8) 875-6972  
Director: Mr. Nguyen Ngoc Sang

Nha May Hoa Chat Tan Binh  
Tan Binh Chemical Factory  
46/6 Huong Lo 11  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 842-6185  
Fax: +84 (8) 849-5936  
Director: Mr. Trinh Minh Hong

Cty Vietnam Ky Nghe Suc San (Vissan)  
Vissan Import Export Corporation  
420 No Trang Long  
Binh Thanh District  
Ho Chi Minh City  
Tel: +84 (8) 843-3907  
Fax: +84 (8) 843-2372  
Director: Mr. Le Quang Nhuong

Xi Nghiep Lien Doanh Saigon-Vewong  
Saigon Vewong Co. Ltd.  
1707 National Road No. 1  
An Phu Dong Ward, District 12  
Ho Chi Minh City  
Tel: +84 (8) 891-9150/ 54  
Fax: +84 (8) 891-9159

Xi Nghiep Ruou Binh Tay  
Binh Tay Distillery  
621 Pham Van Chi  
District 6  
Ho Chi Minh City  
Tel: +84 (8) 855-2644/ 5485  
Fax: +84 (8) 855-7797  
Director: Mr. Nguyen Ba Thi

Xi Nghiep Quoc Doanh Che Bien Hang XK Cau Tre  
Cau Tre Enterprise (C.T.E)  
125/208 Huong Lo 14  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 856-5543  
Fax: +84 (8) 855-0057  
E-mail: [cautreent-hcmc@hcm.vnn.vn](mailto:cautreent-hcmc@hcm.vnn.vn)  
Director: Ms. Nguyen Thi Thu Ba

Cty VIFON  
Vietnam Food Industries Company (VIFON)  
6/1B Cach Mang Thang Tam  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 849-5947  
Fax: +84 (8) 849-6059  
E-mail: [vifon@hcm.fpt.vn](mailto:vifon@hcm.fpt.vn)  
Director: Mr. Nguyen Bi

Cty Thuy Dac San Xuat Khau  
Special Aquatic Product Import-Export Company  
(SEASPIMEX)  
213 Hoa Binh  
Ward 19, Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 865-4081  
Fax: +84 (8) 865-3143  
E-mail: [seaspimex@hcm.vnn.vn](mailto:seaspimex@hcm.vnn.vn)  
Director: Mr. Le Huu Tho

Nha May Bia Saigon  
Saigon Brewery Company  
187 Nguyen Chi Thanh  
District 5  
Ho Chi Minh City  
Tel: +84 (8) 855-9595/ 9488  
Fax: +84 (8) 857-7095  
Director: Mr. Nguyen Chi Thanh

Cty Bot Giat Viso  
VISO Detergent Company (VIDECO)  
672-673 Cu Xa Kien Thiet  
Hiep Phuoc Ward, Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-8202/ 8047  
Fax: +84 (8) 896-1943  
Director: Mr. Nguyen Hung Viet

Xi Nghiep Bot Giat Tico  
TICO Detergent Enterprise  
121 Huong Lo 14  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 855-2730/ 7098/ 0916/ 856-1405  
Fax: +84 (8) 855-2538  
Director: Mr. Ho Chi Cong

Cty Bot Giat Phuong Dong  
ORDESCO40 Kim Bien  
District 5  
Ho Chi Minh City  
Tel: +84 (8) 855-7750/ 1667  
Fax: +84 (8) 855-4723  
Director: Mr. Le Luu Ca

XN Thuoc Sat Trung Binh Trieu  
Binh Trieu Pesticide Enterprise  
Ga Binh Trieu, National Road No. 1  
Hiep Binh Chanh Ward  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-6951

Xn Thuoc Sat Trung Tan Thuan  
Tan Thuan Pesticide Factory  
Tan Thuan Dong Ward  
District 7  
Ho Chi Minh City  
Tel: +84 (8) 872-8523  
Fax: +84 (8) 873-0386  
Director: Mr. Bui Van Duc

XN Thuoc Tru Sau Saigon  
Saigon Pesticide Company  
Hamlet 1, Tan Thuan Dong  
District 7  
Ho Chi Minh City  
Tel: +84 (8) 872-4666/ 9599/ 873-0069  
Fax: +84 (8) 872-8391  
Director: Ms. Le Thi Bich Lieu

XN Chan Nuoi Heo 3/2  
3/2 Pig Breeding Enterprise  
3/9 Kha Van Can  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-6627  
Fax: +84 (8) 896-1492  
Director: Mr. Ngo Cong Hien

XN Chan Nuoi Heo Phuoc Long  
Phuoc Long Pig Farm  
Xom Moi  
Phuoc Long B Ward  
District 9  
Ho Chi Minh City  
Tel: +84 (8) 896-0158/ 5943  
Fax: +84 (8) 896-5943  
Director: Mr. Nguyen Duc Thanh Hai

Nha May Thiep Thu Duc  
Thu Duc Steel Works  
Km 9 Xa Lo Hanoi  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-1150/ 9612  
Fax: +84 (8) 731-0154  
Director: Mr. Le Huu Viet

Nha May Thiep Nha Be  
Nha Be Steel Works  
Khu Pho 1, Phu Thuan  
District 7  
Ho Chi Minh City  
Tel: +84 (8) 872-0261/ 9625  
Fax: +84 (8) 873-0264  
Director: Nguyen Ngoc Vinh

Nha May Thiep Tan Binh  
Tan Binh Stell Rolling Mill  
117 Au Co  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 865-6862/ 3581  
Fax: +84 (8) 865-6862  
Director: Mr. Tran Tien Dat

Nha May Dien Thu Duc  
Thu Duc Power Plant  
21 Duong Van Cam  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-2395/ 6841

Nha May Dien Cho Quan  
Cho Quan Power Plant  
8 Ben Ham Tu District 5  
Ho Chi Minh City  
Tel: +84 (8) 839-7139

Cty Xi Mang Ha Tien 1  
Ha Tien 1 Cement Corporation  
Kilometre No. 8, Hanoi Highway  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-6608/ 13/ 19  
Director: Mr. Nguyen Man

XN Xi Mang Quan Khu 7  
Z11 National Road No. 1A  
Dong Tien Hamlet  
Trung My Tay Ward  
District 12  
Ho Chi Minh City  
Tel: +84 (8) 891-2902/ 1395/ 6821

Nha May Xi Mang Binh Dien  
Binh Dien Cement Joint-Venture Enterprise  
C1/3 Hamlet 3, National Road No. 1, Tan Kien  
Binh Chanh District  
Ho Chi Minh City  
Tel: +84 (8) 875-0284  
Fax: +84 (8) 875-2750  
Director: Mr. Nguyen Thien

Nha May Thuoc La Vinh Hoi  
Vinh Hoi Cigarette Factory  
151-155 Ben Van Don  
District 4  
Ho Chi Minh City  
Tel: +84 (8) 940-1742/ 1489  
Fax: +84 (8) 822-3357  
Director: Mr. Nguyen Nam Hai

Nha May Thuoc La Saigon  
Saigon Cigarette Factory  
152 Tran Phu  
District 5  
Ho Chi Minh City  
Tel: +84 (8) 835-7052/ 3138/ 8554  
Fax: +84 (8) 835-3462  
Director: Mr. Nguyen Triet

Nha May Thuy Tinh Khanh Hoi  
Khanh Hoi Glass Factory  
76 Ton That Thuyet  
District 4  
Ho Chi Minh City  
Tel: +84 (8) 872-3149/ 5293  
Fax: +84 (8) 872-5293  
Director: Mr. Ton Tich Dung

XN Acquy Cuu Long  
Cuu Long Storage Battery Enterprise 277 Ben Binh  
Dong  
District 8  
Ho Chi Minh City  
Tel: +84 (8) 855-3730  
Director: Mr. Nguyen Minh Lam

Cty Bong Bach Tuyet  
Bach Tuyet Cotton-Wool Corporation (COBOVINA-  
BACH TUYET)  
16/2 Au Co  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 849-6080/ 5994/ 842-5576  
Fax: +84 (8) 849-6080  
Director: Ms. Le Thi Mung

XN Duc So 1  
Foundry No. 1 Enterprise  
220 Binh Thoi  
Ward 14  
District 1  
Ho Chi Minh City  
Tel: +84 (8) 865-7761  
Fax: +84 (8) 865-7761

Hop Tac Xa Cao Su Toan Luc  
182 Hoang Van Thu  
Ward 9  
Phu Nhuan District  
Ho Chi Minh City  
Tel: +84 (8) 844-1301

Lo Thieu Binh Hung Hoa  
BINH HUNG HOA Incinerator  
Tan Ky Tan Quy Street  
Binh Hung Hoa  
Binh Chanh District  
Ho Chi Minh City  
Tel : +84 (8) 875 5191

## Appendix L

# “Black Book” Companies in Ho Chi Minh City, List 2

Note: See page viii for abbreviations and acronyms used in this appendix.

Source: Ho Chi Minh City, Department of Science, Technology, and Environment.

Nhaø Maùy Giaáy LINH XUAÂN  
Linh Xuan Paper Company (SAKYGICO)  
61/6 National Road No. 1  
Linh Xuan Ward  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-6784/ 1073  
Fax: +84 (8) 896-1540  
Director: Mr. Tong Van Ngoan

XN Lieân Doanh DOMATEX  
Domatex  
18/3 Au Co  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 842-5519~22  
Fax: +84 (8) 849-6145

Cty Deät Kim ÑOÂNG PHÖÔNG  
Dong Phuong Knitting Company (DOPIMEX)  
10 Au Co  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 849-6062/ 7466/ 6047  
Fax: +84 (8) 849-5940  
Director: Mr. Dinh Cong Hung

Cty Deät Chaên BÌNH LÖÏI  
Binh Loi Blanket Company (BLATEX)  
438 No Trang Long  
Binh Thanh District  
Ho Chi Minh City  
Tel: +84 (8) 843-2359  
Fax: +84 (8) 843-2352  
Director: Mr. Ho Manh Hien

Cty May Nhuôm Deät Len VIEÄT PHOU  
Viet Pho Textile, Dyeing, Garment Company  
3 An Duong Vuong  
District 6  
Ho Chi Minh City  
Tel: +84 (8) 875-0505/ 876-6264  
Fax: +84 (8) 875-0504  
Director: Mr. Luong Van Chu

XN Lieân Doanh TAMICO  
Tamico  
46/1 Au Co  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 865-6436/ 0310  
Fax: +84 (8) 865-0320

Nhaø Maùy Thuûy Tinh GOØ VAÁP  
Go Vap Glass Corporation  
26 Nguyen Thuong Hien  
Go Vap District  
Ho Chi Minh City  
Tel: +84 (8) 894-1716  
Fax: +84 (8) 894-5717  
E-mail: [govapglass@hcm.fpt.vn](mailto:govapglass@hcm.fpt.vn)  
Director: Ms. Nguyen Thi Tuyet Minh

Cty SX Haøng Tieâu Duøng BÌNH TAÂN  
Binh Tan Consumer Good Manufacturing Co. Ltd.  
(BITA's Pte. Ltd.)  
22 Au Co  
Ward 17, Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 844-4173  
Fax: +84 (8) 849-6005  
E-mail: [binhtan@hcm.vnn.vn](mailto:binhtan@hcm.vnn.vn)  
Director: Mr. Do Long

Cô Sôû Xi Mã GIANG HÖNG  
Giang Hung Nickel Plating Enterprise  
17 (Chan Cau So 1) Bui Huy Bich  
Ward 13, District 8  
Ho Chi Minh City  
Tel: +84 (8) 854-6789

Nhaø Maùy Lööùì Theùp BÌNH TAẦY  
Binh Tay Wire Netting Factory  
337 An Duong Vuong  
District 5  
Ho Chi Minh City  
Tel: +84 (8) 855-5316/ 18  
Fax: +84 (8) 855-5316  
Director: Mr. Pham Van Luong

Nhaø Maùy Hôìp Kim Saét NHAØ BE  
Nha Be Ferro Alloys Works  
Khu Pho 2, Tan Thuan Dong  
District 7  
Ho Chi Minh City  
Tel: +84 (8) 872-3553  
Fax: +84 (8) 872-3960  
Director: Mr. Nguyen Van Hai

Cty Cheá Bieán Goã NÖÛC THAØNH  
Duc Thanh Wood Processing Co. Ltd.  
3/58 Hai Muoi Sau Thang Ba  
Go Vap District  
Tel: +84 (8) 894-1839/ 1697  
Fax: +84 (8) 894-1576  
E-mail: [dt.wood@fmail.vnn.vn](mailto:dt.wood@fmail.vnn.vn)  
Director: Ms. Le Hai Lieu

Nhaø Maùy Cheá Bieán Haøng Moác Xuaát Khaáu  
SATIMEX  
Saigon Timber Export Manufacturing Enterprise  
Hiep Thanh Ward, District 12  
Ho Chi Minh City  
Tel: +84 (8) 891-0348/ 0546  
Fax: +84 (8) 891-4394  
E-mail: [satimex@hcm.vnn.vn](mailto:satimex@hcm.vnn.vn)  
Director: Mr. Huynh Ngoc Hoi

Nhaø Maùy Dööøng KHAÛNH HOÃI  
Khanh Hoi Sugar Company  
147 Bis Nguyen Tat Thanh  
District 4  
Ho Chi Minh City  
Tel: +84 (8) 940-4675/ 0103/ 0104  
Fax: +84 (8) 940-4689  
Director: Mr. Phung Van Phong

Nhaø Maùy Mì Aên Lieàn BÌNH TAẦY  
Binh Tay Instant Noodle Stock Company  
634 Bis Pham Van Chi  
District 6  
Ho Chi Minh City  
Tel: +84 (8) 855-3222/ 6611  
Fax: +84 (8) 855-4688  
Director: Mr. Hoang Xuan Duc

Doanh Nghieäp Tö Nhaân CAÛT TÖÖØNG  
Cat Tuong Ent. Pte.  
241/1/24 Bis Nguyen Van Luong  
District 6  
Ho Chi Minh City  
Tel: +84 (8) 865-3276/ 875-6180  
Fax: +84 (8) 865-6985  
Director: Mr. Truong Chi Hieu

XN Nööùc Chaám NAM DÖÖNG  
Nam Duong Sauce Factory  
467-469 Ben Binh Dong  
District 8  
Ho Chi Minh City  
Tel: +84 (8) 855-5761/ 3600  
Fax: +84 (8) 855-9805  
Director: Mr. Van Thanh Su

Cty Boät Mì BÌNH NÖÔNG  
Binh Dong Flour Mill Company (BIFLOMICO)  
277 A Ben Binh Dong  
District 8  
Ho Chi Minh City  
Tel: +84 (8) 855-9744/ 5740/ 6620/ 5786  
Fax: +84 (8) 855-5786  
Director: Mr. Nguyen Hong Le

Nhaø Maùy Daàu TAÂN BÌNH  
Tan Binh Cooking Oil Factory (NAKYDACO)  
6 Cach Mang Thang Tam  
Ward 15, Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 849-6010/ 6013/ 6113  
Fax: +84 (8) 842-5226  
Director: Mr. Do Ngoc Khai

Nhaø Maùy Daàu TÖÖØNG AN  
Tuong An Cooking Oil Factory  
48/5 Huong Lo 11  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 849-5972/ 5950/ 5941  
Fax: +84 (8) 842-5649  
Director: Mr. La Xuan Anh

Nhaø Maùy Söä TRÖÖØNG THO  
32 Dang Van Bi  
Truong Tho Ward  
Thu Duc District  
Ho Chi Minh City  
Tel: +84 (8) 896-0727/ 6884

XN Löông thöic Thöic phaãm MILIKET  
Miliket Food and Foodstuff Enterprise (FOOCOSA)  
130 Chau Van Liem  
District 5  
Ho Chi Minh City  
Tel: +84 (8) 855-9761/ 4347/ 4363/ 857-5122  
Fax: +84 (8) 857-5123  
Director: Mrs. Duong Tu Trinh

Nhaø Maùy Söä THOÁNG NHAÁT  
Thong Nhat Dairy Factory  
89A Cach Mang Thang Tam  
District 1  
Ho Chi Minh City  
Tel: +84 (8) 832-4125/ 24

Cty Lieãn Doanh GOLDEN HOPE  
Golden Hope-Nha Be Edible Oils Co. Ltd.  
Phu Thuan Ward  
District 7  
Ho Chi Minh City  
Tel: +84 (8) 872-8005/ 8006  
Fax: +84 (8) 873-8597

Nhaø Maùy Boät Ngoit ORSAN  
Orsan Vietnam  
28 Phung Khac Khoan  
District 1  
Ho Chi Minh City  
Tel: +84 (8) 824-2782/ 3162  
Fax: +84 (8) 829-3387

Nhaø Maùy Thöic Phaãm THIEÂN HÖÖNG  
Thien Huong Food Company  
Tan Thoi Hiep Ward  
District 12  
Ho Chi Minh City  
Tel: +84 (8) 891-2922/ 23  
Fax: +84 (8) 891-1174  
E-mail: [yen.th@hcm.vnn.vn](mailto:yen.th@hcm.vnn.vn)  
Director: Pham Xuan Dung

Cty Lieãn Doanh VIFON-ACECOOK  
Vifon Acecook Co. Ltd.  
6/1B Cach Mang Thang Tam  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 891-1211/ 1880/ 82  
Fax: +84 (8) 891-1383  
E-mail:

XN Thuùy Saün Ñông Laih VIEÄT PHUÛ  
Viet Phu Frozen Sea Products Enterprise  
138 Hung Vuong  
District 11  
Ho Chi Minh City  
Tel: +84 (8) 855-6807  
Fax: +84 (8) 855-8533  
Director: Mr. Nguyen Cong Thanh

XN Cheá bieán Xuaát khaäu CHIEÁN THAÉNG  
Chien Thang Food Export Processing Enterprise  
219 B Ton That Thuyet  
District 4  
Ho Chi Minh City  
Tel: +84 (8) 940-4399/ 4185  
Fax: +84 (8) 940-4583

Cty Xuaát Nhaáp Khaäu and  
Cheá Bieán Thuùy Saün Ñông Laih 4  
Frozen Seafood Processing and  
Import-Export Co. No. 4 (SEAPRIEXCO 4)  
331 Ben Van Don  
District 4  
Ho Chi Minh City  
Tel: +84 (8) 825-3115/ 9140/ 940-1962  
Fax: +84 (8) 940-1735  
Director: Mr. Nguyen Van Chinh

XN Cheá Bieán Haøng Xuaát Khaäu Quaãn 8 (XN  
Dong Lanh Q.8)  
District 8 Export Processing Enterprise  
2 Tung Thien Vuong  
Ward 11  
District 8  
Ho Chi Minh City  
Tel: +84 (8) 855-5001/ 0371/ 950-0583  
Fax: +84 (8) 855-7766

XN Nông Lãnh VIEÁT LONG  
Viet Long Frozen Food Enterprise  
208 Ben Nguyen Duy  
District 8  
Ho Chi Minh City  
Tel: +84 (8) 855-2796/ 0054  
Fax: +84 (8) 855-8921  
Director: Mr. Vo Van Thanh

Cty TNHH Thuỷ Sản VÃI HÖNG  
Van Hung Seafood Co. Ltd.  
176/2A Hoa Binh  
Ward 20, Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 865-0799/ 5143  
Fax: +84 (8) 865-0002  
E-mail: [vanhin288@saigonnet.vn](mailto:vanhin288@saigonnet.vn)  
Director: Mr. Ho Vi Cuong

Cty Chéá Biéán Thuỷ Hải Sản NHAN HOØA  
Nhan Hoa Agricultural-Marine Product Co. Ltd.  
176/51A Hoa Binh  
Tan Binh District  
Ho Chi Minh City  
Tel: +84 (8) 856-4791  
Fax: +84 (8) 865-4352  
Director: Mr. Nhan Hoa Chau

XN Nông Lãnh COFIDEC  
Coastal Fisheries Development Company (COFIDEC)  
28 Tu Xuong  
District 3  
Ho Chi Minh City  
Tel: +84 (8) 829-2268/ 6391  
Fax: +84 (8) 829-0546/ 896-0789  
Director: Mr. Vo Hue Tran

Xõông Deät Nhuõm May Theâu DÖÙC HOØANG  
Duc Hoang Textiles, Dying and Garment Factory  
8/2B Thuan Hoa  
Tan Thoi Nhat  
District 12  
Ho Chi Minh City  
Tel: +84 (8) 8910692

# Appendix M

## “Black Book” Companies in Hanoi

Note: See page viii for abbreviations and acronyms used in this appendix.

Source: National Environmental Agency.

### 1. Downtown Hanoi (Seven Units)

Coâng Ty Bia Haø Noãi

(Hanoi Brewery)

70 Hoang Hoa Tham

Ngoc Ha Ward,

Ba Dinh District

665 workers. Capacity: 46,470 liters/year.

Nhaø Maùy Gaïch Laùt Hoa and Maùy Phanh Otoã  
(Hanoi Tiles and Automobile Brakes Factory)

Dai Mo

Tu Liem

Hanoi

141 workers. Capacity: 120 tons/year.

Coâng Ty Giaáy Truùch Baïch

(Truc Bach Paper Company)

128 Thuy Khue

Tay Ho District

Hanoi

153 workers. Capacity: 600 tons/year.

Xí Nghieäp Baùnh Keïo Haø Noãi

(Hanoi Bakery)

5 Lang Trung

Dong Da District

Hanoi

183 workers. Capacity: 450 tons/year.

Nhaø Maùy Röðiu Haø Noãi

(Hanoi Distillery)

94 Lo Duc

Hanoi

700 worker. Capacity: 2,000,000 liters/year.

Coâng Ty Xe Daïp Thoáng Nhaát

(Thong Nhat Bicycles)

198 Tay Son

Hanoi

292 workers. Capacity: 20,020 tons/year

Cty Lieân Doanh Hoà Myð Phaãm TNM

(TNM Cosmetic Joint Venture)

129 de La Thanh

Dong Da

Hanoi

43 Workers.

### 2. Mai Dong-Vinh Tuy Area (Five Units)

Cty Bia Doâng Nam A

(Dong Nam A Brewery)

167 b Minh Khai

Hai Ba Tung District

Hanoi

350 workers. Capacity: 30,000,000 liters/year.

Cty Deät Haø Noãi

(Hanoi Textiles)

1 Mai Dong Street

Hai Ba Trung District

Hanoi

3378 workers. Capacity: Textiles: 0.25 ton/day;

Knitted items: 3551 items/year.

Cty Da Giaáy Haø Noãi

(Hanoi Leather and Footwear Company)

Nguyen Tam Trinh Street

Hai Ba Trung Street

Hanoi

230 workers. Capacity: 310 tons/year.

Cty Bia Vieät Haø

(Viet Ha Brewery)

254 Minh Khai Street

Hai Ba Trung District

Hanoi

110 workers. Capacity: 10,000,0000 liters/year.

Cty Deät 8/3  
(March 8 Textiles)  
Minh Khai Street  
Hai Ba Trung District  
Hanoi  
4,600 workers. Capacity: Textiles: 3,930 tons/year;  
cloth: 22,860,000 m/year; garments: 600,000 units/  
year.

#### **Thuong Dinh Area (Three Units)**

Cty Lieân Doanh Thuûy Tinh Pha Lê Bohemia  
(Bohemia Crystal Joint Venture Company)  
Nhan Chinh Ward  
Thanh Xuan District  
Hanoi  
53 workers. Capacity: 120,000 tons/year.

Cty Cô Khí Ngâân Haøng  
(Banking Engineering Company)  
Thanh Xuan Street  
Thanh Xuan District  
Hanoi  
120 workers. Capacity: 1,074 safes/year and other  
strong boxes.

Cty Düng Cũ Cô Khí Xuaát Khaâu  
(Engineering Tools for Export Company)  
Capacity: 1,000,000 items / year

#### **Phap Van-Van Dien-Cau Buou Area (Five Units)**

Cty Phaân Laân Vaên Dieãn  
(Van Dien Phosphorous Fertilizer Company)  
Vinh Quynh Village  
Thanh Tri Commune  
Hanoi  
458 workers. Capacity: fertilizer: 2.6 million tons/year;  
portland cement: 3,000 tons/year.

Cty Pin Vaên Dieãn  
(Van Dien Batteries Company)  
Van Dien Township  
Hanoi  
560 workers. Capacity: 76 items/year.

Cty Goám Xâý Döïng Dãï Thanh  
(Dai Thanh Construction Ceramics Company)  
Cau Buou  
Thanh Tri  
Hanoi  
321 workers. Capacity: 25,000,000 items/year.

Cty Thieát Bò Thöông Mãï  
(Trading Equipment Company)  
Van Dien Township  
Thanh Tri Commune  
Hanoi

Cty Sôn Toång Hôïp Haø Noãi  
(Hanoi Synthetic Paints Company)  
Thanh Liet Village  
Thanh Tri Commune  
Hanoi  
375 workers. Capacity: 3,700 m<sup>3</sup>/year.

#### **Gia Lam-Sai Dong-Yen Vien Area (Four Units)**

Xöôûng Thuoác Saùt Truøng Döüc Giang  
(Duc Giang Pesticide company)  
Thuong Thanh Village  
Gia Lam Commune  
Hanoi  
130 workers.

Nhaø Maùy Söđa Vinamilk  
Vinamilk Plant  
Yen Thuong Village  
Gia Lam Commune  
260 workers. Capacity: condensed milk: 35,000,000  
cans/year; fresh milk: 7 million liters/year.

Xöôûng Cô Khí Yeân Thöðöng  
(Yen Thuong Engineering Factory)  
Yen Thuong Village  
Gia Lam Commune  
Hanoi  
260 workers.

Cty Hoùa Chaát Döüc Giang  
(Duc Giang Chemicals Company)  
Duc Giang Township  
Gia Lam  
Hanoi  
308 workers. Capacity: detergent: 6,570 tons/year;  
chemicals: 550 tons/year; NPK: 10,000 tons/year.

#### **Dong Anh Area (Five Units)**

Nhaø Maùy Coát Theùp Huyndai-Dong Anh  
(Huyndai-Dong Anh Steel Pillar Plant)  
Uy No Village  
Dong Anh Commune  
Hanoi  
304 workers. Capacity: 180,000 tons/year.

Cty Khoaà Vieät-Tieáp  
(Vietnam-Czechoslovakia Lock Company)  
Xuan Non Village  
Dong Anh Commune  
Hanoi  
300 workers. Capacity: 2,000,000 units/year.

Cty Daàm Theùp va Xaây Döïng Thaêng Long  
(Thang Long Steel Girder and Construction)  
Hai Boi Village  
Dong Anh Commune  
Hanoi  
470 workers. Capacity: 2,000 tons/year.

Cty Cô Khí 19/8  
(August 19 Engineering Company)  
Minh Tri Village  
Soc Son Commune  
Hanoi  
225 workers.

Xí Nghieáp Saün Xuaát and Dòch Vui Vaät Tô Dong  
Anh  
(Dong Anh Production and Services Company)  
Uy No Village  
Dong Anh Commune  
120 workers. Capacity: beer: 1.8 million liters/year;  
wine:300,000 liters/year, fruit juice: 1,600 tons/year.

**Chem-Cau Dien Area (One Unit)**

Xí Nghieáp Cheá Bieán Raùc Caàu Dieãn  
(Cau Dien Waste Processing Enterprise)  
Cau Dien  
Tu Liem  
Hanoi

## Appendix N

# Water Project List

<i>Province</i>	<i>Project</i>	<i>Description</i>	<i>Country donor</i>	<i>Beneficiary</i>
Can Tho	Water Project in Can Tho (Phase III)	Drinking Water and Sanitation	France	Can Tho People's Committee
Vinh Phu	Water Supply System in Viet Tri	Drinking Water and Sanitation	Germany	Vinh Phu People's Committee
Thua Thien-Hue	Water Project in Hue (phase IV)	Drinking Water and Sanitation	France	Hue People's Committee
Ha Tay, Lai Chau, Long An	Clean Water Systems and Wells Development	Drinking Water and Sanitation	USA	Provincial Health Services
Ba Ria-Vung Tau, Dong Nai, Ho Chi Minh City, Long An	Nuclear Techniques for Ground Water Pollution Protection	Drinking Water and Sanitation	International Atomic Energy Agency	Centre of Nuclear Techniques, HCMC
Nationwide	Rural Water Supply	Drinking Water and Sanitation	UNICEF	Ministry of Agriculture and Rural Development
Nationwide	Environmental Sanitation	Drinking Water and Sanitation	UNICEF	Ministry of Education and Training
Dac Lac	The Buon Ma Thuot Water Supply and Sanitation Project	Drinking Water and Sanitation	Denmark	Dac Lac People's Committee
Quang Ninh	Ha Long City Water Supply and Sanitation Project	Drinking Water and Sanitation	Denmark	Quang Ninh People's Committee
Lam Dong	Rehabilitation and Extension of Distribution System for Da Lat Water Supply-Phase II	Drinking Water and Sanitation	Denmark	People's Committee of Lam Dong Province
Dong Nai	Thien Tan Water Supply Project, Dong Nai	Drinking Water and Sanitation	Republic of Korea	
Quang Nam-Danang	WB Water Project in Danang	Drinking Water and Sanitation	Australia	Quang Nam-Danang People's Committee
Hai Hung	Improvement of Water Supply in Hai Duong Town, Hai Hung Province	Drinking Water and Sanitation	Japan	Hai Hung People's Committee
Danang City, Hanoi, Hai Phong, Quang Ninh	Water Supply Project	Drinking Water and Sanitation	WB	Danang Water Supply Company
Hai Phong	Water Supply Project and Sanitation	Drinking Water	WB Company	Hai Phong Water Supply
Quang Ninh	Water Supply Project	Drinking Water and Sanitation	WB	Quang Ninh Water Supply Company
Nationwide	Community Water Supply and Sanitation	Drinking Water and Sanitation	WHO	

<i>Province</i>	<i>Project</i>	<i>Description</i>	<i>Country donor</i>	<i>Beneficiary</i>
Nationwide	Community Water Supply and Sanitation	Drinking Water and Sanitation	WHO	
An Giang, Binh Thuan, Gia Lai, Khanh Hoa, Thai Nguyen, Thanh Hoa	Provincial Towns Water Supply and Sanitation	Drinking Water and Sanitation	Asian Development Bank	Khanh Hoa Water Supply Company
Ho Chi Minh City	Ho Chi Minh City Water Supply and Sanitation Rehabilitation	Drinking Water and Sanitation	ADB	HCMC Water Supply Company
Hanoi	Hanoi Water Supply Programme, Phase 4	Drinking Water and Sanitation	Finland	Hanoi People's Committee
Hai Phong	Hai Phong Water Supply and Sanitation Program, Phase 3	Drinking Water and Sanitation	Finland	Hai Phong People's Committee
Hanoi	Rehabilitation of water supply system in Hanoi	Drinking Water and Sanitation	Denmark	Hanoi Urban Environment Management Company
Nationwide	Capacity building for urban water and sanitation	Drinking Water and Sanitation	Switzerland	
Ben Tre, Ninh Binh, Quang Binh, Quang Tri, Quy Nhon Town, Binh Dinh, Tuyen Quang, Vinh City	Provincial Towns Water supply and Sanitation Project	Drinking Water and Sanitation	ADB	
Nam Dinh	Support Social Organizations for water Health Hygiene	Drinking Water and Sanitation	European Union	
Ba Ria-Vung Tau, Dong Nai	Dong Nai and Ba Ria-Vung Tau Water Supply Project	Drinking Water and Sanitation	Japan	
Hoa Binh	Hoa Binh Water Project Phase II	Drinking Water and Sanitation	France	
Hoa Binh	Water Project of Hoa Binh	Drinking Water and Sanitation	France	Hoa Binh People's Committee
Yen Bai	Yen Bai Water Project	Drinking Water and Sanitation	France	Water Company of Yen Bai
Nam Dinh	Water Project in Nam Dinh ( Phase III )	Drinking Water and Sanitation	France	People's Committee of Nam Dinh Province
Dac Lac	Support to water resources management in Daklak	Drinking Water and Sanitation	Denmark	Dac Lac People's Committee
Yen Bai	Development of Four Community Based Irrigation Systems	Drinking Water and Sanitation	Germany	
Bac Giang, Bac Ninh, Ha Tinh, Tra Vinh, Vinh Long	5 Towns water supply project	Drinking Water and Sanitation	Australia	

Source: U.N. Development Program.